



**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
WORKS FOR TALCHER THERMAL
POWER PROJECT STAGE-III: 2X660MW**

SPECIFICATION NO. PE-TS-497-600-C001

VOLUME - II B

SECTION - C | SUB-SECTION

REV.NO. 0 DATE 27/09/2022

SHEET 1 OF 3

NTPC LIMITED

TALCHER THERMAL POWER PROJECT STAGE -III:

2x660 MW PROJECT

TALCHER, ODISHA

VOLUME: II B

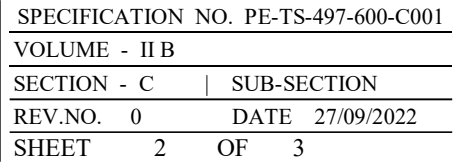
SECTION - C

TECHNICAL SPECIFICATION

SPECIFICATION NO. PE-TS-999-600-C001



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301





**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
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POWER PROJECT STAGE-III: 2X660MW**

SPECIFICATION NO. PE-TS-497-600-C001		
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C O N T E N T

SUB-SECTION

DESCRIPTION

C1

GENERAL CIVIL REQUIREMENTS

C2

SPECIFIC TECHNICAL REQUIREMENTS

NTPC Limited

(A Government of India Enterprise)



TALCHER THERMAL POWER PROJECT STAGE-III (2 X 660 MW)

TECHNICAL SPECIFICATION

FOR EPC PACKAGE

PART – A

SECTION - VI

BIDDING DOCUMENT NO.: CS-4540-001A-2

(This document is meant for the exclusive purpose of bidding against this Package and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

SUB-SECTION – I

INTENT OF SPECIFICATION

CLAUSE NO.	INTENT OF SPECIFICATION		
1.00.00 1.01.00	INTENT OF SPECIFICATION Scope of the proposal The complete scope of the proposal for the Design, Engineering, Manufacture, Supply, Construction, Erection, Testing & Commissioning works for the EPC Package for Talcher Thermal Power Project Stage-III (2X660 MW), shall be on the basis of single point responsibility, completely covering the following activities and services in respect of all the equipment & works specified and covered under the specifications : a) Basic Engineering of the plant including preparation of Plant Definition Manuals; b) Detailed design of all the equipment and equipment system(s) including civil, structure steel works included in bidder's scope. c) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings and other information; d) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required; e) Complete manufacturing including shop testing/type testing; f) Complete Civil, Structural and Architectural works, including survey, providing construction offices, field laboratory and construction equipments, construction water supply, construction power distribution from the supply point of Employer, infrastructure works, construction / permanent roads, drainage arrangements, fencing / boundary wall around the land boundary. g) Packing and transportation from the manufacturer's works to the site including logistic studies, customs clearance & port clearance, port charges, if any. h) Receipt, storage, preservation, handling and conservation of equipment at the site; i) Fabrication, pre-assembly, if any, erection, testing, commissioning and completion of facilities including putting into satisfactory operation all the equipment including successful completion of initial operation; j) Performance and guarantee tests will be carried out along with the initial operation; k) Furnishing of spares on FOR site basis; l) Reconciliation with customs authorities, as required. m) Conclusion of the contract. n) Insurance and other requirements for the complete EPC package in accordance with the provisions of general conditions of contract (Section-IV) of the bidding document. The requirements, conditions, appendices etc. given in Technical Specifications (Section-VI, Parts A, B, C, D and E) shall apply to and shall be considered as a part of this volume as completely as if bound herewith. The work to be carried out as per the above scope shall be all in accordance with the requirements, conditions, appendices, etc., stated in Section GCC, which shall be considered as a part of the Technical Specification (Section VI) as completely as if bound herewith. The Contractor shall be responsible for providing all material, equipment and service, which are required to fulfill the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. It is not the intent to specify herein all aspects of design and construction; nevertheless, the equipments and civil works shall conform in all aspects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Employer, who will interpret the meaning of the specification and drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable to		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 1 OF 8

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1.02.00	Indian/ International standards mentioned elsewhere in this specification. Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should be sought within the time period as stipulated in section ITB. Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. However, if the bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately. Bidder may also make alternate offers provided such offers are superior, in his opinion, to the requirements of these specifications in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Employer to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumption, etc. shall be clearly brought out. In any case, the base offer shall necessarily be in line with the specifications. Under no circumstances the equipment/systems as specified herein shall be brought out as an alternative offer i.e. the system/equipment specified shall be made as a base offer. In case the above requirements are not complied with, the offers may be considered as incomplete and would become liable for rejection.			
	This enquiry concerns two (2) power generating units each having a rated output of 660 MW, including but not limited to: ➤ Steam Generators and Auxiliaries including, - Complete pressure parts, structures, platforms, stairs, piping, valves, supports etc. - Soot blowing system with piping, valves, controls etc. - Coal feeder and complete milling system - Coal combustion system including coal / oil burners & scanners. - Selective Catalytic Reduction (SCR) System / Hybrid (SNCR+SCR) Ready System as per the scope defined in scope chapter. - Air and flue gas ductwork. - Primary air fans. - Forced draft fans. - Induced draft fans. - Aux PRDS and piping - Start up & circulation system, - Air heaters & SCAPH. - Fuel oil pressurizing system (Common system) - Elevators for Steam generators - Chemical LP Dosing system and Oxygenated Treatment system - Electrostatic Precipitators. - Wet Limestone based Flue Gas Desulphurization System - Other systems like tools & tackles etc. as specified.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 2 OF 8

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	➤ Turbo Generators including, - Steam turbines. - Condensing plant. - Complete Regenerative Feed system. - HP-LP Bypass system. - Low Pressure Chemical Dosing system. - Condensate Extraction Pumps. - Boiler Feed Pumps - Condensate transfer pumps - Turbine hall E.O.T. crane. - Power cycle piping - Low pressure piping. - Equipment cooling water system - Boiler fill system ➤ Water Treatment Plant Including, - DM plant and CW chemical treatment. - Pre treatment and liquid effluent treatment plant - Chlorine di-oxide plant - Condensate polishing unit including regeneration facility - Reverse osmosis plant for waste water - Laboratory equipment ➤ Cooling Water System including, - Equipment Cooling water system including ACW pumps. - Circulating water system including CW pumps - Cooling towers for circulating water system - Aux water system including Raw water pumps ➤ Make- up water system - Make up water system including make-up water pumps & piping ➤ Plant Utilities including, - Compressed air system - Air conditioning and ventilation system - Fire detection and protection system ➤ Material Handling System including, - Mill Reject Handling system. - Coal Handling Plant - Ash Handling system with AWRS - Fuel Oil Handling Plant		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 3 OF 8

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2.00.00	- Lime Stone & Gypsum Handling Plant ➤ Elevators, Cranes and Hoisting equipments ➤ Electrical Equipments including, - Main generator and associated equipment. - All Transformers. - Bus ducts. - Medium and low-voltage switchgear, motor control centres. - Motors & Cables etc. - Illumination, Earthing, Lightning protection, DG sets, Batteries, Battery Chargers, Overhead lines etc. - Electrical systems as required. - Switchyard ➤ Control and Instrumentation system along with accessories and Instrument Cables. ➤ Civil works for the complete plant covered under bidder's scope shall be as mentioned in Sub-Section II-D, Section VI, Part-A of the specification. ➤ Complete Mechanical, Civil, Electrical & C&I works related to raw water System. ➤ Solar PV Plants on Roof Tops			
	ADDITIONAL REQUIREMENTS (a) Before submitting his bid, the Bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer. (b) Bidder shall take all necessary precautions to protect all the existing equipment, structures, facilities and buildings etc. from damage. In case any damage occurs due to the activities of the contractor on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be immediately made good by the contractor at his own cost to the satisfaction of the Employer. The contractor shall also take all necessary safety measures with specific reference to excavation in rock, at his own cost, to avoid any harm or injury to his workers and staff from the equipment and facilities of the power plant. (c) For his site office and covered store buildings, the contractor shall adopt pre-engineered / pre-fabricated constructions made of steel with single / double skin, insulated or uninsulated roof and wall coverings (fabricated out of permanently color coated metal sheets). Alternatively, contractor can adopt readymade 'Porta cabin' or similar construction. Contractor shall ensure that all such constructions are well engineered, neatly constructed and overall present a pleasing look. (d) In line with Gazette Notification on Ash Utilization issued by MOEF and its amendment thereafter, contractor shall use ash and ash based products in works as specified in these specifications, drawings and as per instructions of the Engineer. He shall also use ash and ash based products in construction of his offices, stores, staff quarters and labour huts etc. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 4 OF 8

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	(e) Contractor shall establish/set up at site suitable repair facilities for construction plant, equipment and machinery (like piling rigs, cranes batching plant, dewatering pumps etc.) In case of piling rigs, cranes, batching plant etc. he will also make arrangements / tie up with equipment manufacturers / suppliers for periodic overhaul/maintenance and for major breakdown, if any. He shall also keep adequate stock of spares at site for various plant, equipment and machinery to meet day to day requirements as recommended by the equipment manufacturer/suppliers or as instructed by the Engineer. Contractor shall deploy dedicated qualified, full time mechanical/electrical foreman/supervisors for manning the repair facilities as specified above.			
3.00.00	TENDER DRAWINGS The tender drawings are enclosed along with the specification as Part-E, Section-VI and shall supplement the requirements specified in these technical specifications. The scope and terminal points of the equipment to be furnished under this EPC package shall be as identified in these drawings read in conjunction with text of the specification.			
4.00.00	OTHER GENERAL REQUIREMENTS Items though not specifically mentioned in the specification but needed to complete the equipment/systems to meet the intent of specification, shall also be deemed to be included unless otherwise specifically mentioned in exclusions. In addition to the scope of supply and services indicated in other Sub-Sections of the scope of supply and services, the other general requirements are covered in this sub-section as part of the scope of the Contractor.			
4.01.00	Paints The Contractor's scope of work includes supply of paints and painting of all equipments and structures as per stipulated requirements and the Employer's standard color coding scheme.			
4.02.00	Pre-commissioning and commissioning activities The contractor's scope shall include all pre-commissioning and commissioning activities, materials and services as detailed in other portion of technical specifications including supply of all consumables (except coal, oil and limestone), temporary equipment and pipings, instruments, labour / skilled manpower's etc. The scope includes complete requirement of flushing oils including fresh oil refilling during the pre-commissioning and commissioning activities and subsequent initial operation. Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose. Further, during execution any requirements (of coal & fuel oil) beyond the quoted quantities by the successful bidder would be issued by NTPC but charged back to the contractor as per the prevailing landed rate at site at that time. There shall be no rebate to the Contractor if the coal & oil quantities as consumed during execution (up to the initial operation as above) remains lesser than the quoted values. And the total required limestone shall be issued free of charge by the employer for such purposes.			
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4.03.00	First Fill of Consumable, Oils & Lubricants			
i.	All the first fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases (excluding H2, CO2 and N2 for Generator) etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.			
	Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases, etc.(as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate Containers.			
ii.	Bidder scope shall supply H2, CO2 and N2 as applicable for the Generator till successful commissioning of the Generator.			
4.04.00	Guarantee Tests			
	The guarantee tests for various equipment and systems shall be carried out as specified under chapter of Functional Guarantees and Liquidated damages, of this part of technical specification. All special equipment, tools and tackles, instruments, measuring devices required for the successful conductance of Guarantee Tests shall be provided by the contractor. All costs associated with the tests shall be included in bid price.			
4.05.00	Spares			
	The scope of supply of contractor includes supply of mandatory spares, start-up and commissioning spares, recommended spares, consumable spares and other spares as required for plant erection, testing, commissioning, startup, initial operation etc.			
4.06.00	Special Tools & Tackles and Test/Measuring Equipment			
	One set of all special tools and tackles including testing, calibrating and measuring instruments required for erection, assembly, disassembly and maintenance and testing of all equipment/systems covered under the scope of the contractor shall be supplied by the Contractor as per relevant clause indicated in Part-C of Section-VI and as specified elsewhere in Part-A of Section-VI of Technical Specifications. The Contractor shall not use these special tools, tackles and testing/measuring equipment for erection/commissioning purposes and shall be in an unused and new condition, when they are handed over to the Employer. A list of all such special tools and tackles shall be submitted along with the offer.			
4.07.00	The scope of the Contractor includes complete design and engineering, technical co-ordination (including participation and arranging technical co-ordination meetings), finalization of drawings/documents, submission of engineering drawing/documents and processing of their approvals by the Employer as per requirement indicated in Part-C of section -VI and other relevant clauses given elsewhere in the Technical Specifications.			
	Further, the scope shall also include submission, in proper shape and format, of all types of manuals, handbooks and documents in requisite numbers to the Employer at different phases of the project as per the requirement of Employer.			
4.08.00	All the plant layouts shall be made in computerized 3D modeling system as detailed in Part C of the Technical Specification.			
	Contractor shall prepare the model of all the facilities located within plant boundary covering facilities in Main Plant Block area and Balance of plant (BOP) area in an integrated & intelligent 3D software solution. Main Plant Block area shall include, Transformer Yard, TG building (including all facilities), Boiler area, ESP area, chimney area, FGD area and any other facility located in main plant block. BOP area shall include all facilities pertaining to AHP, CHP, LHP, GHP, DM PT plant, pipe & cable racks and any other facility located within plant boundary.			
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4.09.00	Contractor shall prepare 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as & when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.) and structural arrangement drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings.			
	The contractor shall prepare the 3D model indicating the control & instrumentation equipments, devices such as location of LIE,LIR, flow elements, instrument tappings, thermowell stubs, JBs , cable trays, Flame scanners, Flame viewing cameras, ASLD, Acoustic Pyrometer, Control valves & actuators, Coal bunker level instruments along with approach / maintenance platform, provided for all these equipment's/devices. The LIE & LIR shall be placed in such a way that the doors can be opened freely from front & back side for ease of maintenance. The cable tray layout shall be implemented in such a way that the fouling to the pipes, ducts and other structures can be avoided.			
	These above drawings are to be extracted from the said 3D model and submitted for employers review and approval along with the 3D model.			
	After the completion of engineering of respective area i.e. TG building/ Boiler/ ESP etc., the corresponding complete 3D review model shall be handed over to the employer for its reference.			
	The Contractor shall be responsible to undertake some activities related to its Corporate Social Responsibility (CSR) in the immediate vicinity of the project. The Contractor shall undertake such activities after prior consultations with the Employer to ensure that the efforts of the Employer and Contractor are complemented. The vendor / contractor is expected to carry out the CSR activities as per the provision (Rules) under section 135 of the companies Act 2013 relating to CSR and other circulars / instructions of various government departments viz MoEF etc. The share of CSR expenditure to be incurred by the vendor / contractor for this project in the total CSR expenditure incurred by the vendor/contractor as a company will be in the same proportion as the turnover of the project concerned to the total company turnover. This will be certified by the chartered accountant once every fiscal year.			
4.10.00	Such activities will be undertaken by the contractor / vendor in consultation with the Employer.			
4.11.00	The Contractor shall also jointly facilitate in resolution of Land Acquisition issues related to the Project. Any due payments arising out of the Land Acquisition process shall however be paid by NTPC to the appropriate Authorities. The vendor / contractor shall visit the site to ascertain the position of land acquisition etc. and it is presumed that the contractor submitted his bid after considering the facts on the ground and that once vendor / contractor is successful in his bid, he will work in cooperation with the client for smooth execution of the project.			
5.00.00	The scope of the contractor shall also include supply and installation of e-learning packages for the equipment / system for the Steam Turbine Generator & auxiliaries and Steam Generator & auxiliaries along with associated electrical and C&I system as indicated in Part-C of Section-VI. GENERAL ENVIRONMENTAL REQUIREMENTS The contractor shall execute all work at site as per the general environmental requirement and following the applicable codal provisions and local regulations in this respect. The contractor shall provide and install suitable safeguards and facilities as approved by the Engineer for meeting general environment requirements given herein under.			
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5.01.00	Protect from damage and disturbance of the existing trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipe lines, drains, sewers, or other surface or sub-surface systems / facilities within or adjacent to the works being carried out given herein below.			
5.02.00	Take all necessary precautions against soil erosion, water and environmental pollution and safe disposal of waste material.			
5.03.00	Control the ground in the vicinity of all excavations, so that the surface of the ground is properly sloped or dyked to prevent surface water from running into the excavated areas, during construction.			
5.04.00	All natural materials arising out of site clearance and excavation shall be the property of owner. All salvaged materials of archaeological importance or of value (in the opinion of the Engineer) shall be segregated from the other materials and stacked separately at locations as indicated by the Engineer.			
5.05.00	The method and arrangement of blast cleaning shall conform to factory act, local laws, stipulations of pollution control board, if any.			
5.06.00	a) Excavated earth should be stockpiled properly at designated areas so as not to spread and cause air pollution (fugitive dust emission) and water pollution (suspended solids in run-off). Top soil (top 150mm layer of the fertile soil) may be stored separately for future use in landscaping / revegetation / horticulture. b) Solid wastes generated during construction such as construction debris, excess cement / concrete, wrapping materials (e.g. plastic packets and wrappers), timber, tins, cans and drums, wire, nails, glass etc., chemical wastes and hazardous wastes, food and domestic wastes etc., should be properly disposed off so as not to cause any air / water pollution. c) Potential pollutants (such as oils, chemicals) shall be kept, stored, and used in such a manner that any escape can be contained and the surface and ground water resources are not contaminated. d) Water containing pollutants such as cements, concrete, lime, chemicals and oils shall be discharged through a temporary sedimentation and equalization tank. e) The necessary precautions shall be taken to control emission of fugitive dust and suspended solids in effluents leading to sedimentation of receiving water bodies. f) Provide necessary sanitation facilities to the labour camps. g) All vehicles and equipment shall be kept in good working order and serviced regularly to maintain the exhaust emissions and noise levels within reasonable limits. h) Control the movement of all vehicles so as to minimize disruption to regular users of the routes. i) The speed of the vehicles on gravel or earth roads in and around site may be restricted to minimize the emission of fugitive dust. Further, the road surface of gravel or earth roads may be provided with suitable cover to reduce the emission of fugitive dust.			
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SUB-SECTION–IID

CIVIL WORKS

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES	एनटीपीसी NTPC		
1.00.00	SCOPE OF CIVIL, STRUCTURAL & ARCHITECTURAL WORKS OF EPC PACKAGE The scope of civil, structural and architectural works shall include topographical survey, detailed geotechnical investigation, site clearance, dismantling of existing structures/substructures/facilities, site levelling, preparation of design documents and drawings and getting approval of the same from the Employer and construction of all civil, structural and architectural works including supply of all construction materials for all buildings, equipment and facilities for the project. The nature of work generally involves detailed geotechnical investigation, piling, earthwork in excavation in all types of soil and rock including controlled blasting/ mechanical means, de-watering, backfilling around completed structures, plinth filling, disposal of surplus earth/rock/excavated material/dismantled material, concreting including reinforcement and form work, chimney construction using slip form, masonry work, plastering, corrosion protection measures including painting, un-insulated / sandwiched insulated metal wall cladding, roofing and flooring including permanent steel decking, false ceiling, under deck and over deck insulation, acid and alkali resistant lining, fabrication of all structures at factory, pre assembly of fabricated structures at factory, transportation of pre-fabricated structures and erection of steel structures (with bolted field connections) and miscellaneous steel works (i.e., steel staircase, cable supports, pipe supports, ladders, walkways, railing, chequered plate/grating floors, inserts etc.), painting of structures, paving, gravel filling, providing pre-cast covers, damp proofing, roof water proofing, anti-weed treatment, roads, drainage, sewerage, rain water harvesting, final grading and site clearance before handing over and any other item of work required for completion of all systems under the scope of work complete. The works covered under the scope of the bidder have to be executed in an existing power station. The bidder shall take all necessary precautions to protect the existing equipment, structures, facilities and buildings etc. from damage. In case any damage occurs due to activities of the bidder on account of negligence, ignorance, accidental or any other reason whatsoever, the damage shall be made - good by the bidder at his own cost to the satisfaction of the Owner. The bidder shall take all necessary safety measures to avoid any harm, injury to his workers/staff from the equipment / facilities of the power station. The scope of Bidder for civil, structural and architectural works as defined above shall include but not be limited to the following buildings/ areas/ systems along with their foundations, super structures and finishes complete: 1. Topographical Survey. 2. Detailed Geotechnical Investigation. 3. Site clearance including cutting of trees of girth less than 30 centimeters. 4. Dismantling, removal, and disposal of identified facilities/ structures/ substructures/ foundations of dismantled quarters/buildings/structures, reinforcement, pavement/paving, pipes and any underground structure/materials, debris etc. all complete. Refer Annexure-P in PART-B along with Tender Drawing No. 4540-999-POC-A-015 - EXISTING FACILITIES / BUILDINGS WITHIN STAGE-III PLANT AREA, for tentative list of existing facilities. The list is only indicative and may not be exhaustive/complete. The list contains structures a) where super structure is to be			
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CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
	dismantled by owner and structures below ground level including foundations is in bidder's scope and b) dismantling of whole structures including above ground level and below ground level. In case where superstructure dismantling is in Owner's scope, dismantling of all underground facilities including paving /flooring and projection of structures above ground level etc., if any, is in the scope of bidder. Existing foundation/underground structures interfering with new foundations/structures are to be removed. All existing foundations/below ground facilities interfering with new facilities are to be dismantled upto minimum 10m or technical/system requirement, whichever is greater, from the extreme outline of the new underground foundation/ structure. No drawing for substructure are available. Bidder may assess the same as per actual site conditions without any additional time and cost implication to owner. In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline and external CHP corridor, dismantling of existing railway siding (both inside and outside plant boundary) is also in the scope of the bidder. Dismantling of all existing facilities and disposal of dismantled material is in the scope of the bidder. The bidder has to take care this aspect while bidding. Bidder shall be responsible for safe disposal of all such materials outside the plant boundary in environmentally friendly manner meeting all statutory requirements. The area will be handed over in as is and where is basis. Dismantling planning shall be as detailed below: a. Existing structures over-lapping with Stage-III facilities: i. Stage-I Raw water reservoir ii. Waste water sump & Pumphouse iii. Rail track from Plant entry gate upto Track Hopper iv. Waste storage shed v. Stage-II Raw water reservoir vi. Stage-II PT Plant vii. AAQMS Room viii. Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage-I Raw water reservoir ix. Coal Stock yard including stacker -Reclaimer x. Coal Slurry Settling pit xi. Dozer shed xii. TP-14 xiii. Conveyor 16 & 17 xiv. Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage-II Raw water reservoir			
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	xv. Central Store facilities including store sheds, Office building, material storage yard, scrap yard, weigh bridge etc.. xvi. New ETP facilities Facility at Sl. No. 4(a)-xiv not to be disturbed since it would be catering to (i) water requirement of existing plant & township and (ii) construction water requirement of Stage-III project. b. Dismantling of facilities at Sl. No. 4(a)-xv is in employers scope. c. Dismantling of facilities from Sl. No 4(a)-i to 4(a)-xiii shall be in bidder's scope. d. ETP Facility at Sl No. 4(a)-xvi shall not be dismantled. Same is to be utilized for Stage-III. e. Temporary fencing, by employer, shall be provided around existing station facilities to isolate from the Stage-III project areas. (Marked in GLP) f. Existing Stage-II reservoir & Stage-II PT Plant will be covered inside the existing Station premises since it would be operational for catering to (i) water requirement of existing plant & township and (ii) construction water requirement of Stage-III project. g. Existing Stage-II reservoir area will be handed over to the Project area (Stage-III EPC contractor) after completion & handing-over of new Stage-III reservoir and providing connection from new reservoir to the existing Stage-II PT Plant by the bidder. h. Existing Stage-II PT Plant area can be handed over to the project area (Stage-III EPC contractor) only after completion & handing-over of new Stage-III PT Plant. i. Dismantling and disposal of ash water reservoir to locate other facilities for stage-III are in the scope of the bidder. j. Demarcation between township and stage-III in the scope of bidder. It is to be done at the beginning of works. For Area Handover Schedule (For above Ground dismantling under Owner's Scope) refer Owner's input in Terminal Points & Exclusions 5. Construction of Raw Water Reservoir and dismantling, removal, disposal of waste material of existing reservoirs and levelling to FGL. 6. Infrastructure Works a. Rigid pavements Roads in Plant area and all other roads as shown in General Layout plan (GLP)/ Road layout tender drawing including approach road /heavy duty paving/heavy duty passage to buildings/ facilities in the package, including construction of priority roads at onset of project works and maintenance of the roads during the entire construction period. b. RCC Storm water drainage in Plant area (including facilities/structures) and RCC drains along roads in Bidder's Scope including connection upto disposal point as shown in GLP/Layout of drain. Drains to be constructed simultaneously with roads. c. Packaged type Sewerage treatment plant (3 nos. as indicated in tender drawing General Layout Plan) and sewage pumping station including sewage			
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	pump, sump & house and connection up to sewage treatment plants (either of owner or bidder); connection of sewage lines of all buildings under Bidder's scope to the nearest sewerage system. d. Patrol/inspection road along Ash Slurry pipe corridor as shown in tender drawings. e. Complete site levelling of entire plant area as shown in drawing no. 4540-001-POC-A-003 Titled 'Site Levelling Plan'. f. Water supply system for Plant area. g. Safety Park Building as per tender drawing. h. Safety Control Room at onset of project works. i. Plant boundary wall as shown in General Layout Plan (Drg. No.4540-999-POC-F-001) j. Separate RCC drainage network with GI grating cover and sump pit for plant effluents for all buildings and facilities in Bidder's scope including floor wash water from all the facilities in Plant Area upto Effluent Treatment plant including connection of effluent line from structures under the scope of package. k. Hard crusting in plant area and preassembly area to facilitate movement of vehicles and erection of equipment. l. Watch Towers 7. Foundations for all buildings/ area/ systems including machine foundations. 8. All Civil, Structural, Architectural works including underground facilities like drainage, sewerage, trenches, earthing mat/ grounding for entire Plant area covering the following: a. Boiler and ESP supporting structures and foundations. b. Elevator pit & Civil Works for Machine Room for Boiler Elevator. c. Mill Bunker building supporting structures and foundations, floors, roof & side cladding. d. ESP control room building. e. Mill reject silo and associated trenches. f. Compressor house. g. Coal mill foundations & PA/FD/ID Fan foundations. h. Seal air fan foundation and all other equipment foundations. i. Coarse ash hopper tower foundations & FEA tower foundations. j. Coal transfer points, coal conveyor galleries and supporting trestles in the boiler area – foundations, floors, roof & side cladding, staircases, gravity take up structure for conveyors in the boiler area. k. Area Paving and miscellaneous foundations in entire area enclosed within the peripheral roads of the entire plant area from edge of drain along peripheral road beyond transformer yard upto road beyond Ash handling facilities area bound by peripheral roads in orthogonal directions, including heavy duty passages, sump pits, drains, culverts, cable slits, fire water trench, including, rail/ road/ drain crossing of fire water trench & pipes etc. (as shown in tender drawing). l. Bunker MCC including RIO room.			
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	m. Main Power House building. n. Service Building (including interconnection with Main Power House) o. Foundations for turbine generator, turbine driven boiler feed pumps and motor driven boiler feed pump(s) including steel helical springs and viscous dampers below RCC top deck (The foundation type can be with/without steel helical springs/ dampers as per option provided in specification) p. CW Pit, CEP Pit, and all other equipment foundations in Turbine-Generator (TG) area. q. CW duct /liner including PCC/RCC encasement r. Transformer yard area foundations including rail track cum road along the entire A-Row extending up to peripheral roads on either side and transformer yard, condensate storage tank foundation, condensate transfer pump foundation, fire barrier wall, pit, sump, pipe and manhole, common oil retention pit/oil-water separation pit, gate and fencing etc. s. Diesel generator set foundations & stack foundations along with steel support structure and foundations for stack support. t. Area paving in and around service building. u. Civil, structural, architectural works for CPU system in Main Power House & regeneration area including Switchgear/MCC and control room building and Transformer foundations. v. Civil, Structural & Architectural works for rooms for Owner's Electrical equipment like HT/LT switchgear, cable vault, batteries/battery chargers, foundation of service transformers, space for bus ducts and cable trays etc. as listed in Electrical Chapter & Layout Chapter PART-B. 9. Chimney including elevator, electrical works, aviation obstruction lighting. 10. Civil, structural, architectural works of all facilities associated with complete Flue gas desulfurization (FGD) including Gypsum and limestone handling system and DeNOx system. 11. Civil, Structural, Architectural works for all buildings/ structures/ facilities for ash handling and ash water recirculation system along with switchgear building & control room including the following: a. Ash Water Pump House open type b. Ash Slurry Pump house shed as per system requirement c. Ash Water Recirculation Pump House complex including switchgear room, transformer yard, control room, battery room, Disaster management room, boundary wall etc. d. Switch gear/MCC and Control Room for all buildings. e. Silo area utility building, ash classifier system and bagging plant complex (build type as per system requirement) f. Fly Ash Silo foundation, Foundation for Bottom Ash silo, Intermediate silo, Foundation for ash classifier system and bagging plant including base plate and supporting pedestals g. Transport air compressor Shed with side sheeting h. Conveying air Compressor Shed with side sheeting (if required as per system) i. Steel Trestles including foundation for supporting fly ash Piping within plant area and up to silos			
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	j. RCC pedestals for ash slurry disposal pipes lines upto mine voids including garlanding pedestal for mine voids k. RCC pedestals for supporting ash water recirculation pipe l. Miscellaneous works like Transformer Foundation, Fencing, Paving etc. m. Miscellaneous structures including Foundation for settling tank, surge tank BA overflow tank, etc. n. Culverts/local humps or bridges as per site conditions, for routing of the ash pipes at crossing for nallah /water body crossing /roads/rail lines etc. o. Weigh Bridge p. Entire ash pipeline corridor road from plant boundary to mine voids including garlanding road on mine voids and connecting road for Ash Water Recirculation Pump House Complex. q. Any other buildings/structures if required as per system. 12. Civil, structural, architectural works for fuel oil unloading & storage system namely fuel oil unloading cum pressurizing pump house with switchgear room, MCC cum control room and Fuel oil unloading system civil works including Fuel Oil tanker unloading platform, foundation and dyke wall and all associated works for LDO storage tank. 13. CW system Civil, Structural and Architectural works a) CW pump house with steel superstructure and metal sheeting at roof including pump foundations, maintenance area, forebay and Transition zone b) CW Switchgear/MCC & control room building including transformer foundation. c) CW ducts including PCC/RCC encasement from CWPH to TG Hall and from TG Hall up to Cooling Towers. d) CW Channel from Cooling Towers up to CWPH forebay. 14. Raw Water system civil Works Raw Water Pump House (RWPH) with steel superstructure and metal sheeting at roof including connection with reservoir outlet pipes, pump foundations, maintenance area, Forebay/Sump and associated Switchgear/Control/Remote IO Room building, Transformer foundation etc. 15. Civil, Structural, Architectural works for the following buildings/ structures/ facilities of Water & Effluent treatment plant: a) Pretreatment plant and associated structure and facilities b) DM plant and associated structure and facilities c) CW Chemical Treatment Plant and associated facilities d) Coal slurry settling pond and associated facilities e) Chlorination(ClO₂) plant and associated facilities f) Water System Control Room Building and remote I/O room associated with PT plant, DM & CW chemical plant. g) DM Plant laboratory h) Zero liquid discharge and associated facilities i) Liquid effluent Treatment Plant & associated facilities required for disposal of liquid effluent. Effluent quality monitoring system(EQMS) j) DM, PT & Service Water Switch Gear & Control/Remote I/O Room Buildings, transformer foundation etc			
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	k) l) DM & CW Chemical plant Station Piping Civil works Civil, Structural works for pipe /cable /duct supporting structures, trestles and foundations, Condensate Storage Tank and CST pump house, trenches, duct banks, pedestals, thrust blocks, trenches, Hume pipes & culverts, duct banks etc at crossing in offsite area for pipes and cables, buried pipes and crossing, racks, culverts across rail tracks for pipes/ drains/ sewers and any other facility and thrust blocks etc. associated with all systems covered under the scope 16. All civil, structural & architectural works associated with Natural Draught Cooling Towers (NDCT) including associated facilities.. 17. Civil Works for 400kV GIS including AIS portion Switchyard. All civil, structural & architectural works associated with Switchyard, that is, Switchyard Control Room Building, GIS Building, GIS Duct Support, Towers, Girders, Equipment Supports, Lighting Masts, Lightning Masts, Transformer /Reactor foundations, cable trenches, roads, drains, fence with gate, anti-weed treatment, gravel filling, water supply & sewage system for switchyard buildings, inter-connections to employers facilities etc. and all other related works complete as per system requirement. 18. Coal, , Lime and Gypsum Handling Plant All civil, structural & architectural works associated with coal, Lime and Gypsum handling plant, i.e. track hopper, transfer points, crusher houses, overhead/ground conveyor galleries, tunnels for conveyor galleries, Lime Stone, stacker/reclaimer foundations, pump houses, MCC/Control Buildings, penthouse, Truck tippler, Covered Structural shed over stock pile area, Gypsum storage shed drainage etc. 19. Makeup water system All civil, structural & architectural works associated with Makeup water system including: i. ii. iii. iv. v. vi. vii. Clearing and grading of work area including requirement of work areas and access there to and stacking of reference markers. Intake structure in the river, RCC channel including desilting arrangement, forebay, sump, Stop-logs and Trash Racks, pump house for makeup water pumps including river bank protection. Trenching for laying of pipes and back filling of trenches. associate civil works for air release valves. bridges for make water pipe across water bodies, irrigation canal and culvert across roads, railway tracks, highways as indicated in Tender drawing. MCC cum control room, foundation of all the transformers and associated transmission system including one Bio Toilet block. approach road to Makeup water pump house area to nearest available road. <tr><td>TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2</td><td>SUB-SECTION-IID CIVIL WORKS</td><td>PAGE 7 OF 13</td></tr>	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-IID CIVIL WORKS	PAGE 7 OF 13
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CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
	viii. Construction Concrete Pedestals and thrust blocks for makeup water pipes for above ground portion and culverts. All Sumps required for dewatering of below ground level pipeline near culverts shall be in bidder scope. ix. Boundary wall and gates and paving around all the facilities. 20. Pipe /Cable / duct supporting structures, trenches, culverts, duct banks, pedestals, hume pipe culverts and thrust blocks etc. associated with all systems covered under the scope of EPC package. 21. Civil works for Outdoor transformer foundations 22. Civil, Structural, Architectural, Electrification, air-conditioning and ventilation works, for the following Miscellaneous Buildings/ structures/ facilities: a. Administration Building b. Canteen c. O&M Workshop building d. Gate Complex along with CISF Building e. Fire Station building and Drill Tower f. CHP Office cum Workshop Building g. Dozer Shed h. FQA Lab Building 23. Earthing mats & risers for all buildings. 24. Sheds for O&M/Workers, including food serving kiosk and bio Toilet Blocks for ladies and gents, in adequate numbers to cater to the workers working in each work area. The sheds should be easily accessible to workers by foot. Minimum 06 numbers of shed in different areas shall be provided. Drinking water facility and maintenance of toilet and shed shall be the responsibility of the bidder till COD of all the units. 25. Facilities for rainwater harvesting in Plant area and other buildings in Bidder's scope. 26. Civil Works associated with fire detection and fire protection system Civil, structural, architectural works for fire water tank foundation, fire water pump house including Switchgear/MCC & Control room, fire water booster pump house & control room, foam system including foam system shed & control room, deluge valve housing, pedestals for pipes, concrete encasement of pylon pipes (within filled up gravel portion) used for HVW spray system for protection of transformers, rail/road crossing of fire water trench etc, civil works associated with buried pipes & crossing etc. 27. Civil works associated with air conditioning & ventilation system. 28. Civil, Structural works for pipe /cable /duct supporting structures, trestles and foundations, trenches, culverts, duct banks, pedestals, hume pipe & culverts, buried pipes, racks, culverts across rail/road tracks for pipes/ drains/ cables and any other facility and thrust blocks etc. associated with all systems covered under the scope. 29. Miscellaneous Switchgear building. 30. Civil, structural, architectural works for SOLAR PV plant on 'A-Row' elevation for main power house and roof top of building/facilities in the bidder's scope. 31. Owner's construction office as shown in tender drawing. 32. Primary health center with rest room.			
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	33. Any other miscellaneous building or facility. 34. Railway Siding NTPC has undertaken a feasibility study for Railway siding of Talcher STPP for handling of coal / Ash transportation for Talcher STPP Stage-III (2 x 660MW) through Indian Railway network. For unloading of coal, provision of 1 track hopper is envisaged. Connectivity to Ash silos is also envisaged. <u>Scope of Work & Services</u> The scope of work & services for the proposed railway siding and augmentation of serving station as per Railway requirement is described below (but not limited to the following): - The FSR (Feasibility Site Report) attached at Annexure D-1-12(N) is for bidding /reference purpose only. As it is in the process of approval from Indian Railways, the work shall be executed as per the Indian Railway Standards. Executing agency has to prepare the DPR, ESP, SIP & Other necessary drawings and get the approval from Indian Railways. - Review and revalidation of Feasibility Site Report - Preparation of Detailed Project Report (DPR) as per the latest Policy guidelines of Indian Railways, for the proposed railway siding and augmentation of serving station including System Design, Topographical Survey, Geo-Technical Investigation. Engineering Scale Plan (ESP) and Signal Interlocking plan (SIP) and getting the same approved from the Indian Railways. The DPR, ESP & SIP shall be prepared through railway approved consultants and submitted to NTPC, upon the concerned officials approval, executing agency shall submit & get the approval from Indian Railways. - Executing agency shall prepare the Detailed Engineering Study of complete railway siding system for Stage III project from Railway serving station(s)/Take-off point of siding to the plant, which includes in-plant yard & augmentation of serving station. The detailed engineering is to be done through railway approved consultants and approval is to be obtained from Railways. Executing agency shall be sole responsible for any addition/modification required by the Indian Railways. - Construction of the complete railway siding system is to be undertaken as per latest Railways guidelines under supervision of Railway approved agency/consultant, starting from serving station to Talcher plant including in-plant rail yard for Stage-III (2x660MW), augmentation of serving station, necessary drainage arrangements(Cross drains and Longitudinal Drains), Signaling & Telecommunication (S&T) with Electronic Interlocking as per the latest RDSO/ Railway specifications, Over Head Equipment (OHE) for Traction Power and other associated works, Earthwork, Slope Protection, Retaining Walls, Hume Pipes, Track laying/linking for Track Hopper, Track linking in Ash Silo area, Control room, Gunties and other associated buildings, etc.. All Railway related material/tools/machinery shall be procured from the approved Indian Railways/RDSO vendors only. All the works for the proposed Railway siding though not explicitly mentioned above, but required to make the system complete are included in the Bidder's scope. - Commissioning of complete railway siding system including in-plant rail yard as per NTPC/ Railways requirement. Clearances required from Railways, State/Central Govt. and other third party agencies for complete commissioning of Railway Siding is in the scope of Bidder. - All bridges and culverts will be built to Heavy Mineral Loading Standard of loading with maximum axle load of 30 tonnes for locomotives and train trailing load of 12 tonnes per meter behind the locomotives. - There are 2 (Two) Box Culverts, one with 4.5m span and another with 2.5m span on the Lead Line. They have to be extended maximum 15m. - There is a major Bridge with 12.2m span on the Lead Line; it has to be extended maximum 15m.		
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1.00.01	j. There is a 3m x 3m, 60m long Box Culvert Bridge inside the In-Plant Yard. k. There is a 'B' Class Manned Level Crossing. It has to be extended 30m approximately. l. 2 (Two) nos. of Foot Over Bridges (30m & 40m long approximately) will be provided as per RDSO Standard. m. An Electronic In-Motion Weigh Bridge will be provided as per RDSO Standard. n. An entry gate cabin with over head structure for inspection of wagons is to be provided at the plant entry point of the railway siding. o. Utility Buildings(About 250.00 Sqm Plinth Area): FOIS Room, Crew Rest Room, Signaling Cabins, Entry gate cabin, In motion weigh bridge room , Gumties and other associated buildings with all civil amenities, complete electrification work and approach roads of about 2.0 Km length for all above buildings. p. In order to deal with the inward & outward Traffic it is proposed to provide an In-plant R&D Yard with 4 (Four) Running Lines, 1 (One) Brake Van Siding, 1 (One) Outhaul Line each for Silo and Track Hopper. q. Track structure: i. Rails: 60Kg/m prime quality rail as per RDSO specifications will be used. ii. Track: The tracks will be laid with 60 Kg prime quality rails on PSC sleepers with elastic fastenings and with 300mm ballast cushion. iii. Sleepers: PSC sleepers 1660 Nos. per Km. iv. Ballast: Ballast as per RDSO specification with a minimum depth of cushion of 300 mm below the sleepers at rail seat is proposed. r. Points & Crossings: 13 Nos. of 1 in 8.5 and 1 no. of 1 in 12 are required as per RDSO specifications s. 1 no. of 1 in 8.5 Derailing Switch is required as per RDSO specifications. t. Total track KM is about 7.1KM. u. All charges including Deposit works, Codal Charges required for approval, construction and commissioning, payable to Railways for railway siding system are to be paid by the Bidder to the concerned zonal Railways. v. All spares, tools and plants required for maintenance of complete Railway Siding System. Above scope of work is not limiting and any increase in the scope with respect to that mentioned in FSR will be compensated as below:- i) For Civil Engineering works: Applicable Schedule of Rates (SOR) of East Coast Railways (ECoR) as on date of techno-commercial bid opening. ii) For S&T and OHE works : Applicable RVNL (Rail Vikas Nigam Ltd.) standard BOQ as on date of techno-commercial bid opening. Agency has to pass on the rebate for reduction in scope, if any on the same basis.			
	All steel structures shall be fabricated in factory, transported and erected at site. All factory-fabricated structures shall have bolted field connections. Coal bunkers with hoppers, lime storage silos, Chimney flue liners, CW duct liners can either be fabricated at factory in segments, transported and welded at site before erection or fabricated at site. For coal bunkers, hoppers and chimney flue liners, to prevent coal dust/flue gas leakages, the applicable field joints shall necessarily be welded. Note: Steel structures shall mean plant and non-plant building structures, boiler & ESP support structures, Coal, Limestone and Gypsum handling structures, AHP structures, chimney flue liners support platforms & stairs, pipe and cable support structures.			
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	Civil, structural and architectural works though not explicitly mentioned in the above list but required for the completion of the various systems of the package shall also be in the scope of the bidder.			
1.00.02	CORROSION PROTECTION			
	The plant lies in the corrosive category C3 as per ISO 12944. Protection measures shall be provided as specified in Part-B of Technical Specifications.			
1.00.03	Supply of earth for filling in site levelling, reservoir embankment, Railway siding embankment (within plant boundary and outside boundary) & disposal of surplus earth/debris including arranging the borrow pit/disposal site and making payment of royalty, levies, taxes and any other applicable charges etc. shall be in bidder's scope.			
2.00.00	LABOUR & STAFF COLONY AND CONSTRUCTION FACILITIES			
2.01.00	LABOUR & STAFF COLONY			
	The following are in the Bidder's scope of work for labour & staff colony:-			
	a) Development of Bidders temporary staff colony and labour colony along with toilets & fencing etc. Bidder may use Area-A for Labour Colony. For safety of labour, bidder to provide separate approach road for their movement, as per site conditions, which shall be completely isolated from material movement road/path. No material movement shall be allowed on approach road meant for Labour colony.			
	b) Adequate no. of Rest rooms with toilet for bidder's labour & staff.			
	c) All Civil and Structural work associated with drinking and service water for Bidder's labour and other personnel at the work site/colony/offices including pump houses, pipes, overhead tank, tube wells etc.			
	d) The EPC Contractor shall have total responsibility for providing and maintaining facilities for safety, welfare, drinking water and sanitation, hygiene, biennial health checkup etc. for construction workers at their workplaces as well as at labour & staff colonies. The facilities for occupational safety, healthy environment, first aid, drinking water, resting place & toilets, canteen, crèche, etc. shall be provided at the workplace for construction workers by the contractor.			
	e) Accommodation for Workers & staff colony in adequate numbers as required for the project peak demand shall be made in the form of temporary structures which shall be removed after completion of the project. It shall have facilities for drinking water & sanitation, approach road, dust suppression, drainage, sewage treatment plant, solid waste collection & disposal, fuel for cooking, medical healthcare, creches, etc.			
	f) Sole responsibility of development and maintenance of above facilities for construction workers hired by the Contractor or his sub-contractors shall rest with the Contractor. Land, water, electricity for the labour & staff colony shall be arranged by the Contractor as stipulated elsewhere in Technical Specification.			
2.02.00	CONSTRUCTION FACILITIES			
	The following are in the Bidder's scope of work pertaining to construction facilities in this package.			
	1. Construction Water			
	Construction water shall be the responsibility of Bidder during all stages of construction.			
	However, construction water may be provided by Owner at one point near existing Stage-II reservoir on chargeable basis. Bidder shall arrange for further distribution/transportation to required location by their own.			
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	2. Construction Power Scope of supply of construction power is specified in SECTION – VI, PART-B, SUB SECTION B-19 of Technical specification. 3. Construction of following temporary facilities of bidder - Construction office, - Construction stores (covered) & open stores as per his requirement. - Workshops for maintenance of construction plant and equipment. - Material/field testing laboratory facilities and any other temporary building. 4. Providing all necessary fire-fighting devices/equipment/fire tender etc. required during the project execution stage in project areas including laydown/pre-assembly yard area. 5. Providing all tools and tackles required for the work. 6. The Bidder shall arrange skilled/semiskilled/unskilled labour (from local source(s) as far as available) and supervisory staff for quality execution of all civil, structural and architectural works. 7. Development of hard crusted / paved fabrication yard for onsite structural steel fabrication work where permitted. 8. Area lighting at the construction / erection site, fabrication, pre-assembly and storage yard, office areas, labour and staff colony etc. 9. Providing first aid facilities at the construction / erection sites, workshops, laboratories, fabrication, pre-assembly & storage yard, Offices and other places of work as per the requirement. 10. Use of ash and ash based products. In line with Gazette Notification on Ash Utilization issued by Ministry of Environment & Forest and its amendments, Bidder shall use ash and ash based products in all construction. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill. The above requirements shall be applicable to his sub-vendors also and Contractor shall be responsible for enforcing the same on his sub-vendors Fly ash is not available within plant boundary. Bidder to procure Fly ash from TSTPP-Kaniha. Bidder to collect and transport the same meeting environmental norms/ local regulations at his own cost as per operation schedule for fly ash collection. A nominal amount of Rs 1 per MT shall be charged by TSTPP Kaniha. 11. Repair & Maintenance Facilities by the Bidder : Bidder shall establish/set up at site suitable repair facilities for construction equipment and machinery (like cranes, hydra, forklifts, welding equipment, dumpers, rollers, etc.) Bidder shall also make arrangements /tie-up with manufacturers / suppliers of such construction plant, equipment & machinery, for periodic overhaul/ maintenance and for repair of major breakdown, if any. Bidder shall also keep adequate stock of spares at site for various construction plant, equipment and machinery to meet day to day requirements as recommended by the manufacturer / suppliers or as instructed by the Engineer. Bidder shall deploy dedicated qualified, full time mechanical / electrical foreman & supervisors for manning the repair facilities as specified above. 12. Water sprinkling in construction area and roads, as per requirement/directions of Engineer-in-Charge, to arrest fugitive construction dust. 13. Dewatering in construction area during construction period for any seepage water as well as accumulated rainwater. 14. Housekeeping of all construction area and disposal of construction/demolition waste. This also includes cutting and removal of vegetation including dry vegetation to avoid fire hazard in the entire project construction area.			
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CLAUSE NO.	SCOPE OF SUPPLY & SERVICES			
2.03.00 2.03.01	DEVELOPMENT OF LAYDOWN AREA IN ABANDONED ASH DYKE Bidder shall use abandoned ash dyke as a Lay down area. Details of proposed laydown area along with approach to laydown area is indicated in Annexure-J of Part-B (Civil works). Three areas marked as 'A', 'B' and 'C' totalling 70 acres (approx.) are identified as laydown /preassembly area. Fencing of the laydown area and raising/lowering of 33kV line in the area marked for laydown is in Owner's scope. Construction of wire fencing in the proposed laydown area shall be completed within 4 months from NOA. Contractor can do the site preparation work parallelly. The contractor shall develop the following facilities before using the allocated laydown area. - Site clearance including cutting of trees of girth less than 30 centimeters. - Bidder shall construct and maintain approach road from nearby highway to laydown area and road network in the interior of laydown area ensuring that there is no vehicular movement an any portion of dyke except on the constructed roads. Bidder to note that approach road area is a low lying area and is having some habitations adjoining it. Bidder shall ensure the safety of habitations during and after construction of the approach road through construction of retaining walls etc.. Further bidder to ensure measures to avoid noise and dust pollution to habitants during the contract period. - Security of material shall be responsibility of the EPC Contractor, including gate control. - RCC drains in the entire laydown area and along roads shall be planned so as to ensure proper disposal of rainwater. The water from these drains shall be suitably discharged to slope drains of the dyke at selected locations. Slope drains shall be maintained and repaired as per requirement to the satisfaction of Engineer in charge. Proper functioning of slope drains shall be ensured before using it for rainwater disposal. Alternative arrangement shall also be planned in case the disposal of water is not possible through the slope drains. - Levelling, compaction backfilling, for purpose of laydown area surface preparation - Hard crusting of Laydown area, fabrication, and pre-assembly yard area has to be carried out as per specifications mentioned elsewhere. The extent of hard crusting shall be decided by the contractor based on their requirement. Material and equipment storage shall be as per guidelines covered elsewhere. - Turfing works. - Inspection and repair /restoration work of dyke if any which arises due to usage of the dyke lagoon for creation of laydown area purpose. - Refer Annexure I and Annexure J of Part B for detailed scope of work and measures.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-IID CIVIL WORKS	PAGE 13 OF 13	

SUB-SECTION–III

TERMINAL POINTS & EXCLUSIONS AND OWNER’S INPUT

CLAUSE NO.	TERMINAL POINTS & EXCLUSIONS AND Owner's INPUT			
1.00.00	TERMINAL POINTS The following terminal points are to be read in conjunction with the tender drawings, scope of supply and technical specifications of various systems.			
1.01.00	MECHANICAL			
1.01.01	Auxiliary Steam System a) The stub/Tee-off connections with Isolating valve and blank flange on the auxiliary steam Unit/Station header for future connections as indicated in the tender drg.			
1.01.02	Others a) Rail wagon/ closed tanker/ open truck loading outlets of HCSD cum Fly Ash storage Silos/ BA Silo. b) Outlets of mill reject storage bunkers.			
1.02.00	Plant Water System a) Potable water supply line up to Terminal point (E1500, N3500) to meet potable water requirement of colony/Township. Contractor shall ensure that pressure available at Terminal point shall not be less than 2.5 ksc (gauge).			
1.03.00	Ash handling system Employers' cross-country conveyor shall be routed along the Ash slurry disposal corridor from plant end towards mine void where corridor space is limited. Bidder has to ensure that there shall not be any hindrance due to Ash slurry & AWRS corridor for supporting structures of Employers' pipe Conveyor. Employers' pipe conveyor may be taken-up in parallel or in near future.			
1.04.00	Coal Handling Plant Employers Trough Conveyors (downstream of cross-country conveyors from Mine end) shall terminate at TP-1. Supporting structures, drives, pulleys, discharge chutes of Employers' Coal conveyors shall be rested on drive floor of TP-1. Bidder to consider load for the employer's Coal Conveyor's drives and associated supporting structure. Similarly, Employers Biomass Conveyors shall terminate at TP-9. Supporting structures, drives, pulleys, discharge chutes of Employers' Biomass conveyor shall be rested on drive floor of TP-10. Bidder to consider load for the employer's Biomass Conveyor's drives and associated supporting structure. While designing above TP's, 25 m span of employer's gallery may be considered by the bidder. Dust suppression arrangement at Head end, Handling arrangement for drives, pulleys of employers' conveyors at TP-1 & TP-9 shall be in the scope of the Bidder.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO. CS-4540-001A-2	SUB-SECTION-III TERMINAL POINTS & EXCLUSIONS AND OWNER'S INPUT	PAGE 1 OF 3

CLAUSE NO.	TERMINAL POINTS & EXCLUSIONS AND Owner's INPUT			
2.00.00	ELECTRICAL a) Terminal point for Construction power – 6.6kV terminal of employers station transformer. b) Terminal points for switchyard- 400 KV Switchyard at TTPS stage-III shall be in the bidder's scope. (i) Terminations at the switchyard line take off gantries for 400KV lines not in bidder scope. The line side insulators shall be provided by the transmission line contractor, however the clamps & connectors for droppers to equipment connections are in the bidder's scope. (ii) FOTE equipment , FODP JB, Fiber Approach cable etc required at 400 KV Switchyard at TTPS stage-III shall be in the bidder's scope.			
3.00.00	NOT USED			
4.00.00	EXCLUSIONS			
4.01.00	MECHANICAL a) Manufacturing, supply, erection and commissioning scope of SCR/Hybrid System which shall only be limited to the works required for SCR ready /Hybrid ready plant. b) Supply of limestone, Biomass.			
4.02.00	ELECTRICAL a) Supply erection and commissioning of PLCC, HF cable. b) 400kV transmission lines			
4.03.00	CIVIL a) Green belt development and afforestation b) Township c) Landscaping			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO. CS-4540-001A-2	SUB-SECTION-III TERMINAL POINTS & EXCLUSIONS AND OWNER'S INPUT	PAGE 2 OF 3

CLAUSE NO.	TERMINAL POINTS & EXCLUSIONS AND Owner's INPUT			
5.00.00	Owner's Input:			
5.01.00	Schedule of front Handover of stores area:			
	S. No.	Existing Store	Stage-III Facility	Area Handover from NOA Date (in months)
	1.	Store No. 5, 6, 11	TAC and CAC	5
	2.	Store No. 4, 7	Unit-1 ESP-CR Area	4
	3.	Store No. 8, 9, 10	FGD Absorber Area	7
	4.	Store No. 12, 13, 14, 15, 16	ASPH Area	5
	5.	Store No. 17	Limestone Grinding & Slurry Storage Building	7
	6.	Store No. 18, 19, 20	Limestone Crusher House and Silo Area	8
	7.	Store No. 21, 22	Limestone Unloading Area	8
5.02.00	Construction of wire fencing in the proposed laydown area shall be completed within 4 months from NOA. Contractor can do the laydown area preparation work parallelly.			
5.03.00	Right of use (ROU) permission for make-up water corridor shall be available after 8 months from NOA.			
5.04.00	Railways siding land shall be available after 12 months form NOA.			
5.05.00	The area will be handed over as is & where is basis.			
5.06.00	Dismantling and disposal of ash water reservoir to locate other facilities for stage-III are in the scope of the bidder.			
5.07.00	Ash slurry pipe line to be routed through the existing facilities of stage-I/II. The front will be handed over progressively.			
5.08.00	Before construction of the boundary wall (which is in the bidder scope) the bidder shall make arrangements for demarcation between township and stage-III area at the beginning.			
5.09.00	Bidders should visit site and make a logistic study of ODC consignments.			
5.10.00	Stage-III Rreservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC.NO. CS-4540-001A-2		SUB-SECTION-III TERMINAL POINTS & EXCLUSIONS AND OWNER'S INPUT
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NTPC Limited

(A Government of India Enterprise)



TALCHER THERMAL POWER PROJECT STAGE-III (2 X 660 MW)

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – B

(BOOK 4 OF 5 – CIVIL WORKS)

SECTION - VI

BIDDING DOCUMENT NO.: CS-4540-001A-2

(This document is meant for the exclusive purpose of bidding against this Package and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
D-1-1 1.01.00	GENERAL This specification is to cover, survey works, site leveling works, design, preparation of general arrangement drawings, construction and fabrication drawings, supply of labour & materials and construction of all civil, structural and architectural works by the Bidder. Description of various items of work under this specification and nature of work in detail are given hereinafter. The complete work under this scope is referred to as civil works. Various buildings, structures, plant and systems, facilities, etc., covered under the scope is given in Part-A and herein. The work to be performed under this specification consists of design, engineering, construction, erection and providing all labour, materials, consumables, equipment, temporary works, temporary storage sheds, temporary colony for labour and staff, temporary site offices, constructional plants, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of the plant, all in strict accordance with the specifications including revisions and amendments thereto as may be required during the execution of work. All construction materials including cement, reinforcement steel, coarse & fine aggregate, structural steel and construction water etc., shall be arranged by the Bidder. The scope shall also include setting up by the Bidder a complete testing laboratory in the field to carry out all relevant tests for structural steel, reinforcement steel & reinforced concrete (RCC) works. Preliminary geotechnical investigation in the proposed area has been carried out by the Owner and the bore-log data is furnished in Annexure 'C'. The work shall be carried out according to the design/drawings to be developed by the Bidder and approved by the Employer. For all buildings, facilities, systems, structures, etc., necessary layout and details are to be developed by the Bidder keeping in view the statutory and functional requirements and providing enough space and access for operation, use and maintenance. The Bidder's work shall cover the complete requirements as per IS codes, fire safety norms, requirements of various statutory bodies, International Standards, best prevailing practices and to the complete satisfaction of the Employer. The Bidder shall make the layout and levels of all structures from the general grid of the plot and the nearest GSI benchmark or other acceptable benchmark of Government department. As per the directions of the Engineer. The Bidder shall be solely responsible for the correctness of the layout and levels and shall also provide necessary instruments, materials, access to works, etc., to the Engineer for general checking of the correctness of the civil works. All the quality standards, tolerances, welding standards and other technical requirements shall be strictly adhered to. The Bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, soil conditions, local conditions and site-specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-1 CIVIL WORKS GENERAL	PAGE 1 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the Employer. Wherever there is an anomaly in the design concept between the data furnished in the General Design Criteria & Design Concept of Buildings, the data furnished in the design concept of buildings shall be treated as final. Bidder or his agencies engaged as detailer for fabrication drawings should have the experience of detailing for powerhouse structures or steel plant or Industrial structures like Petro/ Chemical/Refinery/Cement etc.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-1 CIVIL WORKS GENERAL	PAGE 2 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
D-1-3	SUBMISSIONS			
3.01.00	The drawings included in the Bidding Document provide a general idea about the work to be performed under the scope of this contract. These are preliminary drawings for bidding purposes only and are by no means the final drawings or show the full range of the work under the scope. Work has to be executed according to drawings prepared by the contractor. The following documents and drawing shall be submitted and got approved before commencement of detailed engineering. The list given below is not exhaustive but indicative only. a) Project design intent, design criteria which shall cover all design aspects, design parameters, material of construction and its specifications, structural idealization including framing system for gravity loads and lateral loads(wind and seismic), load cases, load combinations, assumptions, references, basis of analysis & design of all buildings, machine foundations, facilities, systems and structures etc. b) Survey drawings indicating spot levels for the area under the scope of work. c) Plants 'General Layout Plan' drawing with coordinates of roads, boundary wall, buildings and facilities, pipe/cable corridors, railway lines, Green Belt etc.. d) Geotechnical investigation scheme e) Geotechnical Investigation report including foundation system recommendations. f) Typical design of pile, if applicable, in terms of type, rated capacity, length, diameter and the termination criteria to locate the founding level. g) Scheme for initial and routine load test of Pile foundation high strain dynamic load test and pile integrity test methodology. h) Details of corrosion protection measures for all structures, foundations etc. i) Architectural concept designs which shall cover all concept plans and elevations, finishes and area statements of all buildings and facilities j) The following sequence of submission of drawings/ documents is to be followed: - Architectural drawings, wherever applicable - Relevant GA drawings & loading document - Analysis & design of structures/ buildings/ facilities with drawings. - Analysis & design of foundations with drawings.			
3.02.00	Detailed construction drawings and design calculations for all civil works for static as well as dynamic analysis shall be submitted for approval prior to undertaking construction work.			
3.03.00	Design calculations shall be done in M.S. Office (latest version) and Drawings shall be prepared in Auto Cad (latest version). The analysis shall be done by using STAAD PRO / ANSYS/SAP2000 (latest version). However, design may be carried out manually, using computer work sheets or by using suitable software programs, as mutually agreed by Employer. Final calculations and drawings shall be submitted as mentioned in General technical specification.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-3 CIVIL WORKS SUBMISSIONS	PAGE 1 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
3.04.00	Civil Task drawings indicating various equipment loading and supporting arrangement and floor loads shall be submitted along with design calculations. Soft copies of all STAAD/Other Softwares input and output files shall be submitted along with the design calculations for all revisions.			
3.05.00	Structural steel fabrication drawings to be prepared by the contractor will not be approved by the Employer. However, the Contractor shall submit all fabrication drawings for Employer's reference. Copy of detailed bar bending schedule as prepared by contractor shall also be submitted to Engineer in charge for the reference.			
3.06.00	Approval of construction drawings prepared by the contractor shall not relieve the Contractor of his responsibility regarding the safety and adequacy of design and correctness of the drawing.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-3 CIVIL WORKS SUBMISSIONS	PAGE 2 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS	
D-1-4	GENERAL LAYOUT PLAN	
4.01.00	The preliminary layout plan proposed for the project is shown in the drawing no 4540-999-POC-F-001 titled "General Layout Plan". It shall form the basis for further elaboration by the Bidder for the plant facilities, which are in his scope. Area identified for facilities remain same as indicated in GLP, however, minor modification of location of building may be done to optimize layout. Bidder shall prepare the detailed layout of the plant facilities which are in his scope and shall submit the same for Owner's approval. While preparing the detailed layout, planning his facilities and deciding upon the transportation and erection strategy he shall ensure the following aspects. - All Statutory requirements including safe distances between various facilities as per applicable rules/acts/laws including local bye-laws are met. - Face of the buildings and facilities are located in such a way so as to have an offset of minimum 15 to 20m with respect to center line of road. - The entire construction activity shall take into account the commissioning of the units in phases matching with the phased commissioning of the plant. - The interface requirements with the plant construction/erection activities of other contracting agencies engaged by Owner. These agencies engaged will be working simultaneously with the Bidder within the plant premises. - Available Area for laydown, preassembly and batching plant have been earmarked on the General Layout Plan. - No permanent facility shall be located within the safety zone limit around the fuel Oil storage tanks etc., except those permitted by Owner. - Transportation of all equipment and materials shall be by road as envisaged. Any other mode envisaged by the bidder may be proposed. - All parts of the buildings and facilities shall be approachable by fire tenders. - Main roads /peripheral roads are only shown in GLP and road layout tender drawing. Approach made of heavy-duty paving/passage to buildings/structures/facilities in the scope of bidder from nearby plant road/peripheral road/grid road/internal access road shall be provided. Multiple numbers of access to different parts of any building /facility like main plant building, control room, transformer yard, service building etc. should be provided. - Facilities are to be planned considering the diverted route of transmission line as shown in General Layout Plan.	
4.02.00	DELETED	
4.03.00	Site Levelling and Slope Protection Work	
4.03.01	Complete levelling of entire plant area as shown in drawing no. 4540-001-POC-A-003 Titled 'Site Levelling Plan' shall be done by the Bidder. Filling in reservoir area below the bed of reservoir and for the reservoir embankment shall also be done by the Bidder. Detailed requirements for the same are specified under head 'Raw Water Reservoir' elsewhere in the specifications. Bidder shall carry out the topographical survey before he commences detailed design and site leveling. This survey shall cover the entire plant area including the areas earmarked for administration building, ash based units, ash silos, railyard, raw water pump house & associated facilities, reservoir and the diversion drains in Bidder's scope of work. Based on field observations the contractor shall prepare and submit the survey maps of the surveyed	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	site on suitable scale, indicating grid lines, contour lines and demarcating all permanent features like roads, railways, water-ways, buildings, power lines, natural streams, trees etc. For each area survey maps shall be prepared and submitted, one showing the spot levels and contours with grid lines and the other showing the grid lines, contours and permanent features. Established methods of surveying like triangulation, traversing, fly leveling etc. shall be adopted for the survey work. Spot levels shall be taken at 25 meter interval and at closer intervals where pits, undulations etc. are met with. These levels shall be taken in two orthogonal directions. Contours shall be plotted at 5m interval. It is proposed that for the purposes of site leveling the entire plant and associated areas will be divided into various blocks as defined in the drawing no. 4540-001-POC-A-003 titled, "Site Levelling Plan". Each block shall be finished to the formation level as specified in drawing. Bidder shall deploy adequate number of experienced site leveling contracting agency(s) with requisite earth moving and compacting equipment to complete the work as per schedule. Preparation of leveling & grading as per proposed finished ground level (FGL) is in the Bidder scope. Bidder shall ensure that road access and drainage facilities for each block is available when site leveling in that block is completed. Unless otherwise mentioned, all roads and drains within a block shall be constructed by the bidder within a month from the date of completion of site leveling of that block. The specified formation level(s) shall be achieved either by excavation where the existing ground levels are higher than the specified formation level or by raising by controlled filling with borrowed earth where the existing ground levels are lower than the specified level. The excavation shall be in all types of soils or rock or a mixture of these. Bidder should assess and satisfy himself about the actual nature of soil present at site, before submitting his bid. All natural materials arising out of site clearance and excavation shall be the property of owner. They shall be dealt with in the manner specified by the Engineer. Earth / boulders / rock etc. excavated and useful portion (serviceable materials) of trees cut shall be stacked at suitable places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer. Woods, branches, trunks of trees shall be termed as serviceable material. Other materials like twigs, leaves, roots, vegetable and organic matters etc. shall be termed as unserviceable material and shall be sorted out from the serviceable materials before disposal. They shall be cleared from the area and disposed off at places within Owner's acquired land for the plant including the reservoir and the ash disposal area in a manner as directed by the engineer. If the excavated material is suitable and accepted by the Engineer as fill material, the same can be used for filling in other areas where raising by filling is required. Otherwise, the same shall be taken and stacked at places(s) within the plant boundary as directed by the Engineer. Filling with rock shall be done only after the written permission of the Engineer in the following manner: For filling the areas involving water bodies, dewatering, removal of much, dismantling of existing slope protection of water including all other scope of work required for filling of area to be done by the bidder. - Filling with rock shall be done only in areas identified for laydown and preassembly and ash based units. - Maximum size of rock used for filling should not be more than 150mm in all direction.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS 			
	- Original ground after removal of all organic and vegetable matters shall be consolidated by rolling as directed by the engineer subject to a minimum of six passes of 8-10 tonne roller. - Over the compacted layer of rock (300mm), soil shall be filled in horizontal layers not exceeding 300mm in compacted thickness. The soil shall be compacted as specified elsewhere. - It shall be ensured that the top soil layer is in minimum 3 layers of 300 mm each. To achieve this the thickness and number of rockfill layers below can be suitably adjusted. Contour map and spot levels of the area based on the preliminary survey carried out by Owner is enclosed for the purpose of guidance of Bidder. Refer tender drawing no. "4540-999-POC-F-002". However, Owner does not lake any responsibility about the accuracy of the survey details furnished and any variation of the said data shall not constitute a valid reason for changing the terms and conditions of the contract. Bidder is requested to carry out his independent assessment of the existing ground levels before furnishing his bid. Detailed survey shall be carried out by Bidder after award of work and all findings as stated earlier shall be submitted for Owner's review. 4.03.02 All existing drains/channels in the plant and other areas associated with the plant except those proposed to be constructed by the Owner shall be suitably diverted by the Bidder before taking up any construction. These diversions shall be so designed as to ensure effective disposal of water without any accumulation or flooding within the limits of overall land acquisition line and in adjoining areas. 4.03.03 Before commencement of cutting/filling, all organic and vegetable matters like grass, plants, shrubs bushes, weeds, trees etc. in the areas to be filled, shall be completely removed along with their roots and disposed off. It shall also be ensured that the area to be filled is clear of any water, slush etc. Original ground shall be compacted by rolling as directed by the Engineer subject to a minimum of six passes of 8 to 10 tonne roller. The earth shall then be spread in horizontal layers not exceeding 300 mm in compacted thickness. Each layer shall be watered and compacted with proper moisture content and with such equipment as may be required to obtain a compaction of 95% or more of Standard Proctor's maximum dry density. The moisture content of the fill material shall be controlled to obtain near optimum moisture content during compaction. The fill material shall be tested for determining optimum moisture content and maximum dry density by Standard Proctor Test as per IS: 2720 (Part-VII). The fill material shall also be tested for determining moisture content before compaction as per IS: 2720 (Part-II). For each of the above tests, one sample for every 10,000 cubic metre of fill material shall be tested. Additional samples shall be tested, whenever there is a change in the source or type of fill material. The compacted soil shall be tested for its dry density as per IS: 2720 (Part-XXIX) or Part-XXVIII). Samples shall be taken at the rate of one sample for every 10,000 sq.m. area for each compacted layer. In addition, random checks shall be carried out in compacted soils by means of Proctor needle penetration. Bidder shall submit to the Engineer, the test results immediately after completion of the tests. A sample shall be deemed to have passed the test when the in-situ dry density is equal to or more than the specified percentage of maximum dry density. If a sample taken from a layer fails to pass the test, the layer shall be further compacted till two samples taken and tested from this layer pass without any negative deviation. Only after this. spreading of further layers shall be taken up.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
4.03.04	Before start of filling, the Bidder shall submit to the Owner his proposal for the methodology to be adopted for compaction for each type of fill material. The Bidder shall also carry out compaction trials to establish the proposed methodology. The Bidder shall start the compaction work only after approval of the methodology by the Owner			
4.03.05	The surface of the cut/filled up areas after reaching final level shall be dressed to the required levels and slopes. The difference in levels shall not be more than +/- 10cm locally.			
4.03.06	The borrow areas outside the overall plant boundary limits for obtaining suitable fill material which is required over and above the earth available after cutting high grounds within the plant area, for site levelling shall be arranged by the Bidder himself and all expenses in respect of royalties, taxes, duties, etc. for borrow areas/fill material shall be borne by him. He shall also obtain and submit to the Owner the necessary clearances/permission from the concerned authorities for the borrow areas/fill material.			
4.03.07	Material suitable for filling shall be loaded and transported to the filling site by the Bidder. Any coarse grained or fine grained low plastic soil, free from shingle, salts, organic matter, sod or any other foreign substances, may be used for filling. The Bidder shall test the fill material to establish its suitability and submit its results to the Owner. Fill material shall be approved by the Owner. The following types of materials shall not be used for filling: a) Material from swamps, marshes and bogs. b) Expansive clays c) Peat, logs, stumps, sod and perishable materials. d) Materials susceptible to combustion e) Any material or industrial and domestic produce which will adversely affect other materials in the work. a) Materials from prohibited areas			
4.03.08	Bidder shall include in his offer any extra filling that may be required on account of subsidence of the original ground due to overburden of filling above and/or compaction works for site levelling.			
4.03.09	After levelling, the contractor shall establish concrete pillars at the intersection points of the grid lines for future reference. These pillars shall project at least 450 mm above the formation level and shall be labelled permanently with their respective coordinates and reduced levels.			
4.03.10	Filling upto the specified formation level shall extend at least 2.0 m beyond the outside face of boundary wall/fence. Thereafter, it shall be finished at a suitable slope (not steeper than 1 Vertical: 2 Horizontal).			
4.03.11	For site levelling of railway siding area (as marked in site levelling drawing) shall also comply to Railway Design & Standards Organisation (RDSO) guidelines.			
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	TECHNICAL REQUIREMENTS 		
D-1-5 5.01.00	SALIENT FEATURES & DESIGN CONCEPT This section of specification covers salient features and design concepts of Civil, Structural and architectural works pertaining to Power Plant components as detailed below. Architectural Concepts &Design: - All the Architectural design works shall be carried out by professionally qualified architects having adequate experience (minimum five years) in the design and detailing of architectural work of power plant buildings. Bidder may have in-house Architects with the required experience for the above or engage Architect Consultant having similar experience. - Power plant buildings shall be architecturally treated, based on functional requirements, in such a way that they retain the desired scale, and present a pleasing composition of mass and void. The overall impact of the buildings shall be one of aesthetically unified architectural treatment having a comprehensible scale, blending colour scheme with the surroundings. - All buildings and structures shall be architecturally treated in such a way so as to be in complete harmony with the main plant building, surrounding structures and environment. Due considerations shall be given to orientation, landscape design, and interior design. All finishes for floors, walls, ceiling, structural elements, partitions for offices and industrial areas shall be suitable for their aesthetics, durability and functional requirements and shall include the latest building material & technology. Consideration shall be given for achieving standardization & fast track construction. - Overall colour scheme of the buildings shall be designed judiciously and in a comprehensive manner taking into account the mass and void of buildings, its facade, equipment, exposed structural elements, piping, trestles, bus ducts, and other service elements. Architectural design of all power plant buildings shall be suitable for installation of photovoltaic panel on rooftop for renewable energy purpose. - For adequate light and ventilation, National Building Code recommendations shall be followed. All buildings having height more than 4.0 m shall have fixed glazed ventilators. - Architectural design of all Power Plant Building shall be suitable for installation of solar photovoltaic panels on roof tops for renewable energy purpose. - All the buildings shall be architecturally designed to meet the National Building Code requirement & Fire Safety Regulations. - All public buildings shall be designed incorporating the provision of barrier free environment for physically disabled persons. - All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rainwater harvesting scheme for the project and obtaining approval of the scheme from Central Ground water board is in bidder's scope		
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	j) For Control Rooms, CER, UPS Charger Room area in MPH dry wall construction technology shall be incorporated. Control room shall be designed as designer control room with ACP Cladded wall paneling for housing LVS. k) Full glass wall partition with aluminium frame over solid wall with skirting 150 mm high to be provided between CCR and CER of AHP CR, WS CR & CHP control room and MPH Control room. l) All control room shall be provided with air lock lobby. m) The development of green belt is not in bidder scope. However, bidder has to plan the facilities leaving the space for green belt as indicated in "General Layout Plan". In addition to that laydown areas and other vacant land of the plant will be used by owner for the development of green belt. n) All floor areas indicated in subsequent pages shall be total floor area required.		
5.02.00	Main plant Buildings/Structures shall comprise of: a) Mill Bunker Building b) Transfer Points, Conveyor Galleries & Trestles c) Machine Foundations in Main Plant d) Boiler Structure e) Compressor House f) ESP Structure g) ESP Control Building h) Pipe & Cable Gallery i) Main Power House j) Service Building The, Main Power House, Bunker building, transfer points, conveyor galleries and trestles, boiler supporting structure, compressor house, ESP supporting structures including inlet and exhaust duct support structures, Pipe cable Galleries & trestles shall have structural steel framed super structure. All other buildings may have either RCC or structural steel framework. Brief description of the above mentioned Main Plant Buildings is furnished herein:		
5.02.01	Mill and Bunker building i. Salient Features The mill bunker building shall house coal mills, feeders, Cylindrical Coal Bunker & Conical Hopper, Tripper Conveyor & its drive and monorails. All columns, main beams and secondary beams shall be made of structural steel. The RCC floor slabs (supporting the Feeder and Tripper Conveyors) shall comprise RCC slab supported on profiled metal deck sheet (to be used as permanent shuttering) not to be considered for design of RCC slab as composite slab) and shear anchor studs welded to the top flange plate of secondary & main structural steel beams, (which supports the RCC slab & metal deck sheet). Bidder shall integrate the Mill & Bunker Building with boiler supporting structure.		
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5.02.02 5.02.03	Access platforms shall be provided at minimum one (1) level above bunker supporting level for inspection and testing of bunker and hopper connections. Minimum (1) Nos. of man hole/ access window shall be provided for maintenance of silo. The bottom level of base plates of columns shall be 1.20 m below the finished paving level in the Boiler Area. The columns of Mill-Bunker building shall consist of built up structural steel I-sections. Rolled sections with additional cover plates on column flange shall not be acceptable for column sections. The cylindrical coal bunker and conical hopper shall be made of structural steel. The inside surface of hopper shall be lined with stainless steel plates the details of which are mentioned hereafter in this specification. Structural steel brackets with PTFE bearings shall be provided at the end columns to support the external gallery of the Tripper Conveyor The Mill-Bunker building roof shall be provided with Pre-fabricated insulated metal sandwich panels. Composition of Insulated Metal Sandwich Panels shall be as described in Clause 9.08.00, Part-B (Civil) of Technical Specification. Adequate slope shall be provided for quick drainage of rain water. The RCC floor supporting the Tripper Conveyor shall be fully covered up to the Roof level with single skin metal sheet (& structural steel runners).			
	ii. Design Concept The Mill Bunker Building shall be conceptualized as moment resisting frames in transverse direction and braced in longitudinal direction. In the transverse direction the bracings may be provided, wherever feasible, in order to meet the deflection requirement specified elsewhere in this section. Bracing member shall be connected to column flange plate through gusset plate (minimum 12mm thick). Minimum thickness of structural steel Bunker plates shall be 12mm inclusive of 4mm corrosion allowance. Minimum wall thickness of Hopper shall be 8mm. Minimum thickness of stainless steel liners on the entire inner surface of hopper wall shall be 4mm conforming to ASTM A240 S304 (Type 304) with Mill finish 2B cold rolled, annealed, descaled (pickled) and skin passed. To ensure smooth flow of coal, the hopper surface shall be provided with minimum angle of 73° with the horizontal plane. The top of the cylindrical bunker shall bear no load/ reaction from the tripper floor and accordingly neoprene bellow strap shall be provided at the interface between the two structures to allow free deflection of the tripper floor. Neoprene bellow strap shall be provided all-round the bunker to effectively seal the gap between top of bunker and sealing plate below bunker. For all other design methodology, refer to Design Criteria specified hereafter in this specification.			
	iii. Architectural Features The Mill & Bunker Building shall be a structural steel framed structure having RCC floors and prefabricated insulated metal sandwiched panel sloped roof. The tripper floor side cladding shall be Single skin Metal cladding with steel louvered windows and fixed windows with poly carbonate sheet glazing. Area of windows shall be minimum 10 % of floor area. Rainwater down comer shall be of galvanized MS pipes and shall be located at every column location.			
	DELETED			
	Machine Foundations in Main Plant Area A. SG Area			
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	TECHNICAL REQUIREMENTS 		
	i. Salient Features The scope of work of the Bidder shall be design and construction of all Civil & Structural Works of Machine Foundations including supply of all materials. PA/ FD/ID Fan and Mill foundations: PA/ FD/ ID Fan and Mill foundations shall be RCC block foundation directly resting on virgin soil/ pile below Ground level. The vertical faces of this block foundation shall be isolated from adjacent footings by providing minimum 100mm thick polystyrene board of type-1 conforming to IS: 4671 with density 20 Kg/cum sandwiched between the vertical face of block foundation and 230 thick brick wall all round. ii. Design Concept: - For the foundations of Fans (ID, FD and PA), Mills, etc. detailed static and dynamic analysis shall be done. - Wherever block foundation is adopted by the bidder, suitable provisions to be ensured by the bidder in their General Arrangement and design to prevent transmission of vibration from these machine foundations to other nearby structures / foundations. - The bidder or his consultant should have adequate prior experience in design of machine foundations and the machines should be in successful operation for at least one year prior to the date of submission of bid. B. STG Area i. Salient Features The scope of work of the Bidder shall be design and construction of all Civil & Structural Works of Machine Foundations including supply of all materials, springs & viscous dampers. Turbo-Generator (TG) foundation: Alternative-1 The TG foundation shall comprise of RCC top deck supported on steel helical springs & viscous dampers (called herein as the Vibration Isolation System – VIS) and shall be located in the Turbine bay of Main Power House. The springs-cum-viscous dampers shall be placed on a group of RCC/ Structural Steel columns. These TG columns can be interconnected to the Main Power House Building frame either rigidly or connected through PTFE bearings on corbels/ brackets of the TG Columns. The general arrangement & details of springs/ viscous dampers and supporting group of columns and beams shall be based on TG Equipment detail of the Bidder. Alternative-2 The TG foundation shall be conventional machine foundations comprising of RCC top deck directly supported on substructure comprising of columns and beams without any steel helical springs and viscous dampers. The columns shall be rigidly connected to the RCC deck at top and shall rest on open / pile supported foundation at bottom. The entire foundation system (including deck, columns and raft) shall be isolated from the main plant building structural system and no connection between the main plant structure and TG foundation is permitted. Bidder has the option to choose either Alternative -1 or Alternative-2 based on his design philosophy and practice. However in case Alternative-2 is adopted by bidder, then the bidder has to furnish extended warranty of five years for satisfactory static and dynamic performance of the foundation system. TDBFP & MDBFP foundations:		
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5.02.04	Alternative-1 TDBFP&MDBFP foundations shall consist of RCC top deck supported on steel helical springs & viscous dampers inside Main Power House. In case the top deck is located at operating floor/mezzanine floor level, the springs/ viscous dampers shall be supported on a group of structural steel columns-beam grid which shall be rigidly integrated with the Main Power House Structural frame. Alternative-2 TDBFP&MDBFP foundations shall consist of RCC top deck directly supported on RCC/ structural beams and columns without any steel helical springs & viscous dampers inside Main Power House. The structural columns and beams supporting the TDBFP / MDBFP shall be independent of the Main Power House Structural frame and shall also have independent foundation without any connection to other nearby foundations. Further each TDBFP / MDBFP shall have independent supporting structural arrangement without any interconnection among themselves. Bidder has the option to choose either Alternative-1 or Alternative-2 based on his design philosophy and practice. However in case Alternative-2 is adopted by bidder, then the bidder has to furnish extended warranty of five years for satisfactory static and dynamic performance of the foundation system. BFPs in ground floor In case the MDBFP/TDBFP foundation is envisaged to be located at ground floor of Main Power House, then these shall be designed as block foundations directly resting on soil / pile. Vertical facing of this block foundation shall be isolated from adjacent footings by providing minimum 100mm thick polystyrene board of type-1 conforming to IS: 4671 with density 20 Kg/Cum sandwiched between the vertical face of block foundation and 230 thick brick wall all round. ii. Design Concept: a) For the foundations of Turbo-generator, Boiler feed pumps, etc. detailed static and dynamic analysis shall be done. b) The vibration isolation system (where ever applicable) supplied shall be of proven make and shall be in successful operation supporting machines like steam turbo-generators, BFPs, etc., c) Wherever alternative-2 is adopted by the bidder for TG or BFPs, suitable provisions to be ensured by the bidder in their General Arrangement and design to prevent transmission of vibration from these machine foundations to other nearby structures / foundations. d) The bidder or his consultant should have adequate prior experience in design of machine foundations for the respective alternative to be adopted by the bidder and the machines should be in successful operation for at least one year prior to the date of submission of bid. For detailed specification of steel helical springs and viscous dampers refer General Specification Chapter.			
	Boiler Structure i. Salient Features The Boiler supporting structure shall be structural steel framed superstructure adequately braced in vertical planes in both the orthogonal directions. The general arrangement & details of structural steel columns, beams, bracings, ceiling girders etc shall be as per the Bidders Boiler Structure design and detailed engineering scheme.			
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5.02.05	The bottom base plates of Boiler structure columns shall be 1.20m below the finished paving level in the Boiler area. The RCC pedestals supporting the column base plates shall be extended in order to provide RCC encasement to the structural steel columns up to at least 350mm above the top of the paving RCC slab. Steam Generator roof (pent house)/canopy/side cladding shall have single skin troughed profile permanent colour coated sheet. Cladding for Boiler elevator enclosure except its machine room shall be with single skin troughed profile permanently colour coated sheet. Bidder shall integrate the boiler supporting structure with Mill & Bunker Building Structure. Waterless Bio Urinals with enclosure are to be provided by the contractor on each floor elevation of each boiler. Maintenance of toilet in hygienic condition till COD of the unit shall be the responsibility of the bidder. ii. Design Concept Boiler supporting structure shall be designed by the Bidder based on provisions of IS 800 for structural steel and IS: 456 for RCC works. Boiler Elevator Machine Room Floor of Machine Room shall be provided with profiled metal decking sheet. Trough shall be filled with Insulating Material (glass wool or rock wool) and thereafter finished with Minimum 50 mm thick wooden flooring, consisting of 37 mm thick hardwood planks, finished with 11mm thick laminated wooden flooring (of 'pergo' or equivalent) with plank size 193x1195mm (material class shall be 34 as per EN13329), over 2 mm expanded polystyrene foam and polythene sheet under laying. Roof and Side enclosure of Machine Room shall be provided with Prefabricated Insulated Metal Sandwich panels. Composition of Insulated Metal Sandwich Panels shall be as described in Clause 9.08.00 of Part-B (Civil) of Technical Specification. Doors of Machine Room shall be Double Plate Steel flush doors of thickness 45 mm with steel sheets of 18 gauge with necessary stiffeners. Space between two sheets shall be filled with mineral wool insulation. Frame of doors shall be pressed steel sheets of 16 gauge. All necessary fittings for the doors shall be provided by the Bidder. Rubber sealing, for making the Doors airtight shall also be provided. Windows/ventilators shall be of standard extruded anodised Aluminium Sections of minimum 2 mm thickness with 24 mm hermitically sealed double glazing consisting of two 6 mm thick toughened glass separated by 12 mm. gap. Technical requirements of prefabricated insulated metal sandwich panels/decking sheets shall be same as given elsewhere in this specification.			
	Compressor House i. Salient Features: The compressor house shall be a structural steel framed superstructure with a overhead crane as per requirements specified in Part-A Sub Section IIA-19 and Part-B Sub Section A-25 of Technical Specification. The gantry girder for the crane shall have walkway with chequered plate on both rows and cage ladder access. The roof shall comprise minimum 40mm thick RCC slab (with additional water proofing) supported on profiled metal deck sheet and purlins. The ground floor slab shall comprise of all RCC block foundations, cable trenches and pipe trenches. The building shall be completely covered with vertical cladding and roof. Design Concept:			
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5.02.06	The Design of Compressor House steel structure shall be based on provisions of IS 800 & IS 456 for RCC works. The structural frame shall be moment resisting sway frame in the lateral direction and longitudinally braced in the longitudinal direction. Design shall also be based on the Design Criteria specified elsewhere in this specification. ii. Architectural Features This building shall be steel framed structure with brick wall up to window sill height & Single Skin Metal Panel cladding above it. The roof system shall be as per the detail furnished in the salient features of this building Cut-outs and opening shall be provided in floors and walls as per requirements. Metal Panel cladding shall be composed of different colour shades to match with the existing surroundings. External finish shall be of Premium Acrylic Smooth Paint with Silicone additives The size, height, door/window/rolling shutter details and building size shall be as per the approved equipment layout plan of the bidder.			
	ESP Structure i. Salient Features The ESP structure shall be a structural steel superstructure with vertical bracings in the required vertical planes in both longitudinal and transverse directions, the details of which shall be as per the approved ESP equipment GA & details of the bidder. The bottom of base plate for ESP structure columns shall be 300mm above the finished paving level in ESP area. The RCC pedestals supporting the column base plates shall be extended accordingly above the top of the paving RCC slab. Further, the gusset plate / base plate shall be encased in concrete up to the top of bolts. ESP roof (pent house)/canopy/side cladding shall be single skin troughed profile permanently colour coated sheet. ii. Design Concept Design of ESP structure shall be based on provisions of IS 800 for structural steel and IS 456 for RCC works. It shall be an axially braced structure in both orthogonal directions. The ESP supporting columns shall be suitably strengthened about the minor axis for sliding movement of the base plate of ESP due to thermal movement.			
5.02.07	ESP Control Building i. Salient Features ESP Control Building can either be structural steel superstructure or RCC framed structure with RCC floors at ground floor level and upper levels. The RCC floors at upper levels shall support the Switchgears, cable galleries and Control Room. The RCC floors at upper levels shall be cast in situ RCC slabs. For steel framed building the RCC floors shall be supported on profiled metal deck sheet and structural steel beams and roof of the building shall comprise of minimum 40mm thick RCC slab supported on profiled metal deck sheet and structural steel beams. The rainwater down comers shall be as per specification and shall be suitably concealed. The external Transformer Yard of the building shall comprise the transformer foundations and cable slit below ground level.			
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5.02.08	The building shall have Lift structure with lift pit below ground level and staircase at each gable end of the building. ii. Design Concept The Design of ESP Control Building shall be based on provisions of IS 800 for Structural Steel & IS 456 for RCC works. iii. Architectural Features This building shall be completely covered with Light Weight Autoclaved aerated concrete blocks on all four sides except for the portion in front of the external Transformer Yard and toilet and pantry block. Provision for glazed/ fire proof doors & windows shall be included. Minimum 345mm thick brick wall shall be provided for the external brick wall facing the adjacent transformer yard and the brick wall height shall be 600mm above the highest point of the transformer. Inside the building, AHU rooms, UAF Room& Battery rooms shall have brick masonry of one brick thickness. The internal walls of air-conditioned area shall be finished with 2 hour fire rated Aluminum Composite Panel Cladding. Entire transformer yard, which shall be adjacent to the building, shall be provided with metal fencing with gates. The building shall accommodate cable vault, toilet, staircase, switchgear rooms, control rooms and AHU room. An auxiliary transformer yard with fencing and gate shall be provided adjoining to the building. Control room and VFD room shall be air-conditioned and shall have false ceiling. Windows& Ventilators all shall be provided with Aluminium sections. All doors, windows in air conditioned area shall be provided with hermetically sealed toughened glass glazing in Aluminium frame work Steel doors and Fire proof doors shall be provided as per requirements. Internal columns in Control Room shall be encased with Aluminium Composite Panel cladding. Minimum 2 Nos. of stairs and 2 Nos. of Toilets shall be provided as per requirement. Cut-outs and opening shall be provided in floors and walls as per requirements. External finish shall be of Aluminum Composite Panel Cladding except Transformer area where premium smooth Acrylic Paint shall be provided.			
	Pipe & Cable Galleries i. Salient Features The Pipe- Cable Gallery shall be Structural Steel Superstructure with Steel Truss (Lattice Girder) having a general span of 15.0m/20.0m. The steel truss shall be supported on 2 legged/ 4 legged trestles the arrangement of which shall be developed by the Bidder. Trestles for pipe and cable galleries shall also be of structural steel. The width of the Gallery shall vary depending on the functional requirement. A walkway of minimum width 600mm shall be provided along the Cable Trays supporting floor of the gallery. The walkway shall comprise 40mm thick MS grating and 1.0m high handrail made of 32NB MS pipes. For pipe cable galleries carrying ash pipes, galvanized MS grating shall be provided over entire width of the gallery. Plan bracings shall be provided at all chord levels of the cable gallery truss. Minimum gusset plate thickness shall be 8mm for all connections. The level of the bottom chord (bottom of steel) of the gallery shall be at least 3.0m above the finished paving level in general. However, at all road/rail crossings, the level of bottom of steel of the gallery shall be at least 8.0m from the top of road surface and 8.5 m from top of rail track. Before and after the road/rail crossings, a barrier of suitable height shall be constructed so as to prevent the approach of cranes (having height more than 8 m) up to the pipe/cable racks/trestles.			
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5.02.09	The Caged structural steel ladder shall be provided at an interval of 200m for access to the Pipe-Cable Gallery Walkway. At the inter-connection of Pipe/Cable gallery with Plant buildings, Pipe/Cable gallery shall be terminated at a maximum distance of 1.50m from the building. The foundation of the Pipe/Cable Trestle shall be constructed at a distance of 4.0M from center line of the plant building. Cantilever of 2.50m shall be taken from pipe-cable gallery/ trestle structure. The foundation for Pipe-Cable gallery trestles shall be open foundation or pile foundation depending upon bearing capacity requirements. For specification regarding open and pile foundations, clause. 7.00.00 is to be referred. The grade of concrete for RCC footing/pilecaps & pedestals shall be M25. The structural trestles shall not be supported on paving RCC slab. ii. Design Concept The pipe-cable structure shall be designed as a 3-dimensional space frame for all the relevant load cases mentioned in the design criteria chapter. The gallery being an unclad building, wind load shall be evaluated based on the projected frontal area of the structural members and cable tray depth. The end portals shall be designed as rigid frames hinged (pinned support) at the base plate level (on top of the trestle column). Deflection of end portal due to wind shall be evaluated at the portal column-rafter joint. The gallery vertical truss shall be designed as simply supported girders on trestles and detailing of end portals shall be done accordingly. Suitable expansion gap shall be provided in the gallery structure by providing twin two-legged trestles at the expansion gap. The expansion gap shall be provided at an interval of 100 to 120m. Expansion gap shall also be provided at location where changes in plan dimensions (gallery width) take place abruptly.					
	Main Power House (i) Salient Features: Main Power House shall consist of the Turbine bay, adjacent Deaerator Bay, electrical bay & common control room building (CCR Building) (as stipulated elsewhere in this specification). The turbo – generator (TG) foundation, boiler feed pumps foundations and shall be located inside the power house and their foundation system shall be as per design concept of machine foundation. All other equipment foundations (including Heaters & Deaerators) shall be supported on RCC floors with structural steel beams. The RCC floors shall comprise RCC slab over profiled metal deck sheets (to be used as permanent shuttering but not to be considered for design of RCC slab as composite slab). Shear anchor studs shall be provided through metal deck at regular interval on all top flange / flange plate of structural beams. However, steel gratings, chequered plate flooring as well as precast RCC covers shall be provided as per the functional requirements. All RCC pits & trenches below ground floor slab (including Condensate Extraction Pump (CEP) pit) shall be covered with minimum 40 mm thick MS grating supported on structural steel beams. The RCC pits shall also be provided with a sump at the corner for dewatering with submersible pumps. Staircases & ladders shall be provided for access to these pits. Electrically Operated Travelling (EOT) cranes shall be placed in the turbine bay with the gantry girders (supporting crane wheel loads) supported on structural steel brackets on A & B row columns). Walkway with chequered plate shall be provided at crane girder level at both 'A' row & 'B' row side with caged ladder access from the operating floor. All main columns & beams of Main Power House shall be of structural steel girder (open web or solid web) with base plate level of columns 1.20m below ground floor slab level in					
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	general except for other pit areas where structural steel column shall be extended below upto a depth lower than the pit top surface such that the column base plate & stiffeners are concealed below the pit raft level are concealed below the pit raft level. Auxiliary columns in main power house shall be either of structural steel construction. The roof system in turbine bay shall comprise a structural steel girder (open web or solid web) for the entire bay width. The roof slab shall consist of 40mm thick (min. above the crest of metal deck sheet) RCC slab supported on profiled metal deck sheet. The metal deck sheet shall be supported on structural steel purlins. The purlins shall be in turn be supported on turbine bay roof girder top chord at regular interval. Additional waterproofing shall be provided above the roof RCC slab as per details mentioned elsewhere in this specification. 1 in 100 slope shall be provided for the turbine bay roof sloping downwards towards the A-row (towards transformer yard). Minimum 150mm dia. galvanized mild steel pipes shall be used at A-row & C-row as Rainwater Down comers. Staircases in main power house shall be of structural steel. Treads of each staircase shall be 40mmthick MS grating and handrail/ hand post shall be 32mmNB circular hollow sections unless specified otherwise in architectural section of the specification. All staircases in turbine Bay and Deaerator Bay shall be enclosed with minimum 230 thick brick masonry wall with fireproof doors at all floor landing levels. The parapet wall shall be of minimum 1m height and shall be provided all the around roof of main plant building. All edges of openings shall have edge protection angles (minimum ISA 75x75x6) and handrails with hand posts (Hand post spacing 1m maximum). ii. Design Concept: Main Power House shall be designed as moment resisting sway frame in the transverse direction and braced in the longitudinal direction. However, due to functional requirement, vertical bracings to the column in CCR Building not to be provided at (& above) the operating floor level and CCR Building frames shall be designed as moment resisting frames in both transverse and longitudinal directions. All beam column moment connections shall be designed for adequate ductility. The building shall have connectivity with walkways from Boiler & Service Building through sliding bearing only. The connectivity with cable gallery shall be as specified in Pipe &cable gallery section of this chapter. Floor level acceleration spectra shall be generated during seismic analysis for design of pipe supports / equipment located at the elevated floors. Adequate number of thermal expansion gap (minimum 2.00m) between adjacent structural frames at expansion joint and minimum 50mm between RCC slabs at expansion joint) shall be provided between the units and Common Control Building. In the RCC floor/ roof slabs, the spacing of shear anchor studs on structural beams shall be minimum of the spacing required for i) Restraining the compression flanges of beams and ii) Transfer of the horizontal shear at floor/roof to the supporting beams. The roof girder in Turbine Bay shall be provided with a camber to take care of deflection due to dead weight. The Main columns in A, B &C rows of Main Power House Building shall be built-up I sections. Rolled sections/ I sections with additional flange plates shall not be acceptable for main columns & auxiliary columns. The roof girder (open web or solid web) to column connection shall be bolted connection using high strength bolts (grade 8.8/ IS 1367). The roof girder of Turbine Hall shall be adequately braced in plan using Tie level and rafter level bracings. The longitudinal bracing shall comprise a pair of members connected to the column flanges and detailing shall be adequate to restrain the entire column cross-section. Minimum gusset plate thickness for bracings shall be 12mm. Common Control Room at operating floor shall have minimum 60% free space for		
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	movement, control room to be free of any auxiliary/stub columns other than the C-row central column with minimum depth as possible For all other design methodology, refer to Design Criteria specified elsewhere in this specification. iii. Architectural Features This building shall be of Structural Steel Framed structure and shall be completely covered with external cladding and RCC roof. The external vertical face (herein stated as 'A' row) of main power house facing (& adjacent to) the transformer yard and also the two gable ends shall be completely covered with vertical cladding comprising 3.0m high brick wall (on ground floor slab) and single skin profiled vertical metal sheet for the remaining height except for the vertical segment between operating floor & gantry girder bracket level where double skin vertical metal sheet shall be provided. In case of routing of bus-duct is done outside the A-row (part/full), there shall be a continuous cladding of metal sheeting covering steel structure supporting the bus duct to match the entire A-row elevation. The metal cladding shall be designed to suit the aesthetics of the entire main plant building. In front of the power transformers, RCC fire barrier wall shall be provided as per functional requirement in lieu of brick wall at A-row. The above mentioned RCC wall shall be attached with single skin metal sheet on external face. The 'A' row & Gable End columns projecting inside the turbine hall shall be concealed with single skin profiled metal sheet from operating floor level to crane girder bracket top level. The external vertical face (herein stated as 'C' row) facing (& adjacent to) the Boiler area shall be completely covered upto the Deaerator floor level with vertical cladding comprising 3.0m high brick wall on ground floor followed by either single skin metal sheeting with runners or brick wall sandwiched with single skin metal sheeting on external face (for all floors requiring 2 hours of fire rating e.g. cable spreader room, ventilation/ air washer room, AHU Rooms and air conditioned areas) The internal vertical interface plane between Turbine bay & Deaerator bay (herein stated as 'B' row) shall have brick masonry Wall from RCC roof slab level of turbine bay (AB bay) upto specified floor level below such that Turbine bay & Part of Deaerator bay below the Deaerator supporting floor level is completely covered on all sides. Glazing for A Row & gable end shall be reflective 6mm thick clear toughened glass with Aluminium frame. Hermetically sealed double glazing shall be provided between air conditioned & non air conditioned areas. Internal glazed partition inside CCR/CER/Offsite Control Room and B-Row at operating floor level shall be of fire resistant glass having 2 (Two) hour fire rating and with suitable frame. Light weight aerated concrete panels with Single Skin Metal Panel cladding shall be provided in exterior of UPS Battery room area and Control Equipment Room area. All internal side of Aerated concrete panel and columns in air-conditioned areas other than CCR in MPH shall be encased with Aluminium Composite panel cladding from inside. Windows on south side at accessible level at operating floor level shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting. Inside the main power house building, brick masonry wall (and fire proof doors) shall be provided for switchgear rooms, cable spreader rooms, MCC rooms, AHU rooms, Air Washer room & Oil rooms and all other rooms where fire protection is envisaged. Cut-outs and opening shall be provided in floors and walls as per functional requirement. All door, windows in air conditioned area and all windows glazing shall be provided with		
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Aluminium frame work Steel door and Fire Proof doors shall be provided as per requirements.

Stairs in BC Bay and on A-Row shall be provided as per functional requirement and as per National Building Code and Factories Act.

All stairs in BC Bay lift lobby Area shall be in RCC. Stainless steel railing shall be provided at TG floor level for all cut-outs/ openings, walkways, cut-outs at lower level that are visible from TG floor level and stairs near lift lobby. M.S. railing shall be provided for all other locations. All peripheral edges of floor cut-outs / openings at T.G floor level and covered with gratings/ chequered plates, expansion joints along T.G deck, structural expansion joints shall be covered with minimum 2mm thick stainless steel plate of grade SS 316.

For each unit minimum one no. gent's toilet with adequate facilities including drinking water space and janitor's space shall be provided at each level of power house building, in addition one no ladies toilet shall be provided in each unit at 0.00M and mezzanine floor level and CCR level. A separate ladies and gent's toilet and pantry shall be provided for CCR approachable from CCR / CER / Offsite Control Rooms.

B Row portion in TG Hall fronting Control Room & CER and glazed partitions in CER/ CCR/Offsite Control room shall be of 25 mm thick Hermetically sealed double glass of Fire resistant of min 11mm thick clear, toughened, interlayered 120 minute fire rated for both integrity & radiation control and 6 mm thick toughened tinted glass with 8 mm gap and with suitable fire resistant frame of 1.6 mm thick powder coated steel sheet. The partitions shall be up to false ceiling level and wall above up to the soffit of floor slab above control room and shall be finished with Aluminum Composite panels cladding and shall also have FRP mural of theme matching to local art and Culture.

Glass partition between AC areas in CCR/CER and other areas in associated with CCR/ CER shall be single Fire Resistant glass in line with technical specs as per fire zoning requirement. It shall be single toughened glass minimum 10 mm thick if not within fire zone.

In CCR, EIC Room, Conference Room, Programmer's Room and Visitors Gallery etc. a theme based coordinated false ceiling shall be provided with latest state of art design.

In CCR, EIC Room, Conference Room, Programmer's Room and Visitor's Gallery etc., vitrified flooring shall be designed with theme and color coordination in line with the designed false ceiling.

Mullion-less charged glass wall shall be provided in between the control room and the Visitor's gallery.

The fire resistant glass partition in between CER/PADO room & control room (control room left hand side wall) and shift in-charge room/Conference room & control room (control room right hand side wall) shall have motorized blinds (with provision of remote control from Unit in-charge desk) with central metallic panel column having NTPC signature icon.

The rest of the walls including LVS wall shall have coordinated design keeping in mind the overall theme of the control room using metallic panels with calcium silicate boards.

The control room gates shall have biometric physical security feature with double layer of sliding doors.

Control room interiors shall be designed and executed by M/s EVANS / M/s Pyrotech or equivalent vendor who are specialized in control room interior design.

Control room/ Control Equipment Room / Offsite Control Rooms, entire area, False Ceiling shall have Cat Walk Way above for service/ maintenance.

Main power house building shall be provided with passenger lift in BC way as specified

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5.02.10	elsewhere in technical specification. Adequate partitioning as per functional requirement above false ceiling in control Room & CER shall be provided for Inert Gas zoning. Internal steel columns in Air Conditioned Area of Main Power House Building (CER, UPS charger room, SWAS room, etc.) shall be encased with Aluminium Composite Paneling up to false ceiling. Functionally the very heart of Power House Building is its Control Rooms. Special attention shall be given for conceptualization of interior design of the Control Rooms. Control rooms design shall be both functional and ergonomic for ensuring reliable and error free operation of the plant. Control room shall have metallic panels with calcium silicate boards cladded video wall housing large video screens and a separate visitor viewing gallery. A walk through view of the control rooms shall be submitted along with bill of quantity to illustrate the design scheme. Metal Panel Cladding shall be composed of Different Colour shades to match with the surroundings. External finish of Masonry wall shall be premium acrylic smooth exterior paint with silicon additives finish.			
	Service Building			
	i. Salient Features			
	This building shall be an RCC structure having RCC frame with RCC floors and roof slab. For the building, floor-to-floor height shall be as per architectural features. A connecting corridor with MPH building shall be provided at operating floor level. The building walls shall comprise aerated concrete blocks from ground floor to roof level. The grade of concrete for RCC frame (including foundation) shall be M25. Plant road of approx. 12 m width shall pass through the building. Building up to minimum 8 m height shall have no floor in 12 m width for road opening.			
	Architectural Features			
	This building shall be four storeyed (Ground + 3 stories above) and shall be provided with floor area of 3700 sq.m with RCC framed structure. Autoclave Aerated Concrete Block masonry wall shall be provided for the full height of the building for both external and internal walls. Floor-to-floor height shall be minimum 4.25m. A connecting corridor with Main Power House building shall be provided at operating floor level. The floor of the connecting corridor shall have vitrified ceramic tiles flooring, stainless steel hand rail & fixed structural glazing with reflective toughened glass. The connecting corridor shall have double skin Aluminium Composite Panel (ACP) cladding & insulated metal sheet sloped roof. Hermetically sealed double glazing with toughened glass shall be provided for external glazing. Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting. A minimum 70 mm margin for floor finish to be kept for providing of metallic raceway. This building shall provide offices for Operation staff, Conference room for 50 persons, C&I Laboratory, Exhibition Hall, VIP Lounge etc. This will be fully air-conditioned building with adequate provision of toilets, pantry, cabins for senior executives and separate rooms for executives, supervisors etc. Lift structure with RCC lift pits shall be located inside the service building. Separate toilet facilities shall be provided for ladies and gents in each floor. One toilet shall be provided for persons with disabilities on each floor. Attached toilets shall be provided with cabin of senior executives cabin and conference rooms. 2 nos of staircases and 2 nos of lifts with adequate capacity shall be provided. One store room shall be provided.			
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	Covered parking space for 10 nos. cars shall be provided. Covered parking shall be of RCC construction. Open parking space for 45 nos. cars & 75 nos. scooters shall be provided. Minimum 23 sq.m./car (including circulation area) and 5 sq.m./Scooter (including circulation area) shall be considered for working out parking space. The service building shall be fully IT enabled. 300x40 mm GI Raceway with standard length 2500 mm single compartment trunking raceways made from 14 gauge (minimum) pre-galvanised sheet including fasteners, floor support, connectors, bends cross-way, earthing stud for fixing etc. complete as per requirement, drawings and instructions of EIC shall be laid under floors of service building for IT enablement. 350x350x50 mm Junction boxes of pre-galvanised sheet with cover plate for raceways shall also be provided. Solar PV panel of 17% efficiency shall be provided on roof of service building. External finishing shall be of premium acrylic smooth exterior paint with silicone additives and Coloured Aluminium Composite panel combination. ii. Design Concept This building shall be analysed & designed as RCC framed structure considering loads & load combinations mentioned in clause 6.2.0. Loads due to Solar PV panels also to be considered on roof slab of the building. Use of shear walls can be made in the building, in case peripheral road of BTG block is to be routed through the building. The design of RCC structure, foundations & slabs shall be carried out as per provisions of IS 456.		
5.02.11	CPU CIVIL WORKS		
5.02.11.01	Design Concepts for Buildings/ Shed		
	i. All Buildings shall have RCC framed structure with cast-in-situ RCC roof slabs with brick cladding. ii. Equipment/facilities with shed shall have structural steel superstructure with permanently colour coated metal sheeting at roof and side open. However, kerb wall shall be provided all around the plinth/ floor area above the Finished Floor Level (FFL). For other buildings brick wall cladding on exterior face shall be provided. iii. Unless specified, the wall cladding for buildings shall be with minimum one brick thick on exterior face. However, brick wall for buildings adjacent to transformers shall be minimum 345mm thick.		
5.02.11.01.01	Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion, etc.		
5.02.11.01.02	The load and load combinations and design criteria shall be as specified elsewhere in the specification.		
5.02.11.01.03	All liquid retaining structures shall be designed for following load conditions. Underground structures: a. Water filled inside up to design level and no earth outside. b. Earth pressure with surcharge of 2.0 T/m² and ground water table up to FGL outside and no water inside. c. Stability against uplift shall be checked for completed structure and under construction stage with no water inside and ground water table up to FGL, with a minimum factor of safety of 1.20 against uplift. Installation of pressure relief valves shall not be permitted in the base slab of any liquid retaining / conveying structure.		
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- d. The structure shall also be checked for normal working condition with water filled inside up to design level and earth pressure outside with no effect of surcharge and ground water table.
- For design of over - ground liquid retaining structures appropriate load cases shall be considered.
- 5.02.11.01.04 All liquid retaining and conveying structures shall be designed by working stress method as given in clause 4.5 of IS 3370(Part2).
- In the wall of liquid retaining structures with cylindrical shape such as clarifiers, vertical reinforcement shall be checked assuming the walls were fully fixed at the base, and the horizontal reinforcement shall be provided to resist horizontal (hoop) tension assuming hinged condition at the junction of the base slab & wall.
- Wherever sandwich slabs are provided in liquid retaining structures to take care of stability against uplift, only well graded sand shall be used as fill material. The sand compaction shall be done with plate / disc compactors in such a manner that the bottom slab is not structurally damaged.
- Clear free board of at least 300 mm above design (total) water level shall be provided in all liquid retaining / conveying structures.
- Coefficient of active earth pressure shall be considered for design of free standing retaining walls and coefficient of earth pressure at rest shall be considered for design of top propped retaining walls.
- The minimum grade of concrete for all RCC structures shall be M30. The minimum concrete clear cover to reinforcement bars in all RCC structures shall be as per IS:456(2000) and IS:3370(Part II) for water retaining structures. Durability of concrete shall conform to severe exposure conditions as per Table-3 of IS 456 except noted specifically otherwise.
- 5.02.11.01.05 Factor of safety against overturning and sliding
- The structure shall be checked for minimum factor of safety of 1.5 against overturning conditions (ratio of stabilizing moment to overturning moment) and 1.4 against sliding conditions as per IS: 456.
- 5.02.11.01.06 For detailing of Reinforcement IS 5525, IS 13920, IS 4326 and SP 34 shall be followed.
- Two layers of reinforcement (on both faces) shall be provided for RCC sections having thickness of 150 mm and above.
- Minimum diameter of main and distribution Reinforcement bars in different structural elements shall be as follows:
- | Sl. No. | Structural Element | Main Reinforcement | Distribution Reinforcement / Stirrups/ ties/ Anchor Bars |
|---------|--------------------|--------------------|--|
| a) | Foundation | 12 mm | 12 mm |
| b) | Beams | 12 mm | 8 mm |
| c) | Columns | 12 mm | 8mm |
- Spacing of reinforcement bars in walls and slabs of liquid retaining / conveying structures shall not be more than 200 mm.
- Suitable shrinkage reinforcement shall be provided at top face of foundations. Minimum shrinkage reinforcement shall be 10 mm dia. @ 200mm c / c.

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	Minimum Reinforcement in all elements of liquid retaining / conveying structures shall be 0.24 % of cross sectional area. Minimum tensile Reinforcement in each direction for all foundation slabs / rafts shall be 0.2% of cross sectional area. 5.02.11.01.07 Minimum thickness of foundation slab / raft and base slab of all liquid retaining tanks / pits shall not be less than 250 mm. Minimum thickness of all other elements of RCC liquid retaining / conveying structures (except effluent drains, launders and aerator waste slab) shall be 200mm. Effluent drains (depth more than 500mm), aerator waste slab and launders shall have minimum element thickness of 150mm. 5.02.11.01.08 All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter rods or 6 mm flats. Edge protection angles shall be provided as specified elsewhere. 5.02.11.01.09 All water retaining structures shall be tested for water tightness as per provisions of IS: 3370 and IS: 6494. 5.02.11.01.10 2.0m wide walkway with M25 grade concrete paving over an under bed specified elsewhere shall be provided connecting all structures, buildings and facilities. The top of walkway shall be minimum 200mm above FGL Reinforcement of the RCC paving shall consist of minimum 8mm diameter bars @ 200 mm c / c in both directions at the centre of the slab. 5.02.11.02 Coating on RCC water retaining structures (other than drinking water) Epoxy phenolic coating shall be applied on (i) internal surfaces of the RCC water retaining structures and (ii) external surfaces of RCC Neutralisation-pit which is in contact with earth, as per details specified below: a) All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% ±2%) of minimum 50 micron DFT. Surface to be coated shall be absolutely dry, clean and dust free. b) Sealer coat shall be followed with the application of epoxy phenolic coating (solid by volume minimum 63%) of minimum 400 micron DFT. This coat shall be applied after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. 5.02.11.03 Coating on RCC water retaining structures (drinking water) Internal surfaces of RCC water retaining structures shall be provided with minimum 400 micron Food grade epoxy coating complying to FDA Title 21, Part 175.300. Surface to be coated shall be absolutely dry, clean and dust free. 5.02.11.04 Architectural Concepts and Finishing Schedule Architectural concepts and finishing schedule shall be as specified elsewhere in architectural specification. 5.02.11.05 Acid / Alkali Resistant Treatment: Acid / alkali resistant lining treatment shall be provided in different areas as follows: Neutralization Pit: The walls shall be provided with one coat of bitumen primer, followed by 18 mm thick bitumastic layer, 115 mm thick Acid Resistant (A.R.) bricks, 6 mm thick under bed of potassium silicate mortar, pointing the joints of bricks with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. Suitable pilasters shall be provided with A.R. bricks at regular intervals depending upon the height of lining, as per the specification.		
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5.02.11.06	The floor of neutralization pit shall be provided with acid / alkali resistant lining treatment as given in the above para, except that the 115 mm thick A.R. bricks layer shall be replaced by 75 mm thick A.R. tile layer and pilasters shall be omitted. The ceiling of neutralization pit shall be provided with one coat of epoxy primer followed by 2 coats of epoxy paint (150 micron). Acid / Alkali storage area / projections above the floor, pedestals projecting from the floor / saddles. The floor shall be provided with one coat of bitumen primer followed by 12 mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick under - bed by potassium silicate mortar, 6mm thick pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar up to a depth of 20 mm and bitumastic end sealing. Dado of 1.0M high with above treatment shall also be provided if applicable in case of walls nearby. The floor shall be provided with acid / alkali resistant lining treatment as given in the above para except that the 75 mm thick A.R. tile layer shall be replaced by 12 mm thick A.R. tile layer. Basket of Alum Solution Preparation tank: 5mm thick epoxy lining over a coat of epoxy primer. Curved surfaces of saddles shall have minimum 12 MM thick bitumastic layer to support the vessel / tanks. Effluent Drains: Acid Resistant lining treatment indicated for the storage area shall be provided on the bed as well as walls of the drains with 38 MM AR tiles. The underside of the pre-cast slab cover shall be applied with one coat of epoxy primer and two coats of epoxy coating, total DFT 150 microns. Lime tank: Two coats of bitumen paint conforming to IS: 9862, with total DFT 150 microns. Guarantee The Contractor shall give a guarantee for satisfactory functioning of the lining for a period of 36 months from the date of completion of the work or date of handing over the site to the Engineer, whichever is later. The Contractor shall replace / rectify defects is any, observed in the lining to the satisfaction of the Engineer without any extra cost during this period.			
	Foundation of Over Ground Steel Circular Water Storage Tanks			
	General Requirements			
	The tank foundation shall be as per IS 803 and as specified in relevant clause of foundation chapter.			
	Sub Grade Preparation			
	The surface of natural soil shall be thoroughly compacted by rolling or other means, as directed by Engineer, to obtain 95% of max. laboratory dry density for the soil, as per IS:2720 (Part-VII).			
	Anti Corrosive Layer			
	Anti-corrosive layer shall consist of screened coarse sand, mixed with 80/100 bitumen or equivalent 8% to 10% by volume.			
	Bitumen shall be heated to a temperature 175°C to 190° C, with 3% kerosene, if required. Sand shall be thoroughly mixed with it in a mixing drum to obtain uniform mixture and shall be laid over the compacted surface, laid in line, grade and levels and as directed by the Engineer. Bitumen shall not be heated beyond the temperature limits given above.			
	The premix carpet shall be laid in two layers of 3 cm and 2 cm respectively. After compacting and laying the first layer of 3cm, a tack coat of hot bitumen at the rate of 1 Kg. per Sq.m. shall			
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5.02.11.07	be uniformly applied to the surface, by means of Sprayer and the Second layer of 2cm thick shall be laid, tamped and compacted to the satisfaction of the Engineer. Sand shall be spread on the final surface at the rate of 0.5 Cu. m per 100Sq.m. Premix Materials Sand Sand shall be clean, dry, coarse, hard angular, free from coatings of clay, dust and mix of vegetable and organic matters and shall conform to IS 383 (Grade -III). Stone Chippings Stone chippings shall be hard black trap or granite or locally available stone and shall conform to IS 383. The grading shall be of normally 12mm down size and 6mm down size, in the ratio of 3:2 respectively. Bitumen Bitumen required for the work shall be 80/100 grade or its equivalent quality. Laying Areas on which the premix is to be laid shall be thoroughly cleaned of all dust and loose materials. On the cleaned surface, a tack coat at the rate of 1.0 Kg. per Sq.M. of hot Bitumen shall be uniformly applied by Sprayers. The applied Binder shall be evenly brushed. The Binder bitumen 80/100 shall be heated to the temperature of about 190° C with 3% kerosene, if required and mixed with stone chippings of size, as mentioned above, at the rate of 400 KG, with Six (6) Cu. M. of stone chips, for 100 Sq.M. of surface. The total mixed quantity, as mentioned above, is the quantity required for the total 50mm thick for 100 Sq. m. of area. Mixing shall continue until the aggregate is well coated.		
5.03.00	CHIMNEY		
5.03.01	Salient Features Configuration and height of chimney(s) shall be as specified in mechanical portion of technical specification. There shall be one flue (liner) for each unit. The chimney shell (windshield) shall be constructed using slip form shuttering. Internal platforms of steel structure shall be provided for enabling access to various elevations of the chimney and to provide support to the flue liners. Spacing of internal platforms shall not exceed 45.0 M. The platform beams shall be supported on concrete shell using suitable load bearing arrangement in the recesses provided for the purpose. The platform beams getting supported in the chimney shell shall have complete bearing support within the thickness of shell at that location and shall in no case be supported completely/partially on corbels/ brackets from the shell. "Through openings" in shell if provided to facilitate erection of platform beams shall be closed with cast-in-situ RCC closure wall on the external face of the shell. Necessary dowel bars shall be provided in the shell during construction for this purpose. Openings in the concrete shell for flue duct entry, access door & truck entry door at ground level, air ventilation etc shall be provided. Hand railing shall be provided all around internal staircase & around the ventilation voids in the internal platform using min. 32 mm nominal bore MS pipes of medium class conforming to IS:1161. Spacing of railing posts shall not be more than 1500 mm centre to centre with a minimum height of 1200 mm. The handrail shall have three rows of horizontal members between the railing posts including the top member. Kick plate of min. size 100x6 thick shall be provided in the hand railing.		
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5.03.02	The flue duct outside the chimney shall be suitably connected to the vertical flue liner inside the chimney as per EPRI Wet Stack Design Guidelines.-Expansion Joint shall be provided at the interface between the flue liner and the absorber outlet duct as per design. The expansion joint in the flue liner shall comprise of non-metallic material suitable for wet stack operations, shall be acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification and shall also prevent dust accumulation. Based on the design requirement and expansion joint manufacturer's recommendation the space between the expansion joint material and the liner shall be packed and sealed by providing a bolster made up of light weight compressible material suitable for wet stack operations and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as specified elsewhere in the specification. The bolster shall be confined in texturized glass fabric having a final covering of stainless steel wire mesh. Design of expansion joint shall comply EPRI guidelines to avoid contact of condensate with expansion joint material and to ensure drainage of condensate. Chimney roof shall be of RCC slab over a grid of structural steel beams and provided with rainwater drainage system. An internal structural steel staircase supported from chimney shell with chequered plate floor panels and pipe handrails, shall be upto the platform just below roof platform and an internal cage ladder for a small height, over last staircase landing to access the chimney roof through a roof access hatch. The other components of the chimney include liner test ports (for continuous pollution monitoring), liner hatches, grade level slab of RCC with metallic hardener floor finish, acid resistant treatment on roof slab, a large electrically operated grill type roll-up door and personnel access metallic door at grade level, roof drain basin, rain water down comer pipe (150 mm diameter galvanized pipe), connection to plant drains, louvers with bird screens for ventilation and all other openings in the wind shield, all finishing works, electrical power distribution boards, lighting panels, power & control cabling and wiring systems, stair and platforms lighting, socket outlet, lightning protection and grounding system, aviation obstruction lighting with photoelectric controller etc, communication system, a rack and pinion elevator and other items, though not specifically mentioned but reasonably implied and necessary to complete the job in all respects. Aviation Warning Lights (AWL) shall be mounted on door panel of required size (open able from interior of chimney shell) fixed to openings in the chimney shell at locations and levels specified elsewhere. Suitable provision for approach to the AWL shall be provided at the platform level. AWL shall be located at about 1-1.5 metre above the top of platform to enable easy handling for maintenance. The size of roll-up door shall be determined based on minimum requirement for ventilation and transportation & erection of flue segments.		
	Design Concept		
	Design and construction of various components and systems of the chimney shall be in accordance with relevant Indian Standard and where provisions are not covered in Indian Standard, reference shall be made to ACI, BS, CICIND and other international standards. In case of any conflict between this document and the Indian and International Standards, the stipulations of this document shall prevail. Imposed loading for design of all chimney components shall not be less than 5 kN/ Sq.m. An additional 25% of liner load shall be taken as impact loading for liner erection in addition to the liner load. The min. thickness of web for plate girders shall be kept as 12 mm. Seismic forces on the chimney system shall be determined based on site specific seismic information provided elsewhere in this document.		
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5.03.03	Wind forces on the chimney system shall be determined based on site specific wind design criteria provided elsewhere in this document. The chimney and its components shall be designed to resist the most onerous forces resulting from all the possible combinations of the various loadings. Wind Shield The wind shield shall be designed for vertical loading, cross wind loading, seismic loading, circumferential wind loading, thermal gradients etc. The load calculation and load combinations shall be as detailed in IS 4998. The wind shield shall be analysed for cases with and without flue liner loads. Forces/stresses in the wind shield due to eccentricity effects of local loadings, insulations effects, rotation of chimney foundations, construction tolerances and moments of second order shall also be considered. Seismic response of the chimney shall be computed by the response spectrum method. Dynamic modulus of Elasticity shall be considered for calculating natural frequencies of the chimney. At least, the first five modes of vibrations shall be used for this analysis. The across wind analysis of the chimney shall be carried out as per the provisions of IS 4998. Across wind loads shall be combined with co-existing along wind loads. The effect of the openings/cut-outs in the chimney shell shall be duly considered in the design of the windshield. The minimum thickness of shell shall not be less than 500mm. The minimum vertical reinforcement shall be 0.3% of the concrete area. The maximum spacing of the reinforcement bars shall not be more than 250 mm on each face. The minimum circumferential reinforcement shall be 0.2% of the concrete area. The maximum spacing of the reinforcement bars shall not be more than 200 mm on each face. The circumferential reinforcement in the top 3 meters of the windshield shall be twice that required from design forces. The clear cover to reinforcement shall be 50 mm. There shall be a continuous ring of concrete shell without any opening for a height of atleast 5m below the soffit of flue duct openings. There shall not be any reverse (outward) slope in the inside face of chimney shell. Where there is a sudden change in slope/ profile of the shell, the circumferential reinforcement shall be increased to twice the requirement as per the design in a circumferential band extending atleast 3m above and below such slope/profile change level. The diameter of the reinforcing bar for the main vertical reinforcement of shell shall not be less than 25mm for a shell height up to the top level of flue duct opening. Shell thickness between any two 10m reference levels shall not vary more than 150mm. The minimum thickness of shell/closure wall at beam support recess/ opening locations shall be 100mm. Grade of concrete for chimney shell, and other super structure shall be minimum M30. Only OPC cement shall be used for Chimney shell and other super structure. The final design shall be checked & verified by 'Wind Tunnel Test' and shall be conducted at a reputed institution. Dynamic interference effects due to additional chimney(s)/NDCTS's and other tall structures located upto distance of 20 times diameter at 2/3rd height of subject chimney in the area or in the future expansion stage of the project, as envisaged by the owner at the time testing, shall be determined along with the other topographical features of the local area through model test.			
	5.03.04	Flue Liners		
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5.03.05	The flue gas parameters & various operating conditions for selection of flue liner material, material specification for flue liner and the criteria of flue gas exit velocity for sizing the flue liner shall be as specified elsewhere in the specification. For flue liner with base metal as mild steel, the thickness of the base metal shall be determined from structural considerations. The thickness of any clad metal/coating/block lining etc. provided on the base metal shall not be considered for computing the structural strength of flue liner. The minimum thickness of the mild steel base metal shall, however, not be less than that specified elsewhere in the specification. Two manholes placed diametrically opposite shall also be provided in each flue at all internal platform levels. The supporting/restraining arrangements of the liners should be such that expansion of the liners longitudinally or circumferentially is not restrained.			
	Internal Platforms The platforms shall be designed for dead, imposed (live), erection work and other possible loadings and temperatures effects. These platforms shall provide support and lateral restraint to the steel liners and provide access for inspections and maintenance. Forces imposed on the floors due to lateral restraint of flues shall be enhanced aptly for impact effects. These platforms shall also be designed suitably for the liner erection works. The platform shall be made up of chequered floor panels supported on grid of structural steel beams. All beams shall have bolted connections. The maximum permissible deflection in main steel girders supporting flue liner shall be span/1000.			
	Internal Staircase The staircase shall have a clear passage way width of not less than 800 mm and a clear headroom of not less than 2100 mm. The riser height shall not be more than 175 mm and tread width shall not be less than 225 mm.			
	Foundation The chimney foundation shall be designed as per limit state method as per IS 4998 for the most critical combination of forces and moments, resulting from all possible combinations of the various loadings from the chimney system during all stages of constructions. The effect of water table shall be considered and the foundation shall be checked for overturning for minimum and maximum vertical loads. There should be no uplift under any portion of the foundation/piles for any loading condition. Since chimney is a wind sensitive structure no allowance shall be made in the load carrying capacity of the bearing strata / piles under any load case/combination with wind. The foundation diameter to depth ratio shall not exceed 12. The diameter of the reinforcing bar for the main radial and tangential reinforcement for the foundation shall not be less than 25mm. The spacing of radial steel at the outer edge of the foundation shall not be more than 250mm. Grade of concrete for foundation shall be minimum M 30.			
	Thermal insulation (Applicable in case of Titanium / C-276 Flue Liner) The insulation shall be semi-rigid, resin bonded type, in the form of slabs and shall conform to IS: 8183. Blanket type insulation shall not be used. The density of insulation shall not be less than 64 kg/cu.m for resin bonded glass wool insulation and 100 kg/cu.m for resin bonded rock wool. The coefficient of thermal conductivity of insulation shall not be more than 0.52mW/cm/°C at a mean temperature of 100°C. The insulation thickness shall not be less than 100 mm, in any case, and shall be provided in two layers with the second layer of insulation covering the joints of the first layer. The insulation			
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5.03.09	shall be wrapped on the outer-most surface with galvanised wire mesh using MS galvanised pins and speed washer. Chimney Painting (i) All exposed steel surfaces (including exterior surface of mild steel flue liner in case the design does not envisage provision of thermal insulation on the exterior surface of flue liner) except surfaces of steel wind strakes shall be painted as specified in corrosion protection clause of this specification. (ii) All steel parts embedded in concrete like Strake embedment assembly including bolts, nuts, washers, pipe sleeves and insert plate shall be galvanized as per IS:4736. The minimum weight for galvanizing shall be 610 g/sq.m and shall comply with relevant IS Codes. (iii) The inside surface of chimney shell above roof, horizontal surface of shell at top, underside of concrete roof slab, etc shall be painted with epoxy phenolic coating system having total 220 microns DFT. a) All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% ±2%) of minimum 50 micron DFT to be applied over cleaned surface in multiple coats. Surface to be coated shall be absolutely dry, clean and dust free. b) Sealer coat shall be followed with the application of Intermediate coat of epoxy phenolic coating (solid by volume minimum 63%) of minimum 100 micron DFT. This coat shall be applied after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer. (iv) The entire external surface of chimney shell shall be painted with epoxy phenolic coating as specified in (iii) above in alternate bands of 'signal red' and 'bright white' colours.			
5.03.10	Rack and Pinion Elevator A rack and pinion elevator, with a load carrying capacity of 400 kg (min) (passenger cum goods), cabin floor size of 1100 mm x 1000 mm (min.) and an operating speed of 40 m/min. (approx.), shall be provided for travel from the grade level to the top of the chimney. A landing platform shall be provided at all access/ platform levels. The elevator shall be of a proven and approved make. Enclosure shall be fabricated from tubular steel and expanded metal or wire mesh, 2.1 m high (Approx.). A Safety device comprising of an over speed governor in constant mesh with the rack by means of a flame hardened steel pinion shall be provided to protect the cab against over speed during the cab downward motion and the same shall actuate the brake mechanism and stop the downward motion gradually. The lift shall be installed using anchor fasteners. The electrical requirement of the system shall conform to the main electrical specification. Drive motor shall be of S3 duty class with CDF of 25% and maximum number of 120 starts per hour in 55 degree Celsius ambient temperature. The motor shall be provided with internal 220V AC single phase space heaters or an alternate heating system. The elevator shall be supplied, installed, painted, tested, commissioned etc. complete with all mandatory spares (as specified in Part-F of this specification) and operation maintenance manual.			
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5.04.00	RAW WATER RESERVOIR			
5.04.01	Scope The scope of work for Raw water reservoir generally involves design, preparation of general arrangement drawings, construction drawings, supply of labour, materials and construction of all civil and structural works like site clearance, site leveling & grading, excavation, filling, construction of earthen embankment, providing sand filters, sand chimney, sand blanket in embankment, cut-off trench, mechanical compaction, slope protection, HDPE lining, PCC lining, non woven geotextile, Inlet and Outlet Structures, RCC spillways, supplying & laying of MS pipes and associated Civil Works, road works, construction of drains along the reservoir boundary etc. and other ancillary works associated with the completion of reservoir as per directions of the Engineer.			
5.04.02	General Requirements Raw water reservoir shall have gross usable capacity as indicated in the tender drawing.			
5.04.03	Design Requirement Sizing of the reservoir shall be such so as to utilize the maximum allocated area for the reservoir as per the layout drawing of the plant and as directed by the Owner. Bottom 500 mm (minimum) depth of water shall be treated as dead storage for settlement of any silt etc. The dead storage shall be over and above the total required capacity of the reservoir. The reservoir shall be provided with a free board as per requirements of IS 10635, but in no case, the same shall be less than 1500mm. Earthen embankment shall be designed as an earthen dam as per IS: 12169 with internal drainage system i.e. sand chimney and sand blanket of 500mm (min.) thickness shall be provided inside the embankment. Slope stability of embankment shall be analyzed as per IS: 7894. However, the minimum slope of embankment shall be 1V:2.5H with a berm of 3.0m at every 6.0m interval. The founding level of embankment shall be at least 300mm below natural ground level. The top soil shall be stripped to a minimum depth of 300mm. However, the stripping depth, if required, shall be increased to the required level as per actual conditions to totally remove all vegetations, organic matters, roots, soft spots, etc. The whole area of reservoir bed shall be graded & leveled by cutting and filling. Wherever filling is required at the bed of the reservoir, area shall be stripped first and then embankment filling shall be done in layers of 300mm compacted thickness and compacted to minimum 90% of maximum dry density (Standard Proctor) by mechanical means at optimum moisture content. Minimum top width of embankment shall be 6.0m with provision of single lane WBM road including black topping all around on top of embankment. WBM road shall be constructed in accordance with IRC: 19 (latest edition). On downstream slope of the embankment, rip-rap shall be provided from toe up to or higher level than the HFL. Turfing shall be provided from embankment top to rip-rap/HFL level. Rock-toe with toe drain shall be provided at the toe (bottom) of the embankment all around the reservoir. Toe drain shall be of adequate capacity to be constructed in RCC grade M30. An approach ramp of minimum 6m width and min. 1V:8H slope shall be provided for access to the top of reservoir embankment along with single lane WBM road including black topping. The side slope of ramp embankment shall be minimum 1V:2.5H and shall be provided with rip-rap/turfing (as required) on side slopes. In order to arrest the seepage/percolation losses through reservoir bed/embankment, 1mm thick high density polyethylene (HDPE) liner shall be provided at entire bed and upstream side slopes. HDPE liner shall be laid on the prepared soil bed which is free from any sharp objects, roots or any other organic materials. HDPE liner shall be anchored in PCC filled trench at the edge of top of embankment. HDPE liner shall be protected by providing non woven geotextile and 75 thick PCC lining.			
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5.04.04	Suitable underdrainage system consisting of Pressure Relief Valves (PRV) shall be provided below the HDPE liner in the reservoir bed to counter uplift forces on HDPE liner occurring when the reservoir is empty and ground water table in the vicinity is above the reservoir bed level. PRVs shall conform to IS 4558. Earthen Embankment Material for Filling Material to be used for embankment filling shall be of approved quality excavated from inside the reservoir/plant area or brought from borrow area arranged by the Contractor. Material used for embankment filling shall not be organic soils, peat, cohesionless soil, sand dust, expansive soils and chemically aggressive soils. They shall be clean and free from shingle, salts, organic roots and sod, lumps, concrete or any other foreign substances. Fill shall be placed in horizontal layers not exceeding 300 mm compacted thicknesses. Compaction shall be done to achieve minimum 95% standard Proctor density by mechanical means. Filling shall be accurately finished to line, slope, cross-section and grade as shown on the approved drawings. Finished surface shall be free of irregularities and depressions and shall be within (+/-) 20mm of the specified level. When the borrow area is located contiguous to the embankment alignment then it must be ensured that the borrow area shall not be opened within a distance of 5 times the height of embankment contiguous to the heel or the toe of the embankment or 25 metre whichever is more. The required approach roads and haul roads shall be constructed and maintained by the Bidder. The Bidder shall divert the existing roads, nallah/drain if any which are in the Raw Water Reservoir area at his own cost before the start of work. Frequency of sampling and testing including the methods for conducting the tests are as given in Table-1. The testing frequencies set forth are desirable minimum and Engineer shall have the full authority to carry out or call for tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications. Following Acceptance Criteria shall be followed: a. All individual samples collected and tested should pass without any deviation when only one set of sample is tested. b. For re-test of any sample, two additional samples shall be collected and tested, and both should pass without any deviation. c. Where a large number of samples are tested for a particular test then 9 samples out of every 10 consecutive samples tested shall meet the specification requirement.		
5.04.05	DELETED		
5.04.06	Graded Coarse Aggregate Filters Graded coarse aggregate shall be used in filters below rip-rap and rock-toe as per IS 8237. The coarse aggregate material shall consist of durable well graded broken rock of hard stone. The materials shall range in the size from 10mm to 75mm and shall satisfy the filter criteria. The rock material used in the aggregate filters shall satisfy the following condition: a) Specific gravity shall not be less than 2.50. (As per IS 1122)		
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	b) Sulphate soundness less than 10% loss of weight after 5 (Five) cycles (As per IS 1126) c) Aggregate Impact value shall not exceed 30% (As per IS 2386) d) Water absorption shall not exceed 2.5% (As per IS 2386) a) In slake durability test (as per IS 10050), the percentage retained after two ten (10) minutes cycles shall be more than 85%.			
5.04.07	DELETED			
5.04.08	HDPE Liner The proposed lining system consisting of High Density Polyethylene (HDPE) membrane shall form the water-tight barrier to prevent seepage/leakage. Bidder shall examine in detail the prevailing conditions and provide a liner system to meet the above requirement. The specification as outlined hereunder shall be treated as bare minimum. However, bidder shall offer the system to meet the site specific requirements and shall provide complete details in the offer. In case bidder deems it necessary to provide additional measures over and above what has been specified, he may do so at the quoted rate against the schedule of item. Bidder shall guarantee the satisfactory performance of the proposed liner system for a period of five years from the end of defect liability period. REQUIREMENT OF HDPE MATERIAL The High Density Polyethylene (HDPE) Liner shall be manufactured out of polyethylene resin. The resin composition and production shall meet the intended purpose as specified above. The natural polyethylene resin without the carbon black shall meet density of 0.932 g/cc or higher and melt index less than 1.0 g/10min. The test methods shall conform to ASTM D 1505 or ASTM D792 or equivalent for density test and ASTM D1238, condition E or equivalent for Melt Index test. The HDPE liner shall not be less than 6.0 M in width. Carbon Black shall be included in the resin to render it ultra-violet resistant. The Carbon Black content shall be between 2-3 percent as per ASTM D 1603. The surface of liner shall not have striations, roughness, pinholes or bubbles. The liner may be smooth. The liner sheet thickness shall be 1.0MM (40 Mil) with sheet density not less than 0.94 g/cu.cm. The Melt Flow Index shall be less than 1.0 g/10min. The method for testing melt flow index shall be as per ASTM D 1238 or equivalent. The Tensile stress at yield shall not be less than 17.0 N/mm and the yield strain not less than 12%. The strain at break shall not be less than 700%. The Tear Strength as per ASTM D 1004 or equivalent shall not be less than 130 N. The Puncture Resistance as per ASTM D 4833 (or equivalent) shall not be less than 390 N. For all other properties & test methods specified elsewhere in this specifications shall conform to GRI test method GM13 (Latest revision). Any sealants used shall be of type as per the recommendations of the HDPE manufacturer compatible with the intended use. However, before the use, Owner's approval shall be obtained. INSTALLATION AND LAYING OF LINING SYSTEM The HDPE Liner sheet (Geo-membrane rolls) shall be brought to site by trailer/truck or by any suitable transport without damaging the geo-membrane. The geo-membrane rolls shall be stored in such a way that they are protected from puncture, dirt, grease, moisture and heat. In case any material gets damaged, it shall be segregated and stored separately for replacement. All the geo-membrane rolls shall be stored on a prepared smooth surface. The HDPE Liner works shall be executed at site by the supplier of HDPE liner only.			
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	Subgrade (reservoir bed) shall be rolled and compacted and made flat and smooth. The top layer of reservoir bed subgrade shall be compacted with 2 passes of 8 to 10 flat footed roller over rock and soil surface. Any weak and soft spots, if present shall be removed and replaced with compacted fill. All subgrade surface where lining shall be placed should be smooth, free of all foreign and organic matter, sharp objects. Standing water or excess moisture shall not be allowed. For the purpose of anchoring the geo-membrane, anchor trench shall be excavated to the line, grade and width as shown in the drawings, rounded corners shall be provided in the trench to avoid sharp bends in the geo-membranes. Geo-membrane shall be laid using a spreader bar assembly attached to a loader bucket or any other method as approved by the Engineer. While laying the geo-membrane precaution shall be taken to avoid any damage to the lining system. Equipment or tools shall not damage the geo-membrane during handling, transportation and laying. Personnel working on the liners shall not smoke or wear shoes that may damage the geo-membrane. The method of unrolling the panels should be such that it should not cause scratches or crimps in the geo-membrane. While unrolling due care shall be taken to ensure that the subgrade is not damaged. In order to prevent uplift by wind, adequate loading by sand bags or similar items that will not damage the geo-membrane shall be placed over the geo-membrane. Continuous loading along the edges of the geo-membrane panels shall be provided in order to minimize the risk of wind flow under the panels. Geo-membrane shall not be laid when ambient temperature is above 50°C. Placement of geo-membrane shall not be carried during rains or in presence of excessive moisture such as fog, dew, etc. In presence of high winds also laying of geo-membrane shall not be taken up. Deployment of geo-membrane shall immediately followed by field seaming operation. The field seaming shall be as per manufacturer's recommended process. The field operation shall either be hot shoe fusion type or extraction welding type. Any other process may be acceptable subject to approval of the Owner. On embankment slopes and other slopes, in general, seams shall be oriented in the general direction of maximum slopes. In other words, the seams shall orient down and not across the slope. In corners and other geometric forms, the number of field seams shall be minimized. At the base, T-seam shall not be closer than 1.5m from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and fishmouths. If a fishmouth or wrinkle is found, it shall be relieved and cap stripped. All geo-membrane panels shall have a finished overlap of 100mm (minimum) in case of hot wedge welding and 75mm (minimum) for extrusion welding. Unless approved by the Engineer-in-Charge, cleaning solvents shall not be used. Bidder shall provide all equipment as approved by the Owner. The equipment shall consist of, but not limited to, hot-wedge welder, Extrusion Welder, high speed side grinder, generator, necessary power grid, Vacuum Box Test Equipment for non-destructive seam testing, Air pressure test equipment for non-destructive seam testing, Field Tensiometer for performing shear and peel tests. In order to verify that seam conditions are acceptable, field test on seams shall be conducted. Test seams shall be carried out at the outset of each seaming period and at least once every four hours for each seaming instruments and personnel deployed that day. All test seams shall be made in contact with the subgrade. All welding rods used for extrusion welding shall have the same properties as the resin used in the geo-membrane. The length of test seam sample shall be 3.0 meter in case of hot wedge welding and 1.0 meter in case of extrusion welding. At least five test specimens shall be cut from each end of the test seam. A tensiometer shall be used to test five specimens for shear and five specimens for peel. Each specimen shall be at least 25mm wide with a 100 mm plus width of the seam as grip separation, the seam shall be centered between the clamps. The rate of grip separation shall be 50mm per minute. Average of five specimens test results shall be considered for seam strength properties, four out of five		
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specimens shall pass seam acceptance criteria. Shear and peel test shall result in film Tearing Bond (FTB), as defined in NSF std. 54 or equivalent, which is a failure in ductile mode of one of the bonded area. In case a test seam fails to meet the field seam requirements of the specification, the apparatus for seaming and / or seamer shall not be used until the deficiencies are corrected and a successful test seam results.

All fields seams are over their full length shall be tested non-destructively. The non-destructive test shall be conducted either by vacuum Box Testing Method and /or Air pressure testing Method.

Vacuum Box Testing (VBT)

VBT shall be carried out by bidder as per the procedure outlined hereunder. A vacuum box assembly consisting of a rigid housing with a transparent window and having a soft rubber gasket attached to be bottom, porthole or valve assembly and a vacuum gauge shall be used. A soapy solution in plastic bucket with a mop shall be made available. The excess sheet overlap, if any, shall be properly trimmed away. Then a strip or geo-membrane of length 300 mm shall be wetted by the length of box with the soapy solution. The box shall be place over the wetted area and compressed. Create a vacuum of 0.2kg/sw.cm to 0.35 kg/sq.cm. Care shall be taken to ensure that a leak proof seal is created. Vacuum shall be maintained for sufficient time. For a period of approximately 15 seconds, examine the geo-membrane through the viewing window for presence of any animated soap bubbles. In case no animated bubbles appears after 15 seconds, close the vacuum valve and open the bleed valve. Thereafter, move the box over the next area adjoining the tested area with a minimum 75 mm overlap. Repeat the process as described above.

In case animated soap bubbles appear all such areas shall be marked, repaired and then retested successfully.

In locations where seams cannot be non-destructively tested, the seam shall be spark tested according to the manufacturer's recommendations and directions of the Engineer.

Air Pressure testing (APT)

APT shall be applicable for all double fusion seams, only. Bidder shall furnish all required equipment. An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 1.7 kg/sq.cm and 2.1 kg/sq.cm. The pressure gauge shall be equipped with a sharp hollow needle.

The Bidder shall seal one end of the seam to be tested. Then insert needle or any other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld. Then energize the air pump to verify the unobstructed passage of air through the channel. Seal the other end of the channel. Then energize the air pump to about 2.1 kg/sq.cm. Close the valve and allow 2 minutes for the injected air to come to equilibrium in the channel and keep the pressure approximately for 5 minutes. In case loss of pressure exceeds 0.28 kg/sq.cm or even pressure does not stabilize, then locate faulty area. The area to be repaired and then retested successfully. In case the test is successful, the air channel should be deflated.

Destructive seam testing shall be carried out as per the recommendations of the manufacturer. One destructive test shall be carried out for every 150 meter length of seam or as directed by the Engineer. Holes in the geo-membrane resulting from obtaining the seam samples shall be immediately patched and vacuum tested. The sample shall be 300mm wide and 1.0 meter long with the seam centered lengthwise. The sample shall be cut into three equal length pieces. One piece to be given to the Engineer and the other shall be with bidder for testing. Bidder shall test ten 25mm wide specimens, five specimens for shear strength and give for peel strength. To be acceptable, four out of five specimens must pass.

The Owner may send seam samples, at his own discretion, to a laboratory for testing.

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	In case the sample fails the destructive test, then the Bidder shall cap strip the seam between the failed locations. If the test fails, then process is repeated. Over the length of seam failure, the Bidder shall either cut out the old seam, then reposition the panel and re-seam or add a cap strip. Bidder shall thoroughly inspect all seams and non-seams areas of the geo-membrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Surface of the geo-membrane shall be cleaned at the time of inspection by the Bidder. Each suspect location in seam and non-seam areas shall be further non-destructively tested in presence of Engineer, if so desired. Each location that fails the non-destructive e testing shall be marked and repaired by the Bidder. The defective seams shall be cap stripped or replaced. Small holes shall be repaired by extrusion welding. If the holes are larger than 6mm, if should be patched to the satisfaction of the Engineer. All tears shall be repaired by patch work, where the tear is on a slope or an area susceptible to stress and has a sharp end; the same shall be properly rounded before patching. Blisters, large cuts and undispersed raw materials shall be repaired by patches; Patches shall be done by extrusion welding. The weld area shall be ground not more than 10 minutes prior to welding. It shall be ensured that no more than 10% of the thickness is removed by grinding. Welding shall commence immediately after grinding and must overlap the previous seam by at least 50mm. Re-seaming over an existing seam shall be carried out, if permitted, only after regrinding. Generally, welding shall restart by grinding the existing seam and re-welding a new seam. Patches shall be round or oval in shape, made of the same geo-membrane, and extend a minimum of 150mm beyond the defective areas. Each repair shall be non-destructively tested to the satisfaction of the Engineer-in-Charge. Repairs that pass the non-destructive tests shall be considered as an acceptable repair. In case the tests fails, the repair shall be repeated and retested until passing test results are obtained. The bidder shall keep daily reports and details of all non-destructive and destructive testing. The report/ documentation shall clearly identify all seams that initially failed the test and include all evidence/ certification from the Engineer that these seams were satisfactorily repaired and successfully retested. All anchor trenches shall be casted by the bidder. Anchor trench material shall be plain cement concrete. It shall be suitably placed to the size as specified in the drawings without damaging geo-membrane. If damage occurs, it shall be repaired immediately. For attachments to concrete, stainless steel concrete anchors and epoxy anchors, stainless steel nuts and washers along with stainless steel slotted flat bars (6mm thick) shall be provided at no extra cost to the owner. Bidder shall also provide closed cell neoprene gaskets and associated adhesive with no extra cost to the owner. Bidders shall make their own assessment of the requirements and include all cost in the quoted price of geo-membrane (HDPE Liner). Wherever pipe penetrations are to be sealed, the geo-membrane shall be formed around the pipes with stainless steel clamps, closed cell neoprene gaskets, etc shall be provided all around the pipe to make it leak proof. The details of the seal generally follow the manufacturer's recommendations subject to the owner's approval. No separate payment shall be made for all pipe penetration sealing works. The bidder shall make his own assessment of the total work and provide for the same in the unit rate quoted for geo-membrane (HDPE Liner). All quality control measures shall be deployed by the bidder. All tests are required to be carried out at Bidder's own cost during the production of materials as well as during laying operation. All resins for use in geo-membrane shall conform to the requirements. Each lot shall be sampled with following tests conforming to manufactures specifications. <table><tr><td>1. Density</td><td>:</td><td>ASTM D 1505</td></tr><tr><td>2. Melt Index</td><td>:</td><td>ASTM D 1238</td></tr></table> All additives are to be tested and approved prior to use with the following testing performed and compared to the manufacture's requirements'.	1. Density	:	ASTM D 1505	2. Melt Index	:	ASTM D 1238
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2. Melt Index	:	ASTM D 1238					
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 28 OF 120				

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	1. Carbon Black content : ASTM D 1603 Manufacturer's quality Assurance Testing shall conform to the provisions as stipulated here. Full width samples shall be taken as tokens from the end of each roll. The HDPE liner that is to be supplied, quality control testing shall meet following frequency. <table><tr><th>Test</th><th>Description</th><th>Method</th><th>Frequency</th></tr><tr><td>1.</td><td>Thickness</td><td>ASTM D 5199</td><td>Every roll</td></tr><tr><td>2.</td><td>Tensile properties</td><td>ASTM D 638</td><td>Every 5000 Sq.m.</td></tr><tr><td></td><td>a. Tensile strength at yield.</td><td></td><td></td></tr><tr><td></td><td>b. Tensile strength at Break</td><td></td><td></td></tr><tr><td></td><td>c. Elongation at Yield.</td><td></td><td></td></tr><tr><td></td><td>d. Elongation at Break.</td><td></td><td></td></tr><tr><td>3.</td><td>Tear resistance</td><td>ASTM D 1004</td><td>Every 5000 Sq.m.</td></tr><tr><td>4.</td><td>Puncture Resistance</td><td>ASTM D 4833</td><td>Every 5000 Sq.m.</td></tr><tr><td>5.</td><td>Carbon Black Content</td><td>ASTM D 1603</td><td>Every 5000 Sq.m.</td></tr><tr><td>6.</td><td>Dimensional Stability</td><td>ASTM D 1204</td><td>Every 5000 Sq.m.</td></tr><tr><td>7.</td><td>Carbon Black Dispersion</td><td>ASTM D 5596</td><td>Every 5000 Sq.m.</td></tr><tr><td>8.</td><td>Density</td><td>ASTM D 1505/D792</td><td>Every 5000 Sq.m</td></tr><tr><td>9.</td><td>Melt Index</td><td>ASTM D 1238</td><td>Every 5000 Sq.m.</td></tr><tr><td>10.</td><td>Oxidative Induction Time</td><td>ASTM D 3895</td><td>Every 5000 Sq.m.</td></tr><tr><td>11.</td><td>Low Temperature Brittleness</td><td>ASTM S 746</td><td>One per resin lot</td></tr><tr><td>12.</td><td>Environmental Stress resistance</td><td>ASTM D 1693</td><td>Every 5000 Sq.m.</td></tr><tr><td>13.</td><td>High Pressure Oxidative Induction Time</td><td>ASTM D 5885</td><td>Every 5000 Sq. m.</td></tr><tr><td>14.</td><td colspan="3">Oven Aging at 85 Deg C – High Pressure OIT (min. ave.)- % retained after 90 days – ASTM D 5885 - Every 15000 Sq. m. and each formulation</td></tr><tr><td>15.</td><td colspan="3">UV Resistance – High Pressure OIT (min. ave.)- % retained after 1600 hrs – ASTM D 5885 - Every 15000 Sq. m. and each formulation</td></tr></table> Welding rod samples shall be tested at the frequency of once per 25 rolls of welding rod. Following tests shall be performed on the samples. <table><tr><td>1.</td><td>Thickness/diameter as per ASTM D751</td><td>: ASTM D 751</td></tr><tr><td>2.</td><td>Density as per ASTM D 1505</td><td>: ASTM D 1505</td></tr><tr><td>3.</td><td>Melt Index as per ASTM D 1238</td><td>: ASTM D 1238</td></tr><tr><td>4.</td><td>Carbon black content as per ASTM D 1603</td><td>: ASTM D 1603</td></tr></table> All the reference to ASTM codes shall be tested as the base requirement. Other International codes of practices, which are equivalent to the above ASTM, shall also be acceptable to the owner subject to prior approval. Results of all the tests shall be furnished to the owner for his review. Owner or his authorized representative reserve the right to inspect the testing facilities and witness the tests as and when desired. Owner or his authorized representative reserve the right to retest some or all the parameters of HDPE liner at NTPC identified 3rd party testing laboratory anytime during the execution of contract. Sample shall be selected from site randomly jointly by NTPC and contractor. Cost of			Test	Description	Method	Frequency	1.	Thickness	ASTM D 5199	Every roll	2.	Tensile properties	ASTM D 638	Every 5000 Sq.m.		a. Tensile strength at yield.				b. Tensile strength at Break				c. Elongation at Yield.				d. Elongation at Break.			3.	Tear resistance	ASTM D 1004	Every 5000 Sq.m.	4.	Puncture Resistance	ASTM D 4833	Every 5000 Sq.m.	5.	Carbon Black Content	ASTM D 1603	Every 5000 Sq.m.	6.	Dimensional Stability	ASTM D 1204	Every 5000 Sq.m.	7.	Carbon Black Dispersion	ASTM D 5596	Every 5000 Sq.m.	8.	Density	ASTM D 1505/D792	Every 5000 Sq.m	9.	Melt Index	ASTM D 1238	Every 5000 Sq.m.	10.	Oxidative Induction Time	ASTM D 3895	Every 5000 Sq.m.	11.	Low Temperature Brittleness	ASTM S 746	One per resin lot	12.	Environmental Stress resistance	ASTM D 1693	Every 5000 Sq.m.	13.	High Pressure Oxidative Induction Time	ASTM D 5885	Every 5000 Sq. m.	14.	Oven Aging at 85 Deg C – High Pressure OIT (min. ave.)- % retained after 90 days – ASTM D 5885 - Every 15000 Sq. m. and each formulation			15.	UV Resistance – High Pressure OIT (min. ave.)- % retained after 1600 hrs – ASTM D 5885 - Every 15000 Sq. m. and each formulation			1.	Thickness/diameter as per ASTM D751	: ASTM D 751	2.	Density as per ASTM D 1505	: ASTM D 1505	3.	Melt Index as per ASTM D 1238	: ASTM D 1238	4.	Carbon black content as per ASTM D 1603	: ASTM D 1603
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	all testing shall be borne by the contractor. In case the sample does not meet the requirement of Technical Specifications, then owner reserve the rights to reject the HDPE liner lot from which the sample is selected. Precautions to be taken for HDPE liner laying: 1. After the construction of reservoir embankment, the slopes shall be dressed properly and shall be free from any gravel or sharp rock pieces. The slopes & bed of reservoir shall be free from any gravel or sharp rock pieces which can puncture the HDPE liner. 2. After the bed preparation, HDPE liner roll shall be unrolled one at a time. The liner shall be adequately loaded with the sand bags and shall be immediately welded with the adjacent liner roll. 3. Once the welding of previous liner rolls is completed then only the next roll shall be unrolled. 4. The loading of HDPE liner shall be continuous at the edges and in a dense grid of 1mX1m at over the liner area. 5. Liner shall not be left open without adequate loading and it shall be pressed properly (in order to take out air pockets which causes undulation) before welding. 6. Anchoring of HDPE liner at reservoir top shall be done as per the construction drawing. 7. Non-Woven geotextile & over that 75 thick PCC M20 layer shall also be placed over HDPE liner to get finished surface. 8. In the reservoir bed, 300mm thick layer of specified soil shall be provided in rocky surface. Bed shall not consist of gravels and sharp rock pieces. 9. The welding of HDPE liner rolls shall be carried out simultaneously. Large number of rolls should not be left un-welded to avoid tearing off of liner.			
5.04.09	PCC Lining 75mm thick Plain Cement Concrete of grade M-20 (design mix) shall be provided over non-woven geotextile laid over HDPE liner at all levels on the inner surface of reservoir embankment (upstream side slope) and reservoir bed with graded stone chips (12.5 mm nominal size). Synthetic Polyester triangular fibre of length 12mm, effective diameter 10-40 microns and specific gravity of 1.34 to 1.40 shall be mixed in Plain Cement Concrete of grade by using 125gms of synthetic Polyester triangular fibre for 50 Kg cement used as per directions of Engineer. Placing After the slope & bed of reservoir has been dressed to line and HDPE liner has been provided over the compacted earth/soil, the entire upstream slope surface & bed shall then be covered with non woven geotextile followed by placing of 75 thick PCC lining. The PCC lining shall be free from impurities like particles of stone, lime and other foreign materials visible to the naked eye on the surface and shall be of uniform texture. On completion of PCC lining, the surface presented by the lining shall be even throughout, free from irregularities.			
5.04.10	Non-Woven Geotextile This specification covers the technical requirements for the Manufacturing and Installation of the nonwoven geotextile. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these specifications.			
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	Submittals A. Prior to material delivery to project site, the contractor shall provide the engineer with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein. B. The contractor shall submit, if required by the engineer, manufacturer's quality control manual for the geotextile to be delivered to the site. Geotextile A. Geotextile shall be Needle punched Non-woven type. B. The geotextile shall be manufactured from prime quality virgin polymer. C. Geotextile shall be with U-V (Ultra-violet) treatment suitable for a temperature range from 0 Deg. C to 50 Deg. C so that the strength and the life of the same is not affected due to exposure to ultraviolet D. Geotextile shall meet or exceed all material properties as given below. E. In addition to the above, geotextile shall have good resistance to chemicals and to biological degradation 1. Material for Geotextile filter 100% Polypropylene 2. Mass per unit area 250 g/sq.m (ISO 9864) 3. Thickness in mm 2.2 (min.) (ISO 9863) 4. Tensile strength 19 kN/m (ISO 10319) 5. Elongation at break 80/35(md/cd)(ISO 10319) 6. Puncture strength 2900 N (ISO 12236) 7. Effective opening size 0.09mm (ISO 12956) 8. Horizontal water flow 20kPa 13 l/m.h (ISO 11058) Horizontal water flow 200kPa 3.0 l/m.h (ISO 11058) 9. Vertical water flow 50mm head 72.0 l/sqm.h (ISO 11058) 10. Width to be supplied minimum 3.5 m MANUFACTURE All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number and roll dimensions. TRANSPORT A. Transportation of the geotextile shall be the responsibility of the contractor. B. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions. C. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage. INSTALLATION A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Any damage to the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile at his own cost.		
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	B The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods. C. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material. D. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Any damage to such material occur due to the fault of the contractor, the contractor shall repair the damaged materials at his own cost and to the satisfaction of the engineer. E. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the engineer. F. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct Sun light for more than 15 days after installation. G. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat seaming, fusion welding techniques recommended by the manufacturer shall be used. H. The contractor shall not use heavy equipment to traffic above the geotextile without approved protection. I. The geotextile shall be covered (as per drawings) as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days. J. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.			
5.04.11	Spillways/Over Flow Structures Bidder shall suitably design and construct spillways/over flow structures to prevent overtopping of the embankment. The discharge from the spillways/overflow structures shall flow to the nearest nallah or drains with capacity to accommodate it.			
5.04.12	Inlet /Outlet Structures Suitable outlet pipes of mild steel (MS) as per IS: 3589 shall be provided. The adequate nos. of outlet pipes (as per design requirement) of suitable diameter and minimum 500mm thick RCC encasement with concrete Grade M20 as per IS 456. Pipes shall be laid as per IS 783. Inlet structure shall be suitably designed & constructed. Inlet pipes shall be of MS as per IS: 3589 and laying shall be done as per IS 783. The number and diameter of pipes shall be suitably designed to meet the capacity requirement. A minimum 500mm thick RCC encasement with concrete Grade M20 as per IS: 456 within the embankment shall be provided. To dissipate the turbulence and energy of the falling water suitable energy dissipation devices/system shall be provided.			
5.04.13	Rip-Rap Rip-rap shall be hand placed on the slopes of the embankment as per IS: 8237 - "Code of practice for Protection of slope for reservoir embankments". The thickness shall be 300mm and			
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5.04.14	shall be measured normal to slope of the embankment. The rock materials used for rip-rap shall satisfy the quality requirements specified in IS code. Rock Toe The rock material used for the rock toe shall satisfy the quality requirements. Rock toe shall be formed with rock material consisting of sound, durable and well graded broken rock obtained from approved quarries and shall be of approved quality. The materials shall range in size from 10 to 45 cm. All brush, roots or other perishable materials shall be removed from rock-fill during spreading and disposal off. Contamination of the rock with finer materials from any other zones shall be avoided. Accumulations of soil caused by contamination shall be removed. Rock materials shall not be dumped directly but shall be hand placed in layers.													
5.04.15	D/S Slope Protection Works – Turfing The D/S slope of embankment including berms, if any, shall be turf sodded from top of embankment to rip-rap level. Turfing shall consist of at least 5 cm thick grass turf sods of approved variety obtained from the tank beds or river margins for use in this work. The sod shall include a mat of roots and earth at least 5cm thick. Sod containing an excessive amount of obnoxious weed growth shall be excluded. The block of sod shall be laid on the slope in close contact and then tampered firmly in place so as to fill and close the joints between blocks.													
5.04.16	Diversion of Surface & Under Ground Water The whole of the works shall be carried out in the dry condition. Water from any source shall be diverted or pumped as required, clear of the works. Bidder shall make all necessary arrangement whatsoever required for keeping the work area dried by diverting and pumping of water, and also provision and operation of all temporary works including pumps, motors, fuel, piping and for the formation of any sumps, drainage channels, flumes, coffer dams and other protective works.													
5.04.17	Rainfall Run-Off As part of the work may have to be carried out in wet season, Bidders programme and methods must be capable of dealing with run-off from rainfall on the adjacent catchment area. The associated flow in the nallahs etc. shall be diverted clear of the works by an approved system of bunds and channels. Bidder shall supply, install and operate his own temporary pumping installation.													
5.04.18	Prevention of Pollution Arrangement shall be made by the Bidder to prevent pollution of the water in any streams, springs, nallahs and lakes. Arrangements for sprinkling of water in the construction and borrow area to prevent any dust blowing also shall be done by the Bidder. Bidder shall be solely responsible and liable for all damage caused by any pollution that may take place during the execution of the works, and he shall make arrangements, as the Engineer may approve, for preventing pollution but, not withstanding such approval, the entire responsibility for any pollution shall rest with the Bidder Table-1 Frequency of sampling and testing <table border="1"> <thead> <tr> <th>S.No.</th><th>Nature of test/Characteristics</th><th>Method of test</th><th>No. of samples & frequency of test</th><th>Remarks</th></tr> </thead> <tbody> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>				S.No.	Nature of test/Characteristics	Method of test	No. of samples & frequency of test	Remarks					
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	1	Suitability of fill material		One in every 2000 cum for each type and each source of fill materials subject to a minimum of two samples	Test for soil and sand
		a) Grain size analysis	IS: 2720 (Part-IV)		
		b) Liquid limit and Plastic limit	IS: 2720 (Part-V)		
		c) Shrinkage limit	IS: 2720 (Part-VI)	One in every 5000 cum for each type and each source of fill material	Test for soil The frequency of test can be increased depending on type of soil
		d) Free swell Index	IS: 2720 (Part-XL)		
		e) Chemical Analysis	IS: 2720	One in every 5000 cum for each type and each source of fill material	Test for soil and sand
		i) organic matter	Part-XXIL		
		ii) calcium carbonate	Part-XXIII		
		iii) Ph	Part-XXVI		
		iv) total soluble sulphate	Part-XXVII		
	2.	Standard proctor Test	IS: 2720 (Part-VII)	One in every 2000 cum for each type and each source of fill material	Test for soil for determining optimum moisture content, dry density etc
	3.	Moisture content for fill before compaction	IS: 2720 (Part-II)	One in every 2000 cum for each type and each source of fill material	Test for soil
	4.	Degree of compaction of fill			
	a) Dry density by core cutter method or dry density in place for sand displacement method	IS: 2720 (Part-XXIX)	For area filling, one for every 1000 sqm area for each compacted layer	Test for soil	
	b) Relative density (density Index)	IS: 2720 (Part-XIV)	For area filling, one for every 1000 sqm area for each compacted layer	Test for soil	
	c) Dry Density for proctor needle penetration	Standard practice	Random checks to be carried out for each compacted layer in addition to tests	Test for soil	
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TECHNICAL REQUIREMENTS 				
			mentioned under IV(a) above	
5.05.00	ASH HANDLING AND ASH WATER RECIRCULATION SYSTEM			
5.05.01	The civil works for Ash handling system (both wet and dry) shall comprise of bottom ash and fly ash handling systems, which includes Combined Ash slurry pump house and their related sumps/tanks, Ash water pump house, Bottom Ash (BA) slurry transportation pump pit and their related sumps/tanks (In case of SCC system), Transport/instrument Air Compressor house, Conveying air compressor house, Switchgear /Control/RIO rooms, Ash Water Recirculation System (AWRS) pump house complex and their related sumps/tanks, supporting structures and foundations for Bottom ash hopper, Buffer hoppers/Collector tanks, bottom ash overflow tank, Settling tanks and Surge tanks, Seal water tank, Ash Classifier, Bagging plant Complex, Silo Utility Building complex with Fly & Bottom Ash Silos, including development of silo area (i.e. paving, fencing/boundary-wall, access roads, office block and watchman cabin), miscellaneous equipment foundations, trenches, pipe racks, pedestals/thrust blocks for BA / AWR pipe supports (both inside and outside the plant boundary) including bridges/ culverts for road/rail/drain/nallah as required.			
5.05.02	Transport air compressor houses, Conveying air compressor houses, Ash slurry Pump House shall have steel shed building with side sheeting and Silo utility building, & Ash Water Recirculation pump houses shall have RCC framed structure, with RCC columns and profiled metal deck sheet roofing (filled with RCC) supported on steel purlins & truss / girders. Other buildings like MCC /switchgear rooms, control room, Disaster management room etc. shall have RCC framed structure with cast-in-situ RCC roof slabs. Bagging plant Complex building shall be closed steel shed. All RCC buildings shall have brick cladding. Crane girders or monorails shall be provided as per requirement and the same shall be of structural steel construction.			
5.05.03	The documents and drawings as listed below are to be submitted for the approval of the Employer unless specified otherwise. The list given below is not exhaustive but indicative only. - Project design intent document giving the basis of design, which shall cover all the design philosophy aspects, parameters, assumptions, references, loading cases, load combinations, analysis and design of all buildings, structures, facilities etc. shall be furnished for approval, before commencement of detailed engineering. - Structural analysis, design calculations and drawings of substructures and super structures for all buildings/structures, facilities like pump houses/shed, compressor houses, sumps / tanks, channels, pipe support structures, culverts/ bridges, pedestals, thrust blocks transformer yards, etc. shall be submitted for approval of the owner. - The design and drawings for the equipment and their supporting structures like bottom ash hopper, buffer hopper/collector tanks, surge tank/settling tank, silos/bins, etc. associated with Ash Handling System, shall be submitted to the Owner for information only. However, the structural design criteria and basis of design as mentioned at (a) above, for these structures also shall be approved by the Owner. - Top of RCC pedestal of foundation for bottom ash hopper, fly ash silo, other columns etc. shall be 300 mm above paving level or surrounding finished ground level (FGL).			
5.05.04	The finished floor level (FFL) of Ash Water Recirculation (AWR) pump house complex shall be 500 mm above FGL. However, in order to facilitate approach/connection to the road on top of mine void with AWR pump house complex, if required FGL may be fixed at higher level than 1.5 m above HFL. AWR System shall include Ash water recirculation pump house complex near mine void along with related sumps/tanks, MCC/Switchgear building, maintenance room, control room, disaster management room (single storey room of approx. size 15 m x 7.5 m and			
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5.05.05	1.5m wide verandah along the larger dimension), transformer yard, miscellaneous equipment foundations, trenches inside roads/RCC paving and area drainage etc. The peripheral drain inside the complex of suitable capacity & slope shall be suitably connected to the natural drain available outside the complex. The AWRPH complex shall be confined with boundary wall and a security gate. The complex shall be suitably connected to the road to plant and road on mine voids. Since the complex is situated outside the plant boundary, an Independent sewerage system including soak pit/ inspection chamber shall be provided. The Silo utility building complex shall be fenced with chain linked fencing, if placed inside the plant boundary and shall be confined with boundary wall if placed outside plant boundary. Gates shall be provided for rails, truck movement and transformers. The boundary wall shall be of one brick thick of height 2.4 m with a 600 mm high galvanized concertina at top, such that total height is 3.0 m above formation level. The fencing shall be PVC coated G.I. Chain link of minimum 4 mm thickness (including PVC coating) of mesh size 75mm x 75 mm and of height 2.4 m above toe wall. The toe wall shall be 1 brick thick, minimum 200 mm high above paving/formation level and 300 mm below paving/formation level on 75 mm thick PCC (1:4:8) bedding. Entire area in the silo area complex shall be paved and have a peripheral RCC drain of adequate capacity & slopes covered with perforated precast RCC slabs of minimum 150 mm thickness with provision of openable galvanized steel grating covers of 1.0 m at every 4 m interval .The complex shall be provided with a sump for collection of ash water. In addition to the outer confinement, additional fencing with gates should be provided for all transformers in the complex. A watchman cabin with a minimum area of 5 Sq.m shall also be provided in this area.			
5.05.06	For AWR system, the pedestals/thrust blocks for pipe supports from mine voids to AWR sump & AWRPH to ash water PH including bridges/ culverts for road/rail/drain/nallah etc, shall be provided as per the system requirement. The pedestals for AWR pipes may be combined with the pedestals for Bottom ash pipes in the corridor common for pipes. Pipe supports shall be provided for bottom ash slurry pipes, ash slurry pipes, AWR pipes, dust suppression pipes, dry fly ash(FA) pipes including RCC thrust blocks and any other supports required to complete the system. Over-ground pipes shall be supported on RCC pedestals except for FA pipes which shall be on elevated steel trestles. Unless noted otherwise, the top of concrete pedestals shall be minimum 500 mm above surrounding ground level/paving level. Pipes shall be suitably anchored with RCC pedestals to resist lateral and vertical movements as per system requirement. B.A. slurry disposal pipe line pedestals and thrust block/culverts including garlanding of bottom ash slurry mine voids.			
5.05.07	If the layout requires the pipes to cross the road on top of mine voids, all ash pipes shall be laid in hume pipes of suitable diameter (NP-3 class) encased in RCC(minimum 200 mm thick) forming a hump on the road. The road shall be modified such that the slope of road along the length, at hump section, shall not be steeper than 1:20. Single lane maintenance / Inspection road with 1.5m wide shoulders on both sides of the road shall be provided along the entire route of the ash slurry pipeline & recovery pipe line from plant boundary wall to the mine voids along ash pipelines including road for garlanding. Required leveling and grading for ash pipe corridor road shall be provided such that longitudinal slope of road shall not more than 1:30 at any stretch of the road. The details of road shall be as specified elsewhere for patrol road in the specification. However, shoulders shall consist of 150mm thick compacted layer of moorum in place of interlocking blocks specified therein. Based on the actual survey, if it is established that, there is a space constraint in accommodating the maintenance road in the ash pipe corridor, the road width (of 6.75 m including shoulders as per specification), may be adjusted with the approval of NTPC, by reducing the width of shoulders in such stretches. For stretches of roads in cutting and other stretches wherever necessary, longitudinal rectangular brick side drains with minimum 500 wide and 300 deep shall be provided. Only the inside faces and top surfaces of the drains shall			
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	be plastered with 1:4 (cement: sand mortar). These drains shall be connected to the nearest available natural drain or low lying area. Adequate cross drainage with RCC box culvert or RCC pipe culverts (NP-3) as per topography requirement shall be provided under the access/maintenance road to cater to the surface drainage due to rainfall and other existing drain/nallah. Camber shall be provided on the road. The finished top (crest) of all roads shall be minimum 350 mm above the surrounding finished ground level, however based on the site conditions / low lying areas the height of road top shall be increased.			
5.05.08	Where the pipes are crossing the road through RCC box culverts, the culvert top generally, shall not be not more than 100 mm above the road top and a hump with slope of 1:35 shall be provided on the road. All other road crossings inside the plant area can be either underground or overhead road crossings with necessary headroom clearance. For any boundary wall crossings, pipe shall be laid through casing pipe / RCC culvert. After laying the pipe, the boundary wall shall be restored. For other water body crossings, such as local Nallah / canal, local water bodies, local drains etc. suitable structural arrangement with 800 mm wide walkway shall be provided. Minimum clearance of the bottom of pipeline for all such locations shall be 1.50 M above the High flood level (HFL). Bidder to take all statutory clearance from concerned authorities for crossing his pipe/trestles over road / rail / culverts / nallah etc. at his own cost and initiative, without any commercial implication to the owner. For any other additional works, bidder have to make their own assessment too of the quantity/ number of culverts, existing pipe pedestal crossings, nallah crossings etc., based on their site visit before quoting.			
5.05.09	All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method excepted by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines. The railway track crossings are to be designed in accordance with railway Standard/RDSO guidelines and all necessary approvals from the concerned Railway authorities shall be obtained by the Bidder, without any financial implications to the owner.			
5.05.10	Survey inside and outside plant boundary, required for finalization of layout for maintenance road, FA transportation pipe trestles, pipe pedestals up to mine voids including mine voids, is in the bidder's scope. The survey shall include the longitudinal section of the entire corridor			
5.05.11	All liquid retaining structure shall be designed by working stress method as per IS 3370 (Part-1&2):2009. The thickness of base slab in liquid retaining/ carrying structures shall be minimum 150mm. Minimum grade of concrete for liquid retaining structures like Sumps/tanks/drain sumps etc shall be M-30.			
5.05.12	For liquid retaining structures, the minimum reinforcement in each direction shall not be less than 0.24% of the gross cross-sectional area.			
5.05.13	All liquid retaining structures shall be tested for leak proofness with full water level in accordance with clause no.12 of IS 3370(Part 1):2009 and IS 6494.			
5.05.14	All pump houses and other substructures shall be checked for stability as per the following guidelines: a) Stability of structure against sliding during construction as well as operating conditions for various combinations of applied characteristic loads. In case where dead load provides the restoring moment, only 0.9 times the characteristic dead load shall be considered. Factor of safety against sliding shall not be less than 1.4 under most adverse combination of applied characteristic loads. b) Stability of structure as a whole against overturning. It shall be ensured that the resisting moment shall be not less than the F.O.S. times the maximum overturning moment. Factor of safety against overturning shall not be less than 1.2 due to characteristic dead load and shall not be less than 1.4 due to characteristic imposed load. c) Stability of structure against uplift due to the ground water table at finished ground levels during construction and after construction stages. Minimum factor of safety of			
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5.05.15	1.2 against uplift shall be ensured considering 0.9 times dead weight, empty condition inside and ignoring the superimposed loadings. Inclined wedge action shall be limited to 15 degree with vertical plane. Provision of pressure relief valve / flap valves etc. shall not be permitted to counter the uplift. Also FOS against uplift, to be taken as 1.0 considering the dead weight of structure and soil resting on side projections, if any, in the vertical plane. Inclined wedge action of soil shall not be considered in this case. Architectural Features of Ash Handling and Ash Water Recirculation System Buildings a. All buildings shall be fully covered with brick masonry cladding and Aluminium and Steel doors/ windows/ rolling shutters / ventilators. b. Safety norms shall be followed as applicable. The buildings shall be provided for Pump houses, Switch Gear Room, Control Room etc. as per ash handling system requirements. c. External finish shall be of premium acrylic smooth exterior paint with silicon additives. d. All the air conditioned rooms shall be provided with hermetically sealed double glazing in windows and false ceiling. e. Encased staircase shall be provided for double storeyed buildings and cage ladder shall be provided for roof access in single storeyed building. f. Each building shall have one toilet block with drinking water facility. g. Ash water recirculation building shall have Bio toilet as mentioned else where in the specification.			
5.06.00	FGD SYSTEM			
5.06.01	The civil works for FGD system shall comprise of civil, structural and architectural works below and above ground level of Ball mill building, Ball mill foundations, FGD control room building, slurry re-circulating pumps & oxidation blowers building, tank foundations, absorber tower foundation, MCC building, gypsum dewatering building, transformer foundation, equipment foundations, pipe & cable gallery/ trestles, drainage, sanitation, water supply (from terminal points to various buildings/facilities) and all other civil, structural and architectural works associated with the complete FGD system specified elsewhere in this specification. Bidder may also refer terminal points & exclusions in this regard.			
5.06.02	Buildings for FGD System FGD System may comprise of various buildings based on the functional requirement viz. Ball Mill building, MCC/Control room building, Gypsum dewatering building, re-circulating pumps & oxidation blowers building, Gypsum storage shed etc.			
5.06.02.01	Control building, M. C. C. Buildings These shall be steel/RCC framed building with RCC roof and floor. For steel framed building roof /floor shall comprise of RCC slab over profiled metal deck sheets (to be used as permanent shuttering only) over structural beams. Cladding shall be of brickwork/concrete block work with plastering on both sides. Roof shall be provided with roof water proofing treatment, as specified elsewhere in the Technical specification. Suitable arrangement shall be provided so as to prevent ingress of water into the cable trenches inside the building from cable entry locations. All air - conditioned areas, shall be provided with false ceiling system (details specified elsewhere) with under deck insulation.			
5.06.02.02	Limestone Grinding System building/Ball Mill building This shall be steel framed building with R. C. C. roof and floor. For steel building roof /floors shall comprise of RCC slab over profiled metal deck sheets (to be used as permanent shuttering only over structural beams). Cladding shall be of single skin metal sheeting or			
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5.06.02.03	brickwork/concrete block work with plastering on both sides. Roof shall be provided with roof water proofing treatment, as specified elsewhere in the Technical specification. Gypsum Dewatering Building This shall be steel framed building with R. C. C. roof and floor. For steel building roof /floors shall comprise of RCC slab over profiled metal deck sheets (to be used as permanent shuttering only over structural beams). Cladding shall be of single skin metal sheeting or brickwork/concrete block work with plastering on both sides. Roof shall be provided with roof water proofing treatment, as specified elsewhere in the Technical specification			
5.06.03	Booster Fan and Ball Mill foundations: Fan, Mill foundations shall be RCC block foundation directly resting on virgin soil/ pile below Ground level. The vertical faces of this block foundation shall be isolated from adjacent footings by providing minimum 100mm thick polystyrene board of type-1 conforming to IS: 4671 with density 20 kg/cum sandwiched between the vertical face of block foundation and 230 thick brick wall all round. ii) Design Concept: a) For the foundations of Fans, Mills, etc. detailed static and dynamic analysis shall be done. b) Wherever block foundation is adopted by the bidder for mill or FAN foundations, suitable provisions to be ensured by the bidder in their General Arrangement and design to prevent transmission of vibration from these machine foundations to other nearby structures / foundations. The bidder or his consultant should have adequate prior experience in design of machine foundations and the machines should be in successful operation for at least one year prior to the date of submission of bid.			
5.06.04	Pipe and cable gallery/ trestles shall be as per details given in clause no. 5.02.08.			
5.06.05	RCC Floors, Paving & Grade Slab details Passages shall be provided inside the FGD area connecting to the outer periphery road to have access to the various facilities/buildings. These passage areas shall be provided with heavy duty paving for movement of heavy vehicles. The top surface of the passages shall be finished with 50 mm thick metallic hardener topping. Heavy duty paving shall also be provided for the areas in the equipment lay down area, unloading & maintenance area, storage area with 50 mm thick metallic hardener topping. Lightly loaded areas such where no heavy traffic movement is envisaged shall be provided with Normal Duty paving. However, corridors below pipe/cable trestle gallery where no traffic movement is envisaged and in the area over the buried fire water pipes shall be provided with interlocking concrete blocks of minimum M35 grade and minimum 80 mm thickness underlain by 20mm thick layer of sand followed by 200mm thick 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil. All facility/buildings shall be provided with 750 mm wide plinth protection all around. It consists of 50 mm thick P.C.C. M-20 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed, consolidated and grouted with fine sand. An area of minimum 7.5m width all around the tank foundations and other facilities/buildings shall be paved. This paving shall be beyond the extent of plinth protection. Further, heavy duty paving shall be provided for passages connecting the outer periphery road to have access to the various facilities/buildings.			
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	Wherever multiple FGD facilities are located in a cluster in the areas proposed for FGD, the entire extent of the cluster shall be provided with area paving maintaining minimum 7.5 m width around the facility buildings. Paving shall be extended up to nearest road for easy access to FGD facilities. Any functional requirement of paving for FGD facility not specifically mentioned in this document is also in scope of bidder. GRADE SLAB OF BUILDINGS AT GROUND FLOOR In buildings, the grade slab shall consist of 150mm thick RCC M25 grade base slab over an under bed as specified below. The under bed for ground floor slab shall consist of 75mm thick 1:4:8 PCC on stone soling of 200mm compacted thick with 63 mm and down aggregate with interstices filled with well graded selected sand/ moorum/ non-expansive soil on compacted and dressed sub - grade. Reinforcement for the slab shall consist of minimum 8mm dia. bars @ 200 mm c/c at top & bottom of the slab in both directions. However, at unloading & maintenance area, gypsum storage shed stone soiling of minimum 400mm thick and grade slab with minimum 10mm dia bars @ 200 mm c/c at top and bottom in both directions shall be provided. Further, top surface of grade slabs shall be finished with 50mm thick metallic hardener topping. 5.06.08 Bidder shall provide permanent access to all facilities/structures from the nearby existing roads of the Owner. Roads shall be of concrete as per IRC standards, with minimum thickness of pavement (PQC) as 250mm (in M 35 grade) and DLC of 150 thick (in M 10 grade). Double lane road (width 12m having 7.5m wide pavement & 2.25m wide shoulders on both sides) shall be provided. 5.07.00 SEWERAGE SYSTEM: Complete sewerage system including Sewage Treatment Plant for facilities within the plant is in bidder's scope. Bidder shall provide 'De-centralized Sewage Treatment' units. The capacity of the Decentralized Sewage Treatment' units should be as per the design requirements, subject to minimum combined capacity of 75 Cum/day.Design of Sewage treatment plant shall be as per CPHEEO manual. Primary,Secondary and Tertiary treatment to be provided. Cement concrete pipes of class NP-3 as per IS 458 shall be used below ground level for sewage disposal in all areas other than main plant area. However, for pressure pipes and in main plant areas, and under roads spun Cast Iron pipes conforming to IS 1536 of required class shall be used. RCC manholes with CI cover shall be provided at every 30m along the length, at connection points, and at every change of alignment, gradient or diameter of a sewer pipeline. This shall be as per IS 4111. Sewage pump stations shall be provided as per IS 4111. 5.08.00 BIDDER SHALL HAVE TO PROVIDE COMPLETE ARRANGEMENT for sewage disposal up to the sewage treatment plant including pumping facilities. PLANT STORM WATER DRAINAGE SYSTEM Complete storm water drainage system of Plant area is in bidder's scope. Storm water drain shall be designed taking into account the finished ground levels of the plant/township area, drainage pattern, intensity of rainfall, etc as stipulated/mentioned in 'Area drainage study report'. These values shall be based on minimum rainfall intensity of 75mm/hr. All RCC drains shall be either RCC Cast-in-Situ or RCC Pre-cast drains. The minimum grade of concrete shall be M25 for RCC Cast-In-Situ drains and M30 for RCC Pre-cast drains.The maximum velocity for RCC open drains shall be limited to 1.8 metre per second. However, minimum velocity of 0.6 metre per second for self - cleansing shall be ensured. Bed slope not milder than 1 in 1000		
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5.09.00	shall be provided. The inside drain dimension at any point should not be less than 0.45m (height) x 0.75m (breadth). Open RCC rectangular section, unless required otherwise due to functional requirement, shall be provided for all drains. The thickness of side walls and bottom slab of RCC drains shall be minimum 150mm or as per design considerations whichever is higher for drains upto depth of 1m from formation level. For depth of drain more than 1m from formation level, the thickness of side walls and bottom slab of RCC drains shall be minimum 200mm or as per design considerations whichever is higher. The drains shall be provided on both sides of the double lane roads and single lane roads. The drains shall be provided on one side of the patrol roads along boundary wall. These shall be designed to drain the road surface as well as all the free and covered areas, etc. Box culverts shall be provided at all rail, road and other crossings. Layout of drain shall be as per layout given in tender drawing "Layout of drain". Complete drainage upto outfall point to be completed to avoid flooding in the respective area. TRANSFORMER FOUNDATION Foundations of transformers shall be designed for seismic and wind loads in addition to other applicable loads. Solid RCC block foundation shall be provided for the main transformer block. Alternatively, transformer shall be supported on a RCC foundation comprising of common raft for rail supporting walls up to rail-cum-road along with pedestals for jacking pad, roller lock etc. Tie beams connecting roller lock pedestals at rail level shall also be provided. Common raft/solid RCC block shall be supported on soil or pile based on requirement specified elsewhere in the specification. Oil soak pit / oil water separation pit for transformer shall be provided as envisaged elsewhere in the specification. The oil soak pit shall be provided for each transformer and shall be filled with gravel of size 40mm. The volume of the soak pit shall be sufficient to store one-third (1/3) of the oil volume of transformer/reactor considering only 40% of the volume as available voids between gravel filling. The oil soak pit shall also be provided with a sump at the corner to allow drainage of water/oil from the soak pit. Oil soak pits sump of individual transformers shall be connected to common oil retention /oil water separation pit through Hume pipes and manholes. Separate common oil retention pit/oil water separation pit shall be provided for a group of transformers in transformer yard area of each generation unit of plant. The Oil-water Separation pit shall be designed for an effective capacity of complete oil of one transformer having highest volume of oil along with 10 minutes of firewater. For calculating effective capacity of oil-water separation pit, effective depth excluding 200 mm freeboard below invert level of inlet pipe shall be considered. Plan area and depth of oil-water separation pit shall be decided based on above consideration. Oil-water Separation pit shall be provided with five separate chambers interconnected by pipes. First chamber shall be for collecting oil-water mix from transformers' soak pits in case of fire. After entering into first chamber, oil being the lighter in density floats above the water. The water from lower elevation flows in to subsequent chambers interconnected through galvanized MS pipes. The accumulated oil in the first chamber to be pumped out for subsequent usage or disposal. Water collected in the last chamber to be pumped out for subsequent disposal after treatment. Invert level of inlet Hume pipes (of NP-3 grade and adequate capacity), carrying oil and water from transformers soak pits, shall be designed for gravity flow. Freeboard of 200 mm shall be provided below the invert level of inlet pipes. Invert levels of interconnecting pipes of subsequent chambers shall be decided accordingly.		
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5.10.00	Arrangement for moving the transformer into place using rail cum road, jacking pads and pulling blocks including inserts, as required, shall be provided along with the transformer/reactor foundations. RCC Firewall shall also be provided between the transformers wherever required. 300 mm thick PCC M20 encasement all around the Pylon supports inside soak pit for firefighting system shall be provided up to top of gravel filling. However, the supply and erection of Pylon supports with anchor fasteners for HVW spray system are not under the scope of this package. Coarse aggregate filling inside the transformer oil soak pit shall be carried out only after construction/erection of Pylon supports and PCC encasement.			
	Roads All roads shall be of rigid pavements unless otherwise specified. Rigid pavements shall be constructed with either conventional cement concrete or with Geopolymer concrete. Concrete road/pavement or rigid pavement, mentioned in specification, shall mean road /pavement constructed with either Cement Concrete (CC) or Geopolymer Concrete. All concrete roads shall be unreinforced jointed plain concrete pavement having dowels in transverse joints and tie bars at longitudinal joints. A 40mm bitumen mastic wearing course over concrete pavement shall be provided with industrial bitumen of grade 85/25 conforming to IS : 702, prepared by using mastic cooker and laid to required level and slope, including providing antiskid surface with bitumen fine grained hard stone chipping of approved size at the rate of 0.005 precoated cum per 10 sqm and at approximate spacing of 10 cm centre to centre in both directions, pressed into surface protruding 1 mm to 4 mm over mastic surface, including cleaning the surface, removal of debris etc. all complete. (Considering bitumen using 10.2% as per MORTH specification). This 40mm bitumen mastic wearing course shall be laid after completion of construction activities i.e at the time of handover. All the road shall again be repaired/made good as per IRC : SP :83 after completion of construction activities i.e at the time of handover. All service and utility lines like fire water line, sewerage line, electric cables line etc. crossing the road shall be taken through NP3 class RCC Hume pipe. Hume pipe shall be laid before road work so that the road shall not be damaged. Construction of road work shall be as per priorities given in Tender drawing 'Layout of Road Drawing'.			
5.10.00.01	For road to be constructed with Cement Concrete- The design of rigid pavement shall be carried out as per IRC: 58. The effects of design wheel load, maximum tyre inflation pressures, tyre contact area for the vehicle, traffic loads, environmental factors such as temperature changes in the pavement, other factors, like impact, load repetitions, etc., are to be taken. The design traffic load shall be a minimum value of 4 million standard axles. The road shall be designed for 30 years of life and considering a minimum traffic growth rate of 1 per cent per annum. The concrete pavement for roads shall be minimum 250 mm thick slab. The road construction including its shoulders, base, sub base and concrete pavement shall be as per MORTH. The road base shall be with minimum 150 mm thick dry lean concrete over granular sub base. Dry lean concrete shall be laid by a mechanical paver and compacted by vibratory rollers. Concrete pavement of the road shall be done with fully mechanized paver fitted with electronic sensors for construction techniques.Laying /placing of Concrete DLC and PQC manually with hand-guided means or by semi-mechanized methods may be permitted around BTG area provided acceptance criteria as per MORT&H			
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	specification is achieved. Dry lean concrete shall be minimum M10 grade and concrete pavement slab shall be minimum M35 grade concrete pavement shall be provided with 125 micron polythene sheet below it. Concrete pavement shall also be provided with contraction and expansion joint with MS dowel bars and as per Ministry of Road Transport and Highways (MORTH) specification. The finished top (crest) of all roads shall be 350 mm above the surrounding finished ground level. All culverts and RCC bridges at crossings of all roads / rail tracks / facilities with drains / nallahs / channels / roads / rail tracks / pipes / other facilities, etc. are to be designed and constructed. Unless otherwise specified, all roads (excluding access roads to all buildings / facilities / structures, patrol road along boundary wall and road inside the switchyard) shall be double lane roads.		
5.10.00.02	For road to be constructed with Geopolymer concrete- Geo-polymer concrete road shall be constructed over soil sub-grade/embankment. Road section shall comprise of Granular Sub base over soil sub-grade, Dry Lean Concrete of M10 Grade (DLC) base and Pavement Quality Concrete of M35 grade (PQC) top layer. Thickness of different layers of pavement section shall be as per design. However, minimum thickness shall be 150 mm for DLC and 250 mm for PQC. Provisions of Clause 5.10.00.01 in respect of design, construction and other requirement shall also be applicable for Geopolymer concrete road. In addition, specific information pertaining to geopolymer concrete is provided at the end of Chapter D-1-8.		
5.10.01	Double Lane Roads The double lane roads shall be (12 metre wide) with 7.5 metre wide concrete pavement and 2.25 metre wide raised shoulders on both sides of the roads as given in tender drawing "Details of road" .		
5.10.02	Single Lane Roads All access roads to all buildings / facilities / structures, road approaches / connections, access roads to liquid fuel storage areas and other equipment areas where access is necessary from inspection, operation and maintenance point of view and all roads inside the switchyard shall be single lane roads as given in tender drawing "Details of road" .		
5.10.03	PATROL ROADS All patrol roads along the boundary wall shall be single lane roads with 3.75 metre wide concrete pavement and 1 metre wide shoulders on one side of the road. as given in tender drawing "Details of road".		
5.11.00	Pre-cast Boundary WALL A pre-cast boundary wall all around the land acquisition line as shown in the General layout Plan for plant area shall be provided. The total height of boundary wall shall be 3600mm above formation level (natural ground level in case formation level is less than natural ground level). Upto height of 3000mm it shall be constructed with precast reinforced cement concrete panels / cast in situ RCC panels and over that for 600mm concertina coil with maximum loop spacing of 125mm shall be provided with Y-shaped MS angle. The RCC precast/cast in situ reinforced concrete columns shall be provided at spacing not more than 2500mm centre to centre. The RCC precast/cast in situ reinforced concrete columns and footing shall be minimum 1500mm below finished formation level with suitable foundation designed for horizontal and		
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	vertical loads. However, foundations /footings shall not rest in filled up strata. The precast reinforced concrete panels/ cast in situ RCC panels shall be at least 600mm below formation level. The RCC precast concrete columns/ cast in situ RCC panels of minimum size 300mmX350mm shall be provided with two grooves of minimum size 115mmX50mm, so as to receive Precast Concrete RCC panels spanning from column to column with minimum width of 600mm and minimum thickness of 100mm as filler wall. The grade of concrete for all precast/cast in situ work shall be of M30 grade conforming to IS 456. The boundary wall shall be designed as per relevant IS codes and as per standard practices. The same shall be submitted to Owner for approval at the time of detailed engineering, The architecture of boundary wall shall be finalized in consultation with Owner. The precast/ cast in situ reinforced cement concrete coping with minimum projections of 150mm on each side shall be provided at the top of the precast reinforced cement concrete panels / cast in situ RCC panels with suitable provision for MS angle Post for concertina throughout the boundary wall. Opening for gates/drains and for other crossing shall be suitably provided as per the requirement. All exposed concrete surfaces of all precast members/ cast in situ RCC members have high quality shuttering finish with tolerance of +/- 5mm. Plinth protection of 150mm thickness PCC (M20) shall be provided on both side of boundary wall extending upto 300mm from centre line of boundary wall. High quality shuttering to be approved by Owner.			
5.12.00	Fuel Oil Handling system The civil works are to be provided for following fuel oil handling system areas as mentioned below: a. Fuel Oil pressurizing pump house. b. Foundation and dyke wall and all associated works for LDO tanks. c. Pedestals and foundations to support the interconnecting piping between LDO tanks to the pressurizing pumps as well as piping from tanker unloading area to the Unloading pump house and further on to the LDO tank. d. Tanker unloading platform. e. Fuel Oil Unloading Pump House. f. Oil water separator pit.			
5.12.01	Fuel Oil Pressurising Pump House Salient Features: This building shall be a single storeyed framed superstructure with RCC columns, structural steel roof truss (with rafter and tie level plan bracings), purlins and roof slab. The roof slab shall comprise minimum 40 mm thick (above the crest of metal deck sheet) RCC slab supported on profiled metal deck sheet. Waterproofing on Roof slab shall be done as per architectural specifications. The building shall be completely covered with 230mm thick brick wall with provisions for doors, windows, rolling shutters. The building shall have separate enclosures for the control room and the switchgear room. All rainwater down comers shall be concealed with brick wall. The minimum floor area of this building shall be as per the equipment layout plan of the bidder/ EPC contractor.			
5.12.02	Design Concept: The grade of concrete shall be M 25 for all columns, beams, footing and slabs. The building shall be designed as per IS: 456, IS 800, IS 1893, IS 13920 (for ductility detailing). Fuel Oil Storage Tank Foundations			
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	The Fuel Oil Storage Tank foundations shall be either RCC raft or RCC Ring Beam system with compacted infill. The RCC raft /RCC ring beam shall be supported on virgin soil or pile foundation depending on the load bearing capacity of the soil. The tank bottom base plate shall be supported on flexible compacted fill comprising 75mm thick Bitumen aggregate mix on top and compacted sand/ soil fill below, compacted in layers of 200mm to minimum 85% relative density as per IS:2720. The bitumen-aggregate mix shall consist of compact crushed stone, screenings, fine gravel, clean coarse sand(river sand) mixed in hot asphalt (8 to 10 percent by volume) and rolled or compacted. In the GA & detailing of foundation RCC ring wall/ beam it should be ensured that no bearing stress from tank superstructure is transmitted to the concrete surface. The top of flexible compact fill and top of RCC Circular wall shall be atleast 325mm above the surrounding ground surface for effective drainage. The finished tank grade (Top surface of flexible compact fill) shall be crowned from its outer periphery to its centre at a slope of 1 in 100. The Tank foundations shall be inside a RCC dyke wall enclosure. The entire area outside the tank foundations and within the surrounding RCC dyke walls shall be paved with concrete. The thickness of concrete paving shall be minimum 100mm.The single layer reinforcement in paving slab shall be min 10 Tor@200c/c. The area paving RCC slab shall be supported on 230mm thick Rubble soling with the internal voids filled with coarse sand. The height of the RCC dyke wall shall be evaluated based on the depth of Oil spillage for full oil volume of one storage Tank in addition to a free board of 300mm. Structural steel cross over ladder shall be provided (min 2 numbers) for each RCC wall dyke enclosure. Operating platforms wherever required as per functional requirement shall be provided.			
5.12.03	Tanker unloading platform The road tanker unloading platform shall be heavy duty RCC paving minimum 250 thick RCC slab resting on elevated compacted ground surface. A minimum slope of 1:250 shall be provided (in one direction) for the slab for Oil-Water Surface run-off to the peripheral drain. Expansion joints shall be provided in chess board fashion. RCC ramp shall be provided for approach of truck.			
5.12.04	Fuel Oil Unloading Pump House Fuel Oil Unloading Pump house shall be a covered building with RCC columns and Structural Steel Roof truss (with rafter and tie level plan bracings), purlins and roof slab. The roof slab shall comprise minimum 40 mm thick (above the crest of metal deck sheet) RCC slab supported on profiled metal deck. 250mm thick external brick wall shall be provided with provisions for fire proof door, windows & rolling shutters. The basement RCC slab & RCC wall shall be designed as for uplift and external surcharge load as per the design criteria specified elsewhere. All fuel oil pump foundations shall be designed for both static & dynamic loading. The roof slab shall comprise 40th RCC slab over profiled permanent metal deck sheet (min 0.80mm thick) connected through shear anchor studs specified elsewhere in this specification. In case common fuel oil unloading and pressurizing pump house is envisaged, type of building as mentioned in this clause shall be applicable.			
5.12.05	Oil Water Separator Pit The Oil-Water Separator RCC structure (pit) shall be designed as an underground structure. The sizing of the separator shall be based on the total surface run-off from the Fuel Oil Handling area and Hydraulic design for the oil separation. Surcharge load and ground water table up to ground surface shall be considered in addition to other functional loads for structural design of RCC wall for the separator pit. Drainage trenches with proper bed slopes towards the oil-water separator pit shall be provided around the tank foundation. The entire area outside tank foundation shall have slope towards the drain trenches			
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5.12.06	Foundation for trestles and pedestal foundations, for supporting the pipes, shall be provided wherever required, at appropriate spacing. At pipe bends, necessary thrust resisting arrangement shall be provided. The entire fuel Oil Handling area shall be fenced all round with minimum 1.50m high metal fencing with provision for gates at key locations. Seismic design shall be carried out for the Fuel Oil Storage Tank foundation, Fuel Oil Unloading Pump House & the Oil water separator. Architectural Features of Fuel Oil Handling Buildings Spaces for Pump Rooms, MCC Rooms, Control Rooms etc. shall be provided as per functional requirement. One Toilet block with drinking water facility shall be provided in each building. External finishing shall be of Premium Acrylic Smooth Paint with Silicone additives over suitable primer of water proof cement.			
5.13.00	AREA PAVING RCC paving of minimum 150 mm thick with M25 grade concrete, over an under bed as specified herein shall be provided for areas mentioned below. RCC paving shall be designed as rigid reinforced concrete pavement for the crane/ vehicular/ equipment movement loads which the paving has to bear. The under bed for paving shall consist of preparation and consolidation of sub-grade to the required level, laying of stone soling of 200mm compacted thickness for normal duty paving and 400mm compacted thickness for heavy duty paving with 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil followed by 75 mm thick 1:4:8 PCC (1 part cement, 4 parts sand and 8 parts stone aggregate) with 40 mm nominal size aggregate. For normal duty paving, reinforcement of the RCC paving shall consist of minimum 8mm diameter bars @ 200 mm c / c in both directions at the centre of the slab. For heavy duty paving/ passage, reinforcement of the RCC paving shall consist of minimum 10mm diameter bars @ 200 mm c / c in both directions at the centre of the slab. Paving areas shall be provided with the metallic hardener floor finish as specified elsewhere in the specification. Passages shall be provided inside the main plant block connecting to the outer periphery road to have access to the various facilities/buildings. These passage areas shall be provided with heavy duty paving for movement of heavy vehicles. The top surface of the passages shall be finished with 50 mm thick metallic hardener topping. Heavy duty paving shall also be provided for the areas in the complete Mill bunker building and handling areas for PA/FD/ID fans with 50 mm thick metallic hardener topping. Ground floor area in the boiler shall be provided with normal duty paving and shall be finished with 50 mm thick metallic hardener topping. Ground floor area in the ESP envelope shall be provided with normal duty paving with neat cement punning. Wherever paving is envisaged to be provided, RCC paving shall be provided. However, corridors below trestle where no traffic movement is envisaged and in the area over the buried fire water pipes shall be provided with interlocking concrete blocks of minimum M35 grade and minimum 80 mm thickness underlain by 20mm thick layer of sand followed by 200mm thick 63 mm and down aggregate with interstices filled with selected moorum/ non-expansive soil. All other areas inside the Main plant block shall be provided with normal duty paving without metallic hardener topping. Suitable open RCC drains shall be provided to dispose off storm water drain. Separate open RCC drains shall be provided to dispose off floor wash and plant effluents into RCC sump pits. Separate RCC sump pits shall be provided for different types of effluents. The paving shall be provided with slope of 1:500 to dispose the surface water/wash water to the nearest drain. All drains/pits shall be provided with Heavy duty electro forged GI grating cover.			
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5.13.01	Sewer lines (Cast Iron), interconnected by sewer manholes (RCC) at regular intervals (not exceeding 30 meter centre to centre) shall be provided to dispose off sewage from main plant block. For the purpose of area paving, Main plant block is defined as the entire area enclosed between peripheral roads encompassing the Transformer yard area, Main Plant Building area, Service Building area, Boiler area, ESP area, Chimney area & FGD area. Ground Floor Slab of Buildings In all buildings including main plant building, the ground floor slab shall consist of minimum 150mm thick RCC M25 grade base slab over an under bed as specified below. The under bed for ground floor slab shall consist of 75mm thick 1:4:8 PCC on stone soling of 200mm compacted thick with 63 mm and down aggregate with interstices filled with well graded selected sand/ moorum/ non-expansive soil on compacted and dressed sub - grade. Reinforcement for the slab shall consist of minimum 8mm diameter bars @ 200 mm c/c at top & bottom of the slab in both directions. However, at passages, unloading & maintenance bays, stone soling of minimum 400mm thick and minimum 10mm diameter bars @ 200 mm c/c at top and bottom in both directions shall be provided. Further, top surface of ground floor slabs shall be finished with 50mm thick metallic hardener topping.			
5.13.02	Civil Works for Fire Detection & Protection System in Ground Floor/ Paving Fire water pipes shall be provided with either RCC trench/buried underground/on pedestal. Fire water trenches shall be open RCC type trench with removable RCC cover. RCC valve pit alongside trenches and RCC fire trenches crossing drains shall also be provided as per requirement. Interlocking concrete block paving shall be provided over the buried fire water pipes as specified elsewhere in the specification. At road/ drain crossings, NP3 class hume pipe encased in RCC shall be provided as per requirement at a depth of minimum 1m from FGL for routing of fire water pipes. In case of rail crossings, NP4 class hume pipe encased in RCC shall be used instead of NP3 class hume pipe. Each of the outdoor deluge valve and accessories shall be provided with housing comprising of Brick wall and RCC roof.			
5.14.00	GATE COMPLEX The Gate Complex shall comprise two (2) mild steel vehicle entry gates of minimum 8.0m width and height 3.0m and shall be electrically operated. Minimum one room for security personnel shall be located at each end of the gates. Two (2) separate mild steel pedestrian gates minimum 3.0m high and 3.0m wide shall be provided at each end. Gate Complex shall include Central Industrial Security Force (CISF) building. The CISF Building shall be a two (2) storied RCC super structure with office complex in ground floor & first floor. The building shall be constructed with 250mm thick brick wall with provisions for doors, windows & ventilators. The first floor shall also have a viewing gallery. The floor area and architectural details shall be as per the Arch spec. mentioned hereafter in this Specification. Design Concept: The CISF building shall be designed as moment resisting sway frame in both orthogonal directions and shall be designed as per IS: 456, IS: 1893 and IS: 13920 (for seismic ductility requirement) and as per design criteria mentioned hereafter in this specification.			
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	Architectural Features The CISF Building shall be 2-storied building. It shall be of RCC Frame structure & brick masonry. The floor area of this building shall be minimum 700 sq m. Gate Complex Building shall be designed based on Tender drawing incorporating local architectural features. The Gate Complex shall have sufficient no: of guards rooms to regulate movement of men and material and overall security, using latest modern technology like turnstile type/ boom type access control with magnetic cards and close circuit TV sets, computerized time and security office, etc shall be made. For any other gate provided for entry or exit, provision for a suitable small security hut/shed shall be made. Space provision for CISF personal staff, time office including time machine, reception, lounge, Arms store, Detention Room, Conference room, Toilets and pantry shall be provided as per functional requirement including toilets for Ladies, Gents, physically handicapped. The provision for covered parking shall be made for 20 nos. Cars (23 sq.m./car including driveway) and 20 nos. Scooters (5 sq.m./Scooter). In addition to above, provision for space for open parking for 5 trucks, &20 cycles shall be made.			
5.15.00	WATCH TOWERS Watch Towers shall be RCC construction with all-weather enclosure at 6M height. Watch Towers shall be provided at 600 m interval along the Boundary as well as at corner turning points of the plant boundary. Watch Towers shall be provided with caged MS ladders.			
5.16.00	SAFETY PARK BUILDING Safety park shall be one storey building and as per the tender drawing.			
5.17.00	NATURAL DRAUGHT COOLING TOWER (NDCT) The civil works for cooling towers are related mainly to following areas, but not limited to: The design and construction of reinforced concrete double curvature hyperbolic shell, raker columns, ring beams, foundations including piling work (if applicable, vertical/ raker piles), cold water basin with partition walls, hot water ducts, drain sumps, external drain chamber with associated pipe work, cold water discharge channels for each cooling towers (as specified elsewhere) along with trash rack & stop-log gate and its lifting arrangement, hoists and monorails, primary and secondary hot water distribution troughs, fill support systems including columns & beams, testing of cold water basin for water tightness, external stairs, ladders, platforms, walkways as specified or required for operation and maintenance, access doors, Two (2) numbers Pultruded FRP staircase for approach to hot water distribution level of each cooling tower. RCC Paved walkway of minimum 10 m clear width all around the periphery of each cooling tower, Doors and suitable permanent walkways for access into distribution system, drift eliminator and fill packs shall be provided for each cooling tower, Pultruded FRP handrails, steel fittings/fixtures/inserts including fabrication, galvanizing and erection of associated steel work, providing protective measures in concrete and steel materials against effects of chemicals on the completed structure etc. all complete as per specifications, drawings and directions of Engineer. Wind tunnel model test for Natural Draught Cooling Tower shall be carried out by the bidder as per technical specifications. Any other works not mentioned herein, but sufficiently implied and are necessary for completion and proper functioning of the cooling tower.			
5.17.01	GENERAL DESIGN CRITERIA			
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5.17.01.01	Loading The following loads shall be considered for the design of cooling towers a) Dead Loads b) Wind loads c) Earthquake forces d) Loads due to temperature and shrinkage effects. Temperature effects due to solar radiation shall also be considered. e) Construction load. f) Foundation settlement etc. g) Any other load likely to come on cooling tower. A. Dead Load All other dead loads shall be assessed in accordance with relevant codal provision. Dead load shall include the self weight of structure, weight of fill material, weight due to algae growth & salt deposit , weight due to plugging/chocking of fills, weight of falling water, weight of hot water pipe, weight of water in hot water channel and distribution system including the self weight of channel and distribution system, weight of drift eliminators, etc. Secondary stresses, if any, due to permanent fixtures on the shell shall also be considered. B. Wind Pressure The wind pressure on the towers shall be assessed on theoretical basis as well as with the help of Model tests in a wind tunnel of turbulent boundary layer. All the theoretical methods outlined hereunder for estimating wind loads on cooling tower shell shall be valid only if the towers spaced at clear distance of greater than 0.5 times the base diameter at the finished graded ground level. The theoretical method outlined herein forms the basis only for assessing lowest limit of wind forces and shell structure interaction. For conducting Model tests, bidders should survey the whole terrain and make their own assessment of likely critical wind forces & wind-structure interaction. It is pertinent to note that at the project the general topography of the area is uneven with adjacent existing/proposed plant structures of comparable height, and other natural topographical features are present in the vicinity of the plant area. Such model tests shall also include all adjacent topographical features, buildings and other structures which are likely to influence the wind load pattern on the tower significantly including all tall structures/NDCTs/chimneys of earlier stages of project (If applicable). The model test shall be carried out in a well reputed institute/testing laboratory after obtaining prior approval from the owner. The testing agency selected by the bidder shall have requisite experience and should have successfully carried out tests in the past for atleast one cooling tower of similar capacity. The model tests shall be duly witnessed and approved by the Engineer. The model test results shall be made available before final approval of the design. The complete cooling tower shall be designed for all possible wind directions and on the basis of worst load conditions as obtained from Model test and theoretical methods. Under the theoretical method, the circumferential net-wind-pressure distribution and wind pressure coefficient (p1) for the tower shell (without Meridional ribs) shall be obtained from the "Criteria for Structural design of Reinforced concrete Natural Draft Cooling Towers" IS: 11504. The above circumferential net wind pressure coefficient (p1) shall be increased by multiplying it by 1.43 to account for turbulence in the incident wind and load intensification due to turbulence induced by the adjacent cooling tower or the other structures of significant dimensions. Therefore, the actual design circumferential net wind pressure coefficient (p) shall			
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be computed as $p=1.43$ multiplied to (p_1) , where (p_1) is the wind pressure coefficient as per IS: 11504.

This design net pressure coefficient (p) and the distribution along the circumference of tower shall be used at all heights of the tower. The above design net pressure coefficient (p) includes the effect of internal suction.

In order to compute the quasi-static design wind pressure at a given height along the circumference of the tower, the design net pressure coefficient (p) shall be multiplied by the wind pressure acting at that height $[P(z)]$. For details, reference shall be made to "Criteria for Wind Resistant Design of Structures and Equipments" placed under Annexure-II of this sub-section.

The wind pressure at a given height $[P(z)]$ shall be computed as per the stipulations of IS:875 (PART 3). The bidder shall also compute the wind pressure (p_z) along the wind direction by Gust Factor (GF) or Gust effective factor method (GEF). Method for estimating the wind load on the tower and other elements, shall be based on IS-875 (part-3). While calculating the gust factor, the term 'b' shall be taken as the diameter of the throat in Fig. 10 of IS:875 (Part-3).

Dynamic effects on the tower due to wind action shall also be investigated to ascertain the wind induced oscillation such as ovaling and excitation along and across the wind direction. Bidder shall carry out detailed analysis for the tower and consider the worst combination of static and dynamic effects.

Design of the tower shall satisfy quasi-static method & GEF method. In case the bidder proposes to adopt aerodynamic rough surface such as provision of meridional ribs in the cooling tower shell, the pressure coefficients as given in the VGB-BTR KUHLTURME GERMAN SPECIFICATIONS (latest) (structural design of cooling towers) shall be permitted. The provisions of BTR may be adopted for choosing the value of circumferential wind pressure coefficient (p_1) only. The wind pressure coefficient (p_1) , as obtained from BTR after accounting for internal suction, shall be multiplied by a factor 1.43 to arrive at the net design pressure coefficient (p) . The bidder shall furnish authorized English Translation of VGB-BTR KUHLTURME GERMAN SPECIFICATIONS (latest) for the review of the owner. All other stipulations as specified in these specifications shall be met with.

Entire analysis and designs adopted shall be fully supported with authenticated literatures/documents along with relevant references where the same has been successfully implemented.

The wind load as specified in clause 5.17.01.01 above shall be the minimum loading to be considered for analysis and design. The bidder shall also carry out the entire analysis & design on the basis of BS 4485 (latest) for smooth shell surface or BTR (latest) in case of ribbed shell surface. The design of entire tower including foundation shall be checked as per BS 4485/BTR as the case may be.

The final design shall be based on the worst case situation i.e. each element including foundation of the tower shall be designed on the basis of highest loading/ stresses computed as per above. However, the basis of wind speed shall be as per clause given Cl. 5.17.01.01 above. The loading/stresses obtained by model studies shall govern in case they show high values than the theoretical design values obtained as above.

C. Earthquake Forces

Earthquake forces shall be as per the site specific seismic study result enclosed as Annexure-I of this sub-section. The seismic analysis shall be carried out in accordance with IS: 1893 by modal analysis for the hyperbolic cooling towers or any other method as approved by the owner. The earthquake analysis of the shell and its support columns including the foundations shall be carried out by response spectrum method. For the fill supporting structures (RCC frames) response spectrum method is permitted. The modulus of elasticity for concrete shall be obtained from IS:456. All the analysis shall be carried out as per the theory of elasticity.

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5.17.01.01.01	Entire analysis and designs adopted shall be fully supported with authenticated literatures/documents along with relevant references where the same has been successfully implemented. D. Loads due to temperature effects Stresses due to temperature effects: The cooling tower shell shall be designed for stress due to axi-symmetric temperature distribution corresponding to external ambient temperature variation from 3 °C to 50 °C. However, the detailed analysis of actual thermal gradient by considering temperatures inside the tower and external ambient temperatures shall be carried out furnishing detailed references and justification for the same. The shell shall also be checked for thermal stresses arising due to partial operation of the tower in case the operational philosophy so demands. The analysis for the stresses resulting from non-axisymmetric temperature loading shall be carried out. In such non-symmetric temperature loading, the calculation shall be based upon the operating specification. Besides, the shell shall be designed for one sided solar radiation effect also. Nevertheless an effective temperature difference of at least 25°C across the shell thickness constant over the height and following a sine functions along half the circumference shall be considered. Entire analysis and designs adopted shall be fully supported with authenticated literatures/documents along with relevant references where the same has been successfully implemented E. Constructional Loadings The method of construction and the type of formwork to be used shall be decided by the bidder in advance and should be enclosed in the bids submitted. Construction loadings that may occur during execution of work shall be considered in the design of the cooling tower structure. Factors causing temporary loading may include the following depending upon the method of construction. a) Barrowing of concrete b) Scaffolding and formwork c) Loads produced by anchoring devices of climbing scaffolds. d) Hoist fixings e) Storage of materials on scaffolding f) Temporary access f) Tower Crane fixings h) Works temporarily omitted for access purposes. Computations shall be provided to verify the stability of the shell at various levels of construction to ensure that a satisfactory margin of safety always exists during shell construction. F. Any other load such as foundation settlement All loads likely to act on cooling tower but not specified herein shall also be considered for the design of cooling tower structures. In case different degrees of subsoil stiffness exist, effect of the same shall be taken into account. In such a case, for computing settlements, load distributing capacity of the shell may be considered. Differential settlement between adjacent sections of foundation shall be considered under most unfavorable load combination.			
	Load Combinations			
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	Following minimum load combinations shall be considered for the design of cooling towers structures A) DL + WL + SL B) DL + SeL C) DL + TL D) DL + WL + TL + SL E) DL + SeL+ TL + SL F) 1.0 DL + 1.5 WL Where DL = Dead Load, WL = Wind load, SL = Settlement Load. SeL = Seismic Load, TL = Thermal Load, In addition to above, construction loads shall be duly accounted for. Under TL various types of thermal loads, as described above, shall be considered separately. Besides above load combination, other load combinations as per relevant IS codes shall also be followed.			
5.17.01.02	Tower Design Consideration			
5.17.01.02.01	General (a) The complete cooling tower, including the shell, columns, ring beam and foundation, shall be structurally analyzed using a proven finite element modeling technique or an approved alternative method including validation of software used for analysis. For elastic analysis, concrete may be assumed to be uncracked, homogenous and isotropic. The design geometric profile, thickness variation and support conditions of shell shall be considered in the structural analysis. (b) Regardless of analysis method adopted, the equilibrium checks of internal forces and external loads should be performed. (c) Analysis based on a recognized bending theory of the elastic shells shall be adopted for the design of the tower and supporting structures. (d) Geometric imperfections, if exceed the permissible limit, then the analysis of shell shall take into account of such imperfections and resubmitted for owner's approval. (e) Boundary conditions shall be realistic and based on actual configuration. (f) The magnitude of the calculated displacements should be within limits of the applied theory. (g) A detailed dynamic analysis shall be carried out for the complete tower for seismic forces by response spectrum method. (h) Cooling tower shall also be designed for cross wind oscillations (Wind induced vibration) if the fundamental natural frequency of the tower is less than or equal to 1 Hz. Frequency calculation for free vibration analysis shall also be furnished by bidder during detailed engineering.			
5.17.01.02.02	Size and Shape The base diameter, air intake opening height, tower height and throat diameter shall be determined by thermal design consideration by the bidder and submitted to Owner for approval.			
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5.17.01.02.03	As the range of possible hyperbolic shell shapes is infinite, the same shall generally conform to the following major proportions which have been extensively adopted in cooling tower constructions.		
	H/D=1.2 to 1.55		
	Where H is the total tower height above basin sill level		
	Hb/H = 0.75 to 0.85		
	Hb is the vertical distance from the throat to basin sill level and 'D' is the base diameter at basin sill level. However, other proven profiles may be permitted subject to approval from the owner. Bidders shall submit along with the offer complete details of the profile, in case the profile is not within the limits stated above, and the names of the sites where such shell profiles have been successfully constructed. Notwithstanding what is stated above, the owner reserves the right to accept /reject the shell profile.		
	Tower Shell Boundary conditions		
	A. Shell Analysis and Design		
	The following boundary conditions shall be assumed for the design of cooling tower shell:		
	a) At upper Edge		
	The top edge of the shell shall be gradually thickened to form a ring beam to guard against possible instability of the top of the shell due to high velocity wind gusts. Top edge shall be considered as a free edge in the analysis.		
The thickness transition from shell to upper ring beam shall be smooth.			
b) At Lower Edge			
The lower edge of the shell shall be thickened to form a lower ring beam. The thickness transition from shell to lower ring beam shall be smooth and shall be considered as an integral part of the shell. The lower boundary of the shell shall be considered as elastically supported by discrete columns.			
The influence of both support structure flexibility and foundation settlement shall be considered in the analysis and design of cooling tower shell. The shell analysis should include following information at every 10° plan angle and at not more than 0.05 of the shell height interval:			
a) Meridional and circumferential direct stress resultants and the tangential shear stress resultants.			
b) Meridional and circumferential bending moments.			
c) Displacements normal to the shell mid-surface.			
B. Buckling of Tower shells			
Critical dynamic pressure (wind pressure), at buckling shall be as given below:			
$P_{cr} = \frac{0.07 E_c (d)^{7/3}}{r_{th}}$			
P_{cr} = Critical dynamic pressure.			
E_c = Elasticity Modulus of concrete of the shell (short term modulus)			
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	d = Thickness of the shell r_{th} = Throat radius of the shell The shell buckling shall be checked using the design dynamic wind pressure and other relevant loads acting on the tower. The factor of safety against buckling shall be not less than 5 for the completed tower as well as whilst under construction. Besides above, a buckling analysis with wind forces should be made using the theoretical tower geometry and boundary conditions, including the influence of dead weight, by the method of buckling stress state (BSS) approach in accordance with the provisions of VGB. The buckling safety factor shall be at least 5.0 for load combinations of dead load + wind load. When imperfections in the shell geometry are larger than specified tolerances, the analysis should be rechecked to account for such imperfections and ensure that the desired buckling capacity remains. C. Openings in shells: Opening through the shells should be avoided as far as possible. They should be of smallest required dimensions and shall be shaped such that stress concentration is minimized at the boundary of the opening. Should thickening of the edges be necessary, it shall be smoothly tempered back to the shell thickness. Openings shall be provided with additional edge reinforcement of a minimum cross sectional area at each edge equal to 75% of the reinforcement intercepted by the openings in the direction parallel to the edges. In addition, diagonal reinforcement shall be provided at each corner as close as possible. The total cross-sectional area in cm^2 of this reinforcement shall be 0.5 d, at each corner where 'd' is the shell thickness in cm. No horizontal thrust due to the inlet piping shall be transmitted to the shell. D. Minimum Thickness of Shell (for smooth shell towers without Meridional ribs): The minimum thickness of the NDCT shell shall not be less than 350 mm. E. Minimum Reinforcement in Shell, Spacing and Placement: The Minimum reinforcement to be provided shall be as follows: Top one third portion of shell 0.4% of concrete cross - sectional area along circumferential direction and 0.35 % of concrete cross sectional area along meridional direction. Remaining two-third portion 0.35% of concrete cross-sectional are in both of shell meridional and circumferential directions. Minimum bar diameter shall be 8 mm in transverse direction and 10 mm in meridional direction. Spacing of reinforcing bars should not exceed 200 mm in circumferential direction and 250 mm in meridional direction. The two layers of reinforcing meshes shall be adequately joined by s-hook over the total shell surface. Atleast two S-hooks in each square metre area of shell surface shall be provided. The hooks shall be of minimum 6 mm diameter bars. The clear concrete cover to all reinforcement including links shall be 45 mm minimum which shall be ensured by suitable means and frequent quality checks. No leftovers in form of wooden pieces, plastics or any other foreign objects shall be left in concrete. All leftovers holes of scaffoldings/ shuttering or other wise shall be suitably plugged with rich cement-sand pressure grout (minimum one grade higher than concrete) and coated with epoxy paint on either surface. No binding wires wooden pieces, shuttering pieces, cement bags should be left in the concrete.		
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	The relevant provisions of IS:2210 - "Criteria for the design of reinforced concrete shell structures and folded plates" and IS:2204 "Code of practice for construction of reinforced concrete shell roof shall also be deemed to be applicable. All other design criteria for the cooling tower shell which are not specified above shall be in accordance with BS:4485 Part 4 and BTR. F. Provision of meridional ribs in Cooling Tower Shell Meridional ribs in the cooling tower shell may be provided subject to the following conditions : a) Minimum thickness of shell excluding ribs shall not be less than 350 mm. b) Co-efficients for pressure distribution around the cooling tower circumference including suction may be taken as per VGB-BTR KUCHLTURMEN GERMAN SPECIFICATIONS (latest) : All other factors including load intensification factors shall be as specified else where in these specifications. c) Shell buckling and strength shall be checked as per clause-b above without considering the effect of ribs. d) All other stipulations as specified in these specification shall be met with. e) Bidder shall furnish an authorized English translation of the VGB-BTR KUHLTURME GERMAN SPECIFICATIONS (Latest).			
5.17.01.02.04	Raker Columns Inclination of the column shall closely match the meridional slope at the shell so that the load transfer to foundation takes place through predominantly axial force in columns. Raker columns shall be designed for the most critical forces transferred to an individual raker column from super-structure considering various load combination as under Cl. 5.17.01.01.01 For selecting effective length of the raker columns, following restraints shall be considered: a) In case columns restrained at both the ends, the effective length shall be 0.8 and 0.6 times the length of the column radially and tangentially respectively. b) In case columns are restrained at one end only, the effective length of columns shall be 0.9 and 0.7 time the length of columns radially and tangentially respectively. c) The columns shall be designed based on working stress method except for the forces from DL+1.5 WL which shall be designed as per limit state of strength method of IS:456.			
5.17.01.02.05	Pre-stressed Concrete Members Design, construction and workmanship of Pre-stressed concrete, members shall be in accordance with IS:1343. Steel wire for pre-stressing shall conform to IS:1785 (Part I) or IS:6003. Particular attention shall be paid to achieve an effective bond of the wires in pre-tensioned concrete units. For this purpose, indented wire shall be used. Wires shall be corrosion resistant for specified duty conditions.			
5.17.01.02.06	(I) Design Criteria for Structures (Other than Tower Shell foundation) Corresponding to load combination (A) to (E) of Cl. 5.17.01.01.01 above, a) The design of all liquid retaining/conveying structures of cooling tower like C.W. basin, sump, outlet channel, sludge drain, pits and pedestals for raker column shall be designed by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2) : 2009. These structures shall be designed for following conditions :- 1. Water filled inside upto the designed level and no earth outside.			
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2. Earth pressure plus 2.5 T / M² surcharge (Vertical and equivalent horizontal direction) plus ground water table at Finished Graded ground Level (FGL) outside and no water inside.
 3. Hot water distribution channel/basin shall be designed by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2), considering loads such as dead load, live loads, seismic/wind load, temperature loads, water load etc. for full and empty condition.
 4. The pedestals for raker columns shall also be designed for the load transferred by raker columns in addition to the above conditions.
- (b) The design of all structures other than liquid retaining/conveying structures of cooling tower above Cold Water basin slab such as Raker Columns, Shell structure, fill/drift eliminator support columns, beams, walkways, slabs, partition wall, precast beams etc. shall be carried out by limit state method as outlined in Clause 4.4 of IS: 3370 (Part 2). Further, for limiting the crack width, the stress for the reinforcement steel shall be limited to 130 MPa (on all faces) as per clause 4.4.3.1 of IS: 3370 (Part 2): 2009 using the partial safety factor for serviceability condition as per clause 4.4.1.3.
- (c) Wherever, the foundation raft of fill/drift eliminator support structure of cooling tower is same as Cold Water basin slab, the foundation shall be designed by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2) (all faces). However, if the fill/drift eliminator support structure foundation is not the same as the Cold Water basin slab and a separate foundation for the cooling tower is provided below the Cold Water basin slab due to founding level requirements, the Cold Water basin slab (both faces, including beams at Cold Water basin slab level) shall be designed as structural slab by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2) and the structures below Cold Water basin slab shall be designed as per IS:456. However, the size of the fill/drift eliminator support column below Cold Water basin slab upto foundation shall be maintained same as the size of the columns just above Cold Water basin slab. Under the action of horizontal forces transferred at foundation/ pile levels, the passive earth pressure generated from soil surrounding the piles/ foundation shall not be accounted for in arriving the numbers of piles for the tower shell.
- (d) The design of staircase, pipe trestle foundation, and peripheral water drain shall be designed as per IS: 456 (2000).
- (e) For uplift due to ground water table the Cold Water basin shall be checked against uplift for basin empty condition with ground water table at FGL. Stability against uplift shall be ensured both for construction & operating stage with no water inside. The provision of flap valve / pressure release valves is not permitted. The factor of safety against uplift shall be as per IS: 3370.
- (f) Loads during construction, erection and maintenance stage shall also be considered.
- (g) Temperature fluctuations from operation shall be obtained from the design data. Hot water temperature inside and cold air temperature outside shall be considered.
- (h) Minimum thickness of basin slab shall be 300 mm with minimum reinforcement 0.35 % of gross sectional area in both the directions. Reinforcement shall be placed in two layers, top and bottom surface.

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5.17.01.02.07	(i) In the space underneath the basin floor slab a layer of at least 100 mm thick P.C.C. of grade M10 shall be provided. (j) Permissible stress for steel structures shall be as per IS:800 based on working stress. For Load combination (F) 1.0 DL + 1.5 WL of Cl. 3.08.00 above, design of elements shall be carried out by limit state method as outlined in Clause 4.4 of IS: 3370 (Part 2). (II) Design Criteria for Tower Shell foundation. (a) The design of the tower shell foundation below the pedestals for raker column shall be designed for worst load combination as per clause 3.08.00 of this specification by IS:456. In case of load combination (F) DL + 1.5WL of clause 3.08.00, limit state method of design as per IS 456 shall be adopted. (b) Foundation shall be checked for safety against overturning, sliding and uplift for all load combinations specified at clause 3.08.00. While checking stability of the structure, favorably acting loads from water fill, soil cover beyond the edge of the foundation shall be neglected. High ground water level upto final graded ground level shall be considered to take into account buoyancy effect. (c) Generally net tension should be avoided in the foundations/piles for the shell support foundation unless specifically permitted by the Owner. (d) While accounting for over burden of the soil for checking the foundation against up-lift, dead weight of the soil directly above the pile cap or ring raft, as the case may be, shall only be considered, neglecting the weight of soil in the cone of up-lift above the foundation. Under the action of horizontal forces transferred at foundation/ pile levels, the passive earth pressure generated from soil surrounding the piles/ foundation shall not be accounted for in arriving the numbers of piles for the tower shell. (e) The foundation structure will be subjected to following loading and extreme load combination case shall be considered in design: 1) Most critical forces transferred from superstructure for the various load combinations. 3) Loading due to foundation settlement 4) Concentrated local loading from column nodes. 5) Thermally induced local loading where hot water ducts pass through the foundation structure without structural isolation. 6) Surcharge of 2.5 tonnes/sq. m. C.W. basin surcharge load shall also be considered in addition to the other relevant loads for the design. In the design of the cooling tower shell, column, pile caps, pedestals, ring beams etc. no increase in the strength with the age of the concrete shall be permitted. Water Distribution System The structural design of the water distribution system shall consider the worst combination of following loadings: i) Self weight, other imposed loads and live load. ii) Hydraulic pressures during normal operations including pressure surges. iii) Hydraulic pressure due to mal-operation of the tower or supply pumps. The water distribution system shall be provided with adequate pressure surge relief facilities to prevent pressure loading in excess of values used in the design. If such facilities are not provided, a further increase in loading shall be considered in the design.		
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	The design of water distribution system and its supports shall be capable of accommodating all thermal stresses and movements due to changes in inlet water temperature and ambient temperature. The possibility of vibrations being imposed on the distribution system shall be investigated in the design. Seismic loading on the water distribution system shall also be taken into account. Strength check for worst loading including malfunctioning shall be carried out with stress limitations as per IS:3370. The construction shall be completely water tight without the used of fillets, sealing compounds etc. The method of construction shall be such so as to avoid excessive rise in temperature of concrete due to release of heat of hydration.			
5.17.01.02.08	Platforms, Walkways, Stairways, Staircases, Internal Grillage Etc. A minimum live load of 400 kg/sq.m shall be considered for the design of all platforms, Walkways, Staircases, etc. in addition to their own weight. Platforms shall be minimum 1.2 M wide and walkways shall have 1.5 M wide.			
5.17.01.02.09	Steel Structures These structures shall be designed, fabricated and erected as per IS:800 and other relevant Indian Standard codes for structural steel work. All steel structures shall be coated with anti-corrosive system.			
5.17.01.02.10	STOPLOG GATES AND TRASH RACK FOR COOLING TOWER Stoplog gates The stoplog gate shall cover the clear opening of the cold water channel and effectively stop the water leakage. Clear size of the stoplog gates shall be equal to the clear opening size (freeboard of minimum 300mm over the maximum water level in stop log depth shall be ensured.). The capacity of the hoist (Min 2 ton capacity) shall be decided to match with provided size units of the stoplog gate. Structural design of stoplog gate shall conform to IS : 5620 and IS : 4622 (latest). Maximum water level for designing the stoplog gates shall be taken as maximum water level in the CT basin indicated in the tender drawing. Stoplog gate and its lifting arrangement shall designed for a condition when basin is empty and water upto full level on the other side. Proper rubbers seal shall be provided in the stoplog to avoid any leakage of water. All gates shall be painted with sealed spray zinc coating conforming to BS:5493 (Table – 3, Part-8) for very long (20 or more) years of maintenance interval. The design criteria and material specification for Stoplog gates and Trash racks shall be as specified for Circulating Water Pump House. Leakage Tests of Stoplog Gates Leakage tests shall be carried out with the stoplog gates lowered onto the sill. Before observation for leakage, the stoplog gate shall be raised and lowered about one meter several times in order to dislodge any debris that might have lodged in the side and bottom seals, The leakage shall then be measured and it should not be more than 5 Liters / Minute / Meter length of seal under maximum head.			
5.17.01.02.11	Deleted			
5.17.01.02.12	FILL SUPPORT STRUCTURES The self weight of the fill pack support structure shall be based on the weight of the packing including weight of standing, running and dripping water in accordance with manufacturer's data.			
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5.17.02.00	Live load of 400 kg/sq.m on the walkways and platforms shall be considered. Hand railings shall be designed for horizontal load of 60 kg/m. Wind deflector walls and any other structural elements shall be designed for a horizontal wind load of 80 kg/sqm. or as per manufacturer's recommendations, whichever is higher. Thermal loading shall be as per manufacturer's recommendations. Earth quake loading shall be considered based on criteria given for cooling tower. Response spectrum analysis shall be carried out. The foundation shall be designed for the most critical forces transferred from CW basin & fill supporting structure including loadings introduced by constructional equipments and crane deployed for fill supporting structure or shell erection. REQUIREMENTS FOR CONSTRUCTION MATERIAL All concrete work for the cooling tower shall comply with the requirements given in technical specification for Cement Concrete (Plain & reinforced) Structural concrete shall be of design mix complying with the relevant provisions of IS Codes or any International Code of Practice as approved by the owner. Durability of the concrete shall conform to severe exposure category as per table 19 of IS:456 except noted specifically otherwise. Minimum cement content of all RCC structures shall be 360 kg/Cu. M. Column reinforcing bars shall be carefully anchored in the shell and foundation. The anchoring length shall not be less than 80 times the diameter of the bars. All foundations structures shall be provided on all sides with a minimum reinforcement of 0.12 % of gross cross-sectional area distributed over top and bottom faces.																																		
5.17.02.01	The minimum grade of concrete for structural components of cooling towers shall be as follows in accordance with IS:456 :- <table border="0"> <tr> <td>a)</td><td>Precast pre-stressed elements</td><td>-</td><td>M-35 grade</td></tr> <tr> <td>b)</td><td>Entire tower shell, columns and basin</td><td>-</td><td>M-30 grade</td></tr> <tr> <td>c)</td><td>PCC encasement</td><td>-</td><td>M-20 grade</td></tr> <tr> <td></td><td>(Except levelling course)</td><td></td><td></td></tr> <tr> <td>d)</td><td>Mud Mat PCC</td><td>-</td><td>M-10 grade</td></tr> <tr> <td>e)</td><td>Piles/Tower foundation</td><td>-</td><td>M-25 grade</td></tr> <tr> <td></td><td>(with OPC/PPC/PFC)</td><td></td><td></td></tr> <tr> <td>f)</td><td>All other RCC elements</td><td>-</td><td>M-30 grade</td></tr> </table>			a)	Precast pre-stressed elements	-	M-35 grade	b)	Entire tower shell, columns and basin	-	M-30 grade	c)	PCC encasement	-	M-20 grade		(Except levelling course)			d)	Mud Mat PCC	-	M-10 grade	e)	Piles/Tower foundation	-	M-25 grade		(with OPC/PPC/PFC)			f)	All other RCC elements	-	M-30 grade
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5.17.02.02	Coarse and fine aggregates shall be specially selected to ensure that they are not susceptible to alkali/chloride attack or prone to disintegration at high temperatures. The maximum size of coarse aggregate shall not be larger than 1/8th narrowest dimension between reinforcement bars nor more than 20 mm.																																		
5.17.02.03	Washing and screening of coarse and fine aggregates to remove fines, dirt or other deleterious materials shall be carried out by approved means if desired by the Engineer-in-Charge.																																		
5.17.02.04	The water cement ratio by weight shall be as given in IS:456 for severe exposure conditions including free moisture in the aggregates, and slump should be suitably decided to provide good quality concrete work.																																		
5.17.03.00	REQUIREMENTS FOR STAGING AND FORMS																																		
5.17.03.01	Automatic Climiform scaffolding system or Jumpforms shall be used for tower shell construction. Slipform with proven record for similar towers may be used subject to specific																																		
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	approval of Owner. The design and detailed construction of the form work and the scaffolding system shall be based on the relevant IS code/International Code. In absence of the same, DIN 4420/ACT 347 shall be followed. Realistic loads shall be considered for platforms with regard to the classification of scaffolding system used. For material transport, it shall be designed by accounting for all transportation loads. The connection between individual scaffolding units shall be made in such a way that in case of collapse of one unit, the adjoining units are not affected. Scaffolding system should have atleast two independent safety measures against collapse. Concrete shall have sufficient strength to withstand the anchoring loads of scaffolding system. The concrete strength shall be continuously checked and documented during the climbing process of the scaffolding.			
5.17.03.02	Bidder shall prepare at his own cost, detailed scheme, design calculations. detailed working drawings showing all details of form work, staging, scaffolding, member section, connection details and other arrangements for the concreting work and submit the same for approval within one (1) month from the award. Only on receipt of the approval by the Engineer the work shall be taken up. However approval of the same by Engineer in no way relieves the Bidder of his responsibility for the proper functioning and safe working of the scaffolding system.			
5.17.03.03	Hoisting for Personnel The arrangement and method of raising and lowering of personnel, concrete, reinforcement and other materials to various levels for the cooling tower shell shall also be detailed by contractor. Details of equipment and procedure shall be submitted for information to the Engineer by the Bidder.			
5.17.03.05.01	For shuttering, following provisions shall be complied with: a) Self weight of (scaffold + platforms) + minimum superimposed load of 370 kg/m² on total working platform areas at various levels. b) Self weight of (scaffold + platforms) + minimum superimposed load of 50% of 370 kg/m² on total working platform area at various levels + earthquake loads. c) Self weight of (scaffold + platforms) + superimposed load of 370 kg/m² on total working platform areas at various levels + wind load. For load combination (a) above, no increase in the permissible stresses shall be allowed. For load combinations (b) and (c) above increase of 33.3% in permissible stresses shall be permitted.			
5.17.03.05.02	Design and execution of form work, stagings, shutterings and scaffolding shall conform to National Safety Council and all relevant IS Code provisions, i.e. IS 2750, IS:4014, IS:4923, IS:800 etc. In case the IS Codes do not cover the specific type of shuttering system, then any International Code of Practice, as approved by the Engineer, may be followed.			
5.17.03.05.03	Notwithstanding the stipulations contained in various codes, safe slenderness ratio shall be determined as follows: a) Vertical members: Effective length shall be taken equal to the maximum distance between consecutive horizontal runners in any plane. b) Horizontal and diagonal member: Effective length shall be taken equal to centre to centre distance between two nodes			
5.17.03.05.04	If the support from shell for scaffolds are to be taken, following provisions shall be adhered to:			
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	a) Members connecting/joining scaffolds with shell shall act as propping supports. Use of pre-tensioned or pre-compressed members for propping action shall not be permitted under any circumstances. Connection of propping members with shell shall be designed complying with the above stated requirements. b) All prop supports shall be taken at nodal points of scaffolds only.		
5.17.03.05.05	Splicing joints in vertical pipes shall be such that the joints shall be rigid and the entire cross section area of the pipe takes part in load transference.		
5.17.03.05.06	Special inspection hoist shall be provided by the Contractor for regular inspection. The hoist should be so placed that the inspection, checking of scaffolding members, joints etc. are easily carried out. Regular check at every fortnight of the joints and other elements of scaffolds shall be carried out by the Contractor along with representatives of the Engineer. Detailed inspection record shall be maintained by the Contractor and same shall be produced to the Engineer wherever required.		
5.17.03.05.07	For design of structural members, IS:800 shall be complied with.		
5.17.03.05.08	Notwithstanding the approval from Engineer, the Contractor and his collaborator will be solely responsible for the safety, security, functioning proper functioning and the speed of the construction work.		
5.17.03.05.09	The formwork for shell shall be capable of adjusting to shell profile and thickness accurately, and shall be rigidly braced to prevent deflection or movement during concreting.		
5.17.03.05.10	Forms shall be designed to produce hardened concrete having the shape, lines and dimensions indicated on the drawings. Forms shall be constructed and maintained in proper position and accurate alignment. Accurate alignment shall include maintaining hyperbolic shape, round cross section, and plumbness of concrete shell.		
5.17.03.05.11	Forms shall maintain vertical alignment of form seam marks. Forms for the exterior of the shell shall produce surfaces having a smooth uniform appearance.		
5.17.03.05.12	Forms shall be specially designed and installed so as to prevent leakage of mortar, produce a smooth exterior surface, and permit removal without injury to the adjoining work.		
5.17.03.05.13	The insides of the forms shall be coated with an approved non-staining parting agent that will not impair the blend coatings. The Contractor shall ensure that the parting agent is not applied to the reinforcement.		
5.17.03.05.14	Forms shall not be removed until the concrete has adequately hardened and attained sufficient strength to maintain its shape with no spalling and to support safely its own weight together with any construction loads likely to be imposed.		
5.17.03.05.15	All details of formwork staging, placing, tying etc.; shall be subject to the approval of the Engineer and the Contractor shall submit drawings, when required, showing details of procedure of construction. Contractor shall be responsible for the adequacy of the form work to withstand the pressure of freshly placed concrete or other loads imposed without, movement or deflection of the parts.		
5.17.03.05.16	For concrete surfaces that are exposed to view and for all other concrete surfaces that are to be finished smooth, the lining of forms shall be of smooth non-absorbent lining material. All edges of panels shall be square and straight in both directions and all panels shall match perfectly in length, width and alignment as required.		
5.17.03.05.17	Minimum time of form work shall be approved by the Engineer for RCC shell depending upon weather conditions, quality of cement, etc.		
5.17.03.05.18	Outer ends of the permanently embedded portions of form ties shall be at least 25 mm recessed from the adjacent outer concrete faces.		
5.17.03.05.19	All MS embedments in concrete shall have anti-corrosive treatment as per Tech. Spec.		
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5.17.03.05.20	All temporary construction facilities such as office, warehouse tool room storage shed, casting yard etc. required by the Contractor shall be constructed by the contractor within the area allocated by Engineer at no extra cost to the Owner.			
5.17.04.00	Setting out of the shell Survey of absolute position of the shell shall be carried out using the following method: The shell shutters of known radius shall be accurately located through the peg at the base of the tower using a special optical plumb. The optical plumb shall be installed permanently inside of the tower by the bidder. The plumbing of the ring shall be checked at least once per day and shall not be left in the same position for more than four consecutive lifts. The tape used shall be fitted with a spring balance and constant pull of not less than 10 kg shall be applied while reading the tape. No taping shall be undertaken during high wind conditions.			
5.17.04.01	Deployment of vertical laser-ray equipment for measuring the dimensions and controlling the shape of the tower at all elevations and plan angles shall be carried out. Measurements shall be taken by vertical laser-ray technique at different points along the circumference of the tower (number of such points shall be approved by the Engineer depending upon the formwork system used) for each lift before placing the concrete and again after concreting. Wherever required adjustments shall be made through spindling of the formwork. The intermediate points between two laser measuring points shall be chord measured i.e. the gauges are measured off a chord taut string. The measurements shall be taken of the inner form work. The outer formwork shall be aligned accordingly. All measuring points on the shell and the chord gauges shall be predetermined by the contractor and got approved by the Engineer. Depending on the number of laser measuring points, a corresponding number of radial lines on the concrete floor shall be provided and reference points shall be marked for the purpose of placing the laser device. The perpendicular shall be checked once in a week or earlier, as required by the Engineer, from outside points.			
5.17.04.02	Tolerances for the cooling tower construction shall be in accordance with the following: i) Shell wall center line in horizontal plane measured radially at mid point on a 3m wide chord : +/- 15 mm ii) Shell wall centre line in meridional plane measured over a height of 1m : +/- 10 mm iii) Shell thickness : + 10 mm or- 5 mm iv) Horizontal radius of shell at any section other than shell base : +/- 50 mm v) Horizontal radius at shell base : +/- 40 mm Checking of shell geometry Check for absolute positions may be carried out from ground stations arranged at not more than 10 degree plan angle apart. Readings of horizontal radius shall be taken at every 6 m height or weekly during construction period whichever is more frequent. If the permissible dimensional tolerance are exceeded, the Engineer will instruct the contractor, in writing, to stop construction of the shell. The Contractor shall then examine the situation and submit a report to the Engineer who may require the contractor to demonstrate by calculations that the structural integrity of the shell will not be impaired as a result of the imperfections. The calculations shall be submitted to the Engineer, for approval, before construction will be permitted to proceed.			
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	If in the opinion, of the engineer the calculations show that the integrity of the shell could be threatened, the Contractor will be required to submit to the Engineer detailed arrangement and supporting calculations to set right the shell geometry for approval, before construction will be permitted to Proceed. The cost of carrying out the calculation, any remedial work required and idle time or any delays to the construction programme as a result of dimensional tolerances being exceeded will be borne by the contractor. Adjustment to the tower shell line on the basis of the survey results shall be made gradually, limiting the maximum change of direction from the existing vertical shell profile to be not more than an angular change of 10 mm measured over 1 m of height. Any such adjustment shall be made with full knowledge and consent of the Engineer.		
5.17.04.03	The Contractor shall carry out an as-built-survey of each lift of the shell. The results of these checks will be recorded on a suitably developed drawing of the shell from which it will be possible to locate the survey check point. A copy of these results will be presented to the Engineer prior to commencing the next shell pour.		
5.17.04.04	The Contractor's shell construction procedures shall include for providing the Engineer with the facilities and a reasonable time period as may be required to carry out an independent check of the completed works.		
5.17.04.05	Suitable communication system such as telephone, wireless equipments, etc. shall be provided by the contractor so that the communications are possible at different elevations of the tower from the ground during construction.		
5.17.05.00	GENERAL REQUIREMENTS		
5.17.05.01	i) In case the basin slab is divided, the same shall be divided into two equal parts by a partition wall designed to withstand full hydrostatic pressure, with one side empty. The basin construction joints shall be made watertight by injection of chemical grout through nipples. The basin construction shall be tested for water tightness, in accordance with IS:3370 (Part-1) (Latest edition). The cost of the test and any rectification and re-test if required is deemed to be included in the Contractor's quoted price. Any cost of filling and emptying of the basin and to rectify defects shall also be borne by the Contractor. (ii) PVC ribbed water stops with central bulb shall be used where expansion joints are envisaged. The minimum thickness of PVC ribbed water stops with central bulb will be 10 mm and minimum width 230 mm. (iii) The basin floor of each compartment shall be provided with a slope of not less than 1 in 120 towards a peripheral drain of minimum width 500mm and minimum depth of 500mm at the starting point running along the periphery of the cold water basin. Further, this drain shall be sloped 1 in 500 towards collecting sump as indicated elsewhere in the specification. From sump, the water will be drained by C.I. drain pipe, embedded below the basin floor, into a drain chamber outside the tower basin or as per the arrangements described elsewhere in the tender document. Suitable operating platform with access ladders for operating the gate valve(s) shall be provided in the drain chamber. (iv) A 250 mm high sill shall separate the pond floor from the tower outlet. (v) Uniform surface on the top of basin floor shall be provided. In case undulated surface is observed, a top of layer of minimum 25 mm thick 1:3 mix mortar to be provided to achieve uniform surface. (vi) The level of top of basin wall shall be kept at least 300 mm higher than the top surface of paving outside the cooling tower.		
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5.17.05.02	A screed or concrete layer not less than 100 mm thick of concrete grade M10 conforming to IS:456 shall be provided below the cold water basin and other liquid retaining structures. Lean concrete below other foundations and underground structures, unless noted otherwise, shall be of concrete grade M10 (with aggregate of nominal size 40 mm maximum) and shall be at least 75 mm thick.			
5.17.05.03	This specification envisage following anti-corrosive measures for various concrete structures and elements of the cooling tower: All inside concrete surfaces of CW basin floor/slab, walls and interior surfaces of hot water distribution ducts/basin including inside surfaces of CW channel and sludge pit shall receive High Performance Moisture Compatible Corrosion Resistant Coating System. The detailed specification of High Performance Moisture Compatible Corrosion Resistant Coating System on concrete surfaces is given in Annexure-M.			
5.17.05.04	Exterior surfaces of cooling tower shell and all surfaces of raker columns shall be given three coats of waterproof cement paint of approved make and colour. No painting is envisaged for internal surfaces of cooling tower shell and internal grillage columns and beams.			
5.17.05.05	Water proofing and plasticizer admixtures conforming to relevant IS Codes may be added as per manufacturer's instruction to the concrete subject to approval of the Owner.			
5.17.05.06	All mild steel parts of structures including embedments shall be hot dip galvanized. The minimum coating shall be 610 gm/sq.m and shall comply with relevant IS Codes. Galvanizing shall be checked and tested in accordance with IS:2629. All welding shall be done before galvanizing. Any site joints required to be carried out after galvanizing shall be either flanged or screwed joints. Nails, nuts, bolts and all components coming in direct contact with water shall be of stainless steel of AISI 304 or equivalent.			
5.17.05.07	(i) The tower shall be provided with two numbers external FRP Staircase, leading to a heavy duty door giving access to the distribution system. Staircase shall be minimum 1000 mm wide (clear), with landings of minimum width of 1000 mm at not more than 2500 mm height intervals unless approved otherwise. The steps shall have a rise of about 175 mm and tread of about 250 mm. Anti - skid nosing at each step shall be provided. (ii) Minimum size of all doors shall be 2100 mm high (clear) and 1200 mm wide (clear). The door shall be of FRP material. The door shall be air tight when closed. (iii) The hand railing on both sides of the staircase shall be FRP and shall have rails spaced not more than 1200mm centers. The top hand rail shall be at 1000 mm above the steps. Safety kerbs/toe plate with 100 mm (minimum) width shall be provided along each edge. (v) In case the hot water pipes of cooling tower are extended upto inner surface of shell, they shall be supported over the RCC brackets which are cast integral with the shell. Alternatively, these brackets and its fixing bolting arrangement shall be of stainless steel SS316L grade to ensure trouble free operation.			
5.17.05.08	Walkways and platforms, atleast two in each orthogonal direction, shall be provided inside the tower at distribution pipe level. walkways shall be at least 1000mm wide with 50 mm (minimum) safety kerbs along each edge. These walkways and platforms shall provide safe and clear access to all sprayers and all distribution pipes. A FRP platform of 1500 mm clear width shall be provided around the tower periphery which will be a means of access to next walkways and all end valves. Access ways shall be clear of all obstructions such as distribution pipe support beams, drift eliminator support beams, etc. The walkways shall be provided with transverse slots or other opening which will permit the free passage of air and water. FRP handrails shall be provided on all sides of over ground platforms and around hot water basin and cold water outlet.			
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5.17.05.09	Platforms of size 1.5m x 1.5m clear dimensions shall be provided on the cooling tower for maintenance of aviation warning lights at levels specified elsewhere. At least two (2) diametrically opposite galvanized MS caged ladders, 600 mm wide, made out of 6 mm x 10 mm flats for full height of the tower shall be provided. Additional cage ladders for access to aviation obstruction lights at intermediate levels shall be provided at required locations upto the required height. Galvanization shall be provided for all MS components of ladder & caging as per specifications. All fastening bolts and anchor fasteners shall also be of galvanized finish. The ladder shall have 20 mm dia rungs at 300 mm centers, with stays at every 2250 mm, connected to the concrete shell and galvanized M.S. caging consisting of 50 mm x 70 mm vertical cage flats on the exterior surface of each cooling tower. The caged ladder shall be provided with intermediate landing of 1000 x 1200 mm wide at every 4500 mm height interval and further, the ladder shall be staggered at each such landing by a horizontal distance of 600 mm to avoid continuous climb. Some of the landing levels shall be suitably adjusted to give access to aviation warning beacons for maintenance. Handrails as described above, shall be provided on all platforms and landings. The ladder leading to the top platform shall have approach form the ground via the FRP staircase.			
5.17.05.10	Steel gratings, where required, shall be fabricated out of steel flats with minimum thickness of 6 mm. Thickness of fabricated grating shall be 32 mm with flats so arranged as to have a maximum opening of 25 mm or less. Treads for staircases, where needed, shall be of similar grating construction but provided with toe flats of 6 mm thick, and non-skid nosing in an approved manner extending upto 100 mm above the walkway surface.			
5.17.05.11	The finished ground level shall be paved for 10.0 Meter width all-round the outer edge of the cold water basin. The paving shall consist of 150 thick RCC slab of M-25 grade. The minimum reinforcement shall be 10 mm dia spaced 150 mm centre to centre both ways top and bottom. The RCC slab shall be laid over 75 mm thick PCC and 500mm well compacted layer of crushed hard stone aggregates (63mm to 45mm) with interstices filled with sand. A RCC peripheral drain on outer periphery of paving around cooling tower basin shall be provided to collect the water loss due to wind gust and shall be connected to nearest main plant drain.			
5.17.05.12	Mild Steel Hot Dip Galvanized (610gm/sq-m) fixtures shall be erected on top ring beam of shell to facilitate future maintenance of interior and exterior of shell. The details and minimum requirements are stipulated in tender drawings. The entire assembly shall be checked for a minimum vertical load of 1500kg. The minimum thickness of plates for fixtures shall be 16mm.			
5.18.00	CW SYSTEM, RAW WATER SYSTEM AND MAKE-UP WATER SYSTEM CIVIL WORKS			
5.18.01	Circulating Water Pump House (CWPH), Raw Water Pump House (RWPH) and Make-up water Pump House (MUWPH)			
5.18.01.01	A circulating water pump house (CWPH) for housing circulating water pumps and Raw water pump house (RWPH) for housing raw water pumps shall be provided. Separate bays shall be provided for each pump by providing intermediate dividing piers of RCC between the pumps. a) The pump houses shall be provided with minimum two sets of stop-logs for each opening sizes along with electrically operated hoisting arrangements. Steel embedments required for stop-logs shall be provided for all the bays. b) All bays of pump houses shall be provided with a removable trash rack including electrically operated hoisting arrangements and cleaning arrangements. Moreover, one spare trash rack for each opening sizes shall also be supplied. Steel embedments required for trash-racks shall be provided for all the bays. c) Stop-logs, trash-racks and hoists shall be supplied in accordance with the specifications covered elsewhere.			
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	d) The steel structure shall be provided to carry EOT crane of the CW and Raw Water pump houses. The over ground portion of Raw Water Pump House including maintenance bay shall be framed structure of structural steel work with permanently colour coated metal sheeting at roof and side open. However 4m high steel sheet side cladding shall be provided at the top under the roof for protection against rain. At the ground level, brick cladding of 0.9m height above the finished floor level, plastered on both sides shall be provided for all pump houses. e) The pump house including its forebay shall be of RCC with M-30 grade of concrete conforming to IS 456. The CWPB pump house shall be structurally separated from forebay by providing an expansion joint. The pump house shall be provided with separate maintenance bay f) For raw Water Pump House (RWPH), connection shall be provided to meet the flow requirement with all necessary arrangement & precautions. Further, associated structure for & including supply of valves/gates are also to be provided for isolation of the connection.			
5.18.01.02	The Make-up water pump house (MUWPH) shall be of reinforced cement concrete (RCC). The MUWPH shall be consisting of pump house with steel super structure, forebay, channel including maintenance bay. The MUWPH shall house three (3) number of Make-up water pumps (2 working + 1 standby) each of capacity 3000 cum/hr for stage-III. Separate bays shall be provided for each pump by providing intermediate dividing piers of RCC between the pumps. a) All bays of MUWPH shall be provided with a removable trash rack including electrically operated hoisting arrangements and cleaning arrangements. Moreover, one spare trash rack shall also be supplied for MUWPH. Steel embedment required for trash-racks shall be provided for all the bays. b) Stop-logs, trash-racks and hoists shall be supplied in accordance with the specifications covered elsewhere. The sub-structure of the pump house including its forebay and channel shall be of RCC with M-30 grade of concrete conforming to IS 456. The pump house shall be structurally separated from forebay by providing an expansion joint. Each pump house shall be provided with a separate maintenance bay for maintenance of various equipment. Length of maintenance bay shall be adequate for one pump maintenance or minimum dimension indicated in the tender drawing, whichever is higher. Hand-rail with 32 NB (medium) pipes shall be provided around the operating floor on the forebay side in the stoplog and trash rack area.			
5.18.01.03	Sump model study for CWPB Sump model study for circulating water pump house shall be carried out as specified elsewhere in the specification.			
5.18.01.04	Design requirement for CWPB, RWPH and MUWPH Design of substructure shall be divided into two parts, namely, a) Stability analysis, and b) Structural analysis and design. For the design of substructure, a surcharge load of 2.0 T / Sq.m shall be assumed at the finished ground level for nearby vehicular movement. (a) Stability Analysis The Pump House sub structure shall be analyzed and designed for following load combinations: -			
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	1. Under Operation Stages Maximum load from super structure + equipment load + load from sub structure + no water in the pump chambers + earth pressure at rest from outside with surcharge and maximum ground water pressure. 2. Condition (1) + earthquake/ wind 3. Under Construction Stages No load from super structure and deck slab, load from sub structure with no water in the pump chambers, pump units not installed, earth pressure at rest from sides with surcharge and maximum ground water pressure. 4. Condition (3) + earthquake Following stability checks will be made for the above load combinations: i) Check for overturning Factor of safety against overturning, i.e, the ratio of stabilizing moment to overturning moment shall be as per IS: 456. For the above condition, uplift due to maximum Ground water table (GWT) acting on the base slab and side pressures on the walls due to earth and ground water shall be considered as destabilizing forces. In order to have no tension condition at tip of the base slab, resultant of all the forces acting on the pump house under different conditions of loading as listed above shall fall within middle one third of the base width provided. Maximum compressive stress at other end of the base slab shall be within the safe bearing capacity of soil / rock. Under earthquake condition, resultant of all the forces including earthquake force shall fall within middle three fourth of the base width provided. An increase of 25% shall be allowed in the safe bearing capacity of soil when earthquake forces are considered. ii) Check for Sliding Factor of safety against sliding under static condition, i.e. ratio of horizontal frictional resistance to horizontal sliding force shall be as per IS:456. For this condition, earth pressure at rest and the maximum GWT pressure from sides shall be taken as destabilizing forces. Keys shall be provided, if found necessary, to increase the factor of safety against sliding. To ensure an adequate factor of safety under earthquake condition, the factor of safety against sliding shall not be less than 1.2. iii) Check for Uplift Right from construction to operating stage, minimum factor of safety against uplift due to ground water shall be 1.2. Installation of pressure release valves shall not be permitted in the base slab (raft) of the pump houses to counter the uplift due to ground water. (b) Structural Analysis 1) Base Slab Base slab of the pump houses shall be designed as a raft foundation supported at locations of piers. Following load cases shall be considered: - Maximum water level in the sumps with maximum GWT. - No water in the sumps and maximum GWT. - Alternate bays of sumps filled with water with maximum GWT.		
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iv. Same as in (iii) above but with minimum water level.

2) Intermediate Piers

Intermediate piers shall be designed by working stress method as per IS: 456 (latest), with limiting crack width of 0.2mm for the worst combination of maximum water pressure on one side and no water in the adjacent sump. These shall be designed as RC walls fixed at base and supported (hinged) at top by the deck slab. Since a breast wall may be provided for stop logs and back wall is provided connecting all the piers at the rear end, additional restraints for the pier due to breast walls and back wall may also be accounted for.

Intermediate piers are also to be checked for the combined action of direct load due to superstructure and bending due to water pressure from one side.

3) End Piers

Design of end piers will be similar to the intermediate piers. The end piers shall be designed for the following conditions:

- I. Soil pressure + maximum GWT + surcharge of 2 Ton / Sq.m. at FGL from outside or design surcharge load at floor level with no water in the sumps.
- II. Only maximum water level in the sump.

End piers shall be designed by working stress method as per IS: 456 (latest), with limited crack width of 0.2mm on water face and the outside, i.e., earth side shall be designed as cracked section as per IS : 456. Since end piers are fixed at base and supported (hinged) at top by deck slab, there will be negligible yielding of the wall at top. This will give rise to earth pressure at rest and therefore an earth pressure at rest, $K_0 = (1 - \sin \phi)$ is considered where ϕ =angle of internal friction of soil.

End piers shall also be checked for the combined action of direct load due to super structure and bending due to earth pressure with surcharge and ground water pressure.

4) Back Wall

Back walls shall be designed as fixed at bottom of the base slab and on two vertical sides by the piers and supported at top by the deck slab. Since back walls are also of the unyielding type, earth pressure at rest, K_0 , shall be considered for design.

Back walls shall be designed by working stress method as per IS: 456, with crack width limited to 0.2 mm on water face and as cracked section on outer face as cracked section as per IS : 456.

Following load combinations shall be considered:

- i. Soil pressure + maximum GWT + surcharge of 2 T / sq.m. at FGL from outside with no water inside the sump.
- ii. Only maximum water level inside the sump.

5) Operating Floor Slab

Operating floor slab or deck slab shall be designed for loads of the pumps and other equipment, which may be placed on it. A live load of 1.5 ton / Sq.m. shall be considered on the deck slab. The deck / slab shall have monolithic construction with the piers and shall be designed as a continuous RC slab supported on piers. Design of bottom face shall be by working stress method as per IS: 456, with crack width limited to be 0.2 mm. Floor slab of maintenance bay may be designed as slabs on grade. A live load of 3 T / Sq. m. may be considered for the maintenance bay floor slab. Dynamic analysis

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5.18.01.05	shall be carried out to ensure proper separation of natural frequency of the structure and pump operating frequency C.W. Ducts CW ducts shall be concrete encased steel lined ducts. The concrete encasement shall be of minimum 500mm thick with square shape outside. Generally, M20 grade PCC encasement shall be provided. At locations of duct crossing road, rail in transformer yard or any other facility, RCC encasement of grade M25 shall be provided. Minimum two layers of reinforcement (On both faces) of 12 mm diameter bars @ 200 mm c/c shall be provided for RCC encasement of CW Duct. Top of CW duct encasement shall be minimum 1.5 m below finished ground level. The minimum thickness of steel pipes shall be as follows including corrosion tolerance of 2 mm: <table><tr><td>a.</td><td>For pipes above 1800 mm upto and including 2300 mm dia.</td><td>-</td><td>12 mm</td></tr><tr><td>b.</td><td>For pipes above 2300 mm upto and including 3200 mm dia.</td><td>-</td><td>14 mm</td></tr><tr><td>c.</td><td>For pipes above 3200 mm upto and including 3750 mm dia.</td><td>-</td><td>16 mm</td></tr><tr><td>d.</td><td>For pipes above 3750 mm upto and including 4000 mm dia.</td><td>-</td><td>20 mm</td></tr></table> However, for ducts running below rail line in transformer yard/road, minimum thickness of CW liner shall be 20 mm. Suitable tap-offs shall be provided in the duct to connect CW blow down, ACW tapping etc. Based on the transient analysis, sufficient number of stub connection shall be provided in the duct to fix air release valves. All duct installation & jointing shall be strictly in accordance with the stipulation given elsewhere in the specification for structural steel work. All the joints of liners shall be butt welded joints. The circular deformation of liner shall be less than 1% of diameter of liner while handling, transportation, erection & construction. If required, temporary bracings may be provided, during handling, transportation & concreting to reduce the deformation. The completed duct shall be tested for water tightness, for the pressure equal to twice the working pressure or 1.5 times the design pressure whichever is higher and shall be generally water tight to Engineer's satisfaction. The testing pressure shall be held for minimum period of 30 minutes without any signs of leakage or failure of weld. Any in flow / leakage of water from the duct shall be sealed / repaired at Contractor's cost. However, tests in part of length of duct may be permitted with prior approval only. Wherever required anchor / thrust blocks shall be provided with RCC M25 grade concrete. Suitable RCC chambers shall be provided with precast covers to install flow measurement devices and valves in the duct. Manholes of minimum 1000mm clear opening shall be provided in each CW duct at a spacing of 200M (approx.) to facilitate maintenance / dewatering of CW ducts. At least one manhole shall be provided at the deepest point for both intake & discharge duct. Following shall be considered for design of C.W. ducts: <table><tr><td>a.</td><td>Maximum design water pressure</td></tr><tr><td>b.</td><td>Surge or water hammer pressure of 5.0 Kg / Sq.cm.</td></tr></table>			a.	For pipes above 1800 mm upto and including 2300 mm dia.	-	12 mm	b.	For pipes above 2300 mm upto and including 3200 mm dia.	-	14 mm	c.	For pipes above 3200 mm upto and including 3750 mm dia.	-	16 mm	d.	For pipes above 3750 mm upto and including 4000 mm dia.	-	20 mm	a.	Maximum design water pressure	b.	Surge or water hammer pressure of 5.0 Kg / Sq.cm.
a.	For pipes above 1800 mm upto and including 2300 mm dia.	-	12 mm																				
b.	For pipes above 2300 mm upto and including 3200 mm dia.	-	14 mm																				
c.	For pipes above 3200 mm upto and including 3750 mm dia.	-	16 mm																				
d.	For pipes above 3750 mm upto and including 4000 mm dia.	-	20 mm																				
a.	Maximum design water pressure																						
b.	Surge or water hammer pressure of 5.0 Kg / Sq.cm.																						
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5.18.01.06	c. Expected vacuum conditions as arrived from transient analysis d. Soil overburden e. Surcharge Pressure of 2T/Sq.m f. The effect of concrete encasement shall not be considered in the design of CW duct Painting as per Cl. 6.04.03 shall be carried out on machined faces, flanges and external exposed surfaces of CW ducts. For external surfaces of CW ducts encased in concrete, painting shall be as specified in Cl. 6.04.02(a).			
	CW Channel The channel shall be of RCC section with vertical wall projecting minimum 300mm above finished ground level. Hand rails with 32 NB (medium) pipe shall be provided on both walls of the channel where height of channel wall is less than 1200 mm above finished ground level. The channel shall be designed to carry the required discharge with minimum water level in cooling tower basin and considering minimum value of rugosity coefficient (n) of 0.018 for concrete surface. However, the maximum velocity in CW channel shall be restricted to 1.8m/sec. The channel shall be designed by working stress method with crack width limited to 0.2 mm on water face and as cracked section on outer face as per IS: 456 considering (i) no water inside the channel, with earth pressure of soil upto FGL, ground water table upto FGL and surcharge load of 2.0 ton / Sq.m from outside, and (ii) with water inside the channel upto maximum level in the forebay / channel and no earth pressure, ground water pressure and surcharge load from outside. Right from construction to operating stage, minimum factor of safety against uplift due to ground water shall be 1.2. The channel shall be checked against uplift due to 50% of the total water head considering ground water table upto FGL. In addition pressure relief valves with under drainage arrangement in the channel shall be provided to prevent uplift of the channel as per relevant IS Codes. Minimum wall thickness shall be 250 mm.			
	Forebay Structure Forebay consists of retaining wall and forebay slab. The walls shall be analysed as a retaining wall for stability against overturning and sliding, similar to end piers of the pump house. Pressure relief valves and under drainage arrangements shall be provided below the forebay slab to prevent uplift of the forebay slab. Size and spacing of pressure relief valves shall be designed by the Bidder to take care of the uplift due to ground water table. However, centre to centre spacing of PRV shall not exceed 5000mm. The forebay slab shall be designed against uplift due to 50% of the total water head considering ground water table upto FGL. The forebay slab shall be minimum 250 mm thick. The forebay slab shall be structurally separated from the retaining walls and water stops shall be provided at the junction of slab and retaining wall. Minimum thickness of retaining wall at top shall be 250 mm. Hand rails with 32NB (medium) pipe shall be provided on both walls of the forebay.			
	MUWPH Inlet Channel The channel shall be designed by working stress method with crack width limited to 0.2 mm on water face and as cracked section on outer face as per IS: 456 considering (i) no water inside the channel, with earth pressure of soil up to FGL, ground water table up to FGL and surcharge load of 2.0 ton / sq.m from outside, and (ii) with water inside the channel up to maximum level in the forebay / channel and no earth pressure, ground water pressure and surcharge load from outside. The channel shall be checked against uplift due to 50% of the total water head considering ground water table upto FGL. In addition pressure relief valves with under drainage arrangement in the channel shall be provided to prevent uplift of the channel as per relevant IS Codes. Minimum wall thickness shall be 250 mm.			
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5.18.01.07	Deleted.		
5.18.01.08	Stop-logs and Trash Racks for CWPB, RWPB and MUWPB		
5.18.01.08.01	Stop-log gates Clear size of the stop logs shall be equal to the clear opening size of water inlet opening below breast wall. Number of segments of the stop log shall be decided to match the capacity of the electrically operated monorail hoist provided to handle it. Structural design of stop log shall conform to IS: 5620 and IS: 4622. Maximum water level for designing the stop logs shall be taken as maximum water level of the forebay. Top and bottom unit of stop log gates shall be designed for their respective water head, whereas the remaining interchangeable units shall be designed for the water head corresponding to the lower most interchangeable unit. The stop logs shall be operated under balanced water head and they are not to be designed for operating under flowing water. Filling valves shall be provided in the stop logs to balance the water pressure before lifting the stop log. These stop logs are used only during maintenance / inspection of pumps. The stop logs shall be operated by means of an electrically operated hoist. Suitable lifting beam shall be provided to operate the stop logs.		
5.18.01.08.02	Trash Racks Bar screen trash rack is to be provided at inlet of the sump of the pump house in order to prevent ingress of timber & other floating particles which could damage the Pumps. Each bay of pump sump shall be provided with Type - 1 trash rack (removable section rack), conforming to IS: 11388. Centre to centre spacing of trash rack bars shall be 100mm (max). The trash racks shall be provided with number of interchangeable segments, to facilitate easier handling by means of a lifting beam and electrically operated hoist. Trash rack bars shall be designed for a differential water head of 2.0m. and other structural members shall be designed for a differential water head of 1.0m. Minimum thickness of trash rack bars shall be 10mm. Suitable size of horizontal members and end members shall be provided as per design requirements, for efficient operation of trash rack. All trash racks should be capable of being lowered in the associated stop log groove to enable drawal of clean water while a particular trash rack is raised for cleaning purpose. Suitable arrangement for storing all the stop logs and stand by trash rack shall be provided by the Bidder, to keep them in good working condition.		
5.18.01.08.03	Lifting Beams Separate lifting beams (automatic) shall be designed & fabricated with guide shoes, hooks, links and counter weights etc. complete for automatic operation to engage and disengage the stop logs and trash racks in the required position.		
5.18.01.08.04	Leakage Tests of Stop logs Leakage tests shall be carried out with the stop logs lowered onto the sill. Before observation for leakage, the stop log shall be raised and lowered about one meter several times in order to dislodge any debris that might have lodged in the side and bottom seals, The leakage shall then be measured and it should not be more than 5 litres / minute / meter of length of seal under maximum head.		
5.18.01.08.05	Material Specifications of Stop logs & Trash racks All material used in the fabrication of stop log or trash rack shall be of high grade, free from defects and imperfections and shall be of the highest standard commercial quality suitable for the intended use. Radiographic examination or magnetic particle testing or other comparable tests shall be carried out for determining the soundness of steel castings and shall be conducted by the Bidder, if asked for by the Employer.		
5.18.01.08.06	Materials for the various components of Stop logs		
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5.18.01.08.07	Sl. No.	Component Parts	Recommended materials	Reference
	1.	Stop log Leaf	Structural steel	IS 2062
	2.	Stop log Frames, 1 st stage embedded parts and structural steel members	Structural steel	IS 2062
	3.	2nd stage embedment	Stainless steel	SS316L or IS:1570 (part-5)
	4.	Wheels (the hardness of wheel track surface shall be kept 50 points higher than that of wheel tread)	Cast steel	IS : 1030
	5.	Wheel axles, wheel track	Corrosion resistant steel.	IS 1570
	6.	Seals	Rubber	IS 11855
	7.	Bearings	SKF or equivalent	04Cr19Ni
	8.	Seal seats	Stainless steel	SS316L or IS 1570 (part-5)
	9.	Lifting pin	Stainless steel	SS316L or IS 1570 (part-5)
	10.	Guide	Corrosion resistant steel	IS 6603
	11.	Guide shoe	Structural steel	IS 2062
5.18.01.08.07	Materials for various components of Trash Rack:			
5.18.01.08.08	Sl. No.	Component Parts	Recommended	Reference Materials
	1.	Trash rack and 1st stage embedded parts	Structural steel	IS 2062
	2.	2nd stage embedment	Stainless steel	SS 316L or IS 1570 (Part-5)
	3.	Slide Block	Structural steel with bronze padding	IS 2062 & IS 305
	4.	Track base	Stainless steel	SS 316L or IS 1570 (Part-5)
	5.	Track	Stainless steel	SS 316L or IS 1570 (Part-5)
	6.	Guides	Corrosion resistant steel.	IS 6603
5.18.01.08.08	Painting Specification for Structural Steel parts for Stoplog Gates and Trash Racks			
	(i) All structural steel surfaces shall be cleaned by shot blasting.			
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5.18.01.09	(ii) All MS structural parts shall be galvanised to minimum coating of Sealed Zinc spray (250 Micron) as per BS 5493. (iii) Over zinc coating one coat of zinc Phosphate Epoxy primer having minimum 30 micron DFT and three coats of coal tar Epoxy paint having minimum 75 micron DFT / coat shall be provided. Total DFT of epoxy paint including primer shall be minimum 250 microns. CONSTRUCTION REQUIREMENT AND ACCESS TO WORK AREAS Contractor shall notify to the Engineer before start of work well in advance about the method of construction for crossing road, pipeline, cable, railway, canals, utility lines and other existing obstacles. Contractor shall not commence work on such crossings before having obtained approval from the authorities and land owners concerned to the satisfaction of the Engineer. The work at crossings shall meet at all times requirements and conditions of the permit issued by the authorities concerned. In the absence of any specific requirements by authorities, Bidder shall comply with Engineers' instructions. Where the work areas come within the area of influence of high voltage electrical installations, contractor shall propose and provide adequate safety measures for all personnel working. He shall obtain necessary permission/permit from the concern authority. No work is allowed in such areas without Engineer's prior approval.		
5.18.01.10	Switch Gear / Control Room/ Remote IO room for CWPB, RWPB and MUWPB It shall be single storied building, framed RCC structure with beams, columns, floor and roof. It shall have non-load bearing brick wall cladding. It shall house the switch gear and MCC of respective Pump house & associated cable trenches. The architectural features shall be as specified elsewhere in the specification. Bio Toilet shall be opted for make up water facility area outside the plant boundary. Specifications of same shall be as mentioned elsewhere in technical specifications.		
5.18.02.00	MUWPB Piping Works		
5.18.02.01	This section of the specification covers the technical requirements of design, preparation of general arrangement drawing and working drawings, supply of materials and construction of all civil and structural work associated with water piping works.		
5.18.02.01.01	The work to be performed under this specification consists of providing all labour, materials, plant, equipments, temporary works, constructional plant, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the proper completion of the work, all in strict accordance with the specifications and including revisions and amendments thereto as may be required during the execution of the work.		
5.18.02.01.02	Land for pipe corridor The contractor is required to perform his construction activity within the width of acquired land set aside for erection of pipeline or within the Right-of-way area as decided by the Owner. The pipe line shall be buried either in the embankment or shall be buried in the natural ground or to be supported over pedestals or to be supported over steel structure/ bridge.		
5.18.02.02	Scope of Work		
5.18.02.02.01	The scope of civil, structural works shall include design, preparation of drawings and getting the same approved from the Owner and construction of all civil/structural works associated with the laying of complete water pipe lines to various system and facilities. The nature of work shall		
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	generally include clearing, grading, stripping/marking, excavation, backfilling, disposal, dewatering, road & drain cutting, rectification of damaged structure due to excavation, laying of RCC Hume pipe or culvert under road, railway track, canal / drains etc. as the case may be. Crossings may be made by open cut excavation. However, steel-cased boring, if permitted, shall be made below existing canals, rail crossing and for highway over bridge wherever required. Bidder shall restore original ground profile and include all concreting reinforcement, formwork, erection of miscellaneous steel (i.e. steel inserts, bolts etc.) if required, to erect the pipe, all crossings and bends, pockets and all other incidental items though not mentioned specifically but required to complete the work including the requirement of right of way and access thereto, restoration of work areas etc.			
5.18.02.02.02	The tender drawing provides a general idea about the work to be performed under the scope of this contract. These are preliminary drawings for bidding purposes only and are by no means the final drawing or show the full range of the work under the scope. Work has to be executed according to the drawings prepared by the Bidder and approved by Engineer.			
5.18.02.02.03	The work under this specification shall consist of but not limited to items mentioned below: Clearing and grading of work area including requirement of work areas and access there to and stacking of reference markers. Trenching for Laying of pipe. Top of pipe shall be minimum 1.5 M below Finished Ground level (FGL) / Natural Ground Level (NGL) as the case may be. Backfilling shall be done with the excavated material. Supplying and installation of permanent pipeline concrete markers at every 0.5 km and at change of direction including grouting of marker.			
5.18.02.02.04	Clean up and restoration of work areas/embankment. Bidder shall restore the embankment & road work, and all sites used for construction of pipelines, water crossings and other structures in accordance with Engineer's instruction and deliver them to the satisfaction of Owner.			
5.18.02.02.05	Rail & Road Crossings (a) Route the water pipe through casing pipe of adequate strength to cater to overburden & other traffic loads including live loads. Ends of the casing pies shall be sealed with coal tar enamel soaked fiber glass as per relevant IS Codes. (b) Route water pipe through NP-3/ NP-4 hume pipe culvert of internal diameter greater than 300mm of external diameter of water pipe by open-cut excavation and seal both ends of pipe with provision of vent pipes at cart road/ drain, local water body crossings and restore/ rectify cut roads, drain, Nalla, etc. End of hume pipes shall be sealed with coal tar enamel soaked fibre glass coating as per relevant IS Codes.			
5.18.02.03	Ground Water Table For design of pipe line & for design of all structures, the water table shall be considered at finished ground level or actual water Table level, whichever is higher.			
5.18.02.04	Foundation System Buried Pipe			
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5.18.02.05	Pipes shall be laid on firm soil. The backfilling shall be done by excavated soil. Entire backfilling shall be compacted to 90% of standard proctor density or more. Minimum soil cover on the top of buried pipe shall be 1.5 M unless specified otherwise. Thrust Blocks/ Anchor blocks Thrust Block/ Anchor block shall be provided at location of all change in direction, if required. The grade of concrete block shall be minimum M25. The concreting shall meet the requirements given elsewhere in the technical specification. The minimum depth of foundation shall be 1.5M below NGL. Loading Thrust Block/ Anchor Block The thrust block shall be designed for hydraulic thrust in pipe as applicable. Pit and Pipes The pit and pipes shall be designed for earth pressure with a surcharge of 2.0 T/m². The earth pressure shall be estimated based on relevant provisions of IS Codes. Entire length of buried pipe line shall be checked against buoyancy & provided with suitable saddles, counter weights to overcome buoyancy effect, if applicable. For all other load and load combination IS:875 (Part I to V) shall be followed.		
5.18.02.06	Design Criteria And Drawings The pipe shall be designed based on appropriate IS Codes. In case of non-availability of IS Codes, relevant International codes & manufacturers recommendations shall be followed subject to Owner's approval. Whenever floating of the pipeline is to be reckoned with, anti-buoyancy measures shall be provided by Bidder using one or a combination of the following methods as specified. a) extra weight by applying a continuous concrete encasement around the pipe; b) extra weight by installing saddle weights; The above provisions shall be in accordance with the relevant specifications and/or job standards/drawings.		
5.18.02.06	Construction Requirement And Access To Work Areas. Contractor shall notify to the Engineer well in advance during work progress, the method of construction for crossing road, pipeline, cable, railway, river, canals and other existing obstacles. Contractor shall not commence work on such crossings before having obtained approval from the authorities and land owners concerned to the satisfaction of the Engineer. The work at crossings shall meet at all times requirements and conditions of the permit issued by the authorities concerned. In the absence of any specific requirements by authorities. Bidder shall comply with Engineers' instructions. Where the work areas comes within the area of influence of high voltage electrical installations, contractor shall propose and provide adequate safety measures for all personnel working. No work is allowed in such areas without Engineer's prior approval.		
5.18.02.07	Work Areas - Reference Marker		
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5.18.02.08	Contractor shall also establish all required lines and grades necessary to complete the work and shall be responsible for the accuracy of such lines and grades. Prior to clearing operations contractor shall : a) Install Bench Marks, Intersection Points and other required survey pillars. b) Markers in the centerline of the pipeline at distances of maximum 100 metres for straight line sections and maximum 10 metres for horizontal bends. c) Set out a reference line with respect to pipeline centerline at a convenient location. Markers on reference line shall be at a distance of maximum 100 metres for straight line sections and maximum 10 m for horizontals bends. Clearing And Grading Any obstacle which may hinder the construction and laying of the pipeline along the pipeline route shall be removed. All stumps if met with shall be removed for a continuous strip, with a width equal to trench top with plus two metres on either side, centered on the pipeline centerline. All stumps, timber, bush, undergrowth and roots cut removed from the work area shall be disposed of in a manner and method satisfactory to Engineer, and Government Authorities having jurisdiction. In no case shall it be left to interfere with the grading and laying operations. Whenever stumps are removed and a hole is left in the ground, contractor shall back-fill the hole and compact it to prevent water from gathering in it and making a big hole. Bidder shall grade the pipeline work area as required for proper installation of the pipeline, for providing access to the pipeline during construction, and for ensuring that the pipeline is constructed in accordance with the latest engineering and construction practices. Contractor shall grade sharp points, to allow the pipe to be bent and laid within the limits set forth in these specifications, and shall drill, or excavate any rock or other material which cannot be graded off with ordinary grading equipment in order to make an adequate working space along the pipeline. No temporary / permanent deposit or of any kind of material resulting from clearing and grading shall be permitted in the approach to roads, railways, streams, ditches, drainage ditches and any other position which may hinder the passage and/or the natural water drainage. In the case of natural or artificial deposits of loose soil, sand, heaps of earth, or other fill materials, these shall be removed till stable natural ground level is reached so as to ensure the construction of the pipeline trench in stable ground. Wherever the pipeline work area runs across, through or alongside farmyards, built-up areas, groups of trees, groves, horticultural spreads, gardens, grass-fields, river, nallahs, ditches, dykes, roads, paths, railways or any other area with restrictions of some kind, Bidder shall work with all caution necessary for digging the pipeline trench and constructing the pipeline. In the said places Bidder shall carry out the works in such a way that damage resulting from the pipeline construction is kept to a minimum.			
	5.18.02.09	Provision of Detours Contractor shall make all necessary arrangements to permit the passage of its men and equipment. It is understood that the bidder has recognised restrictive features of the work area		
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	and shall provide the necessary detours and execute the works without any extra cost of owner. Public travel shall not be inconvenienced nor shall it be wholly obstructed at any point. Contractor at his own cost shall furnish and maintain watchman, detours, lanterns, traffic lights, barricades, signs, wherever necessary to fully protect the public. Contractor shall be responsible for moving its equipment and men across or around watercourses. This may require the construction of temporary bridges or culverts. Temporary bridging or access if required for crossing water courses shall be constructed. Contractor shall ensure that such temporary works shall not interfere with normal water flow, avoid overflows, keep the existing morphology unchanged and shall not unduly damage the banks of water courses. No public ditches or drains or canals shall be filled or bridged for passage of equipment until contractor has secured written approval of the authorities having jurisdiction over the same. The contractor shall furnish a copy of such approval.			
5.18.02.10	Work Area Damages Contractor shall confine all its operations within limits of the Work Area. Any damage to property within and outside the work area shall be restored or settled at the Contractor expenses. Contractor shall promptly settle all damage claims. Should contractor fail to do so, Owner shall give written notice to the bidder and if contractor does not settle such claims within seven days after such notice, Owner shall have the authority to settle claims from the account of contractor.			
5.18.02.11	Pipe Line Trench Location Contractor shall excavate and maintain the pipeline trench on the Centre-line of the pipeline taking into account the curves of the pipeline. The free working space shall conform to IS:5822. Generally it shall not be less than 150 mm on either side or one third of diameter of the pipe flange whichever is greater. Irrespective of the diameter of pipes for all trenches deeper than 90 cm, the minimum width shall be 75 cm. The trench shall be excavated so as to provide minimum cover of 1500 mm between the top of the pipe and finished grade, or as shown in approved drawings. In steep slope areas before commencing the works, proper barriers or other protection shall be provided to prevent the removed materials from rolling down slope. On slopes-wherever there is danger of landside, the pipeline trench shall maintained open only for the time strictly necessary. In certain slope sections, before the trench cuts through the water tables, proper drainage shall be ensured both near and trench and the work area in order to guarantee soil stability. All sewers drain, ditches and other natural waterways involved in the execution of the works shall be maintained open and functional. The same applies to canals, irrigation canals, pipelines and buried facilities crossed by the trench for which temporary pipelines shall be laid, if required, and proper temporary installations provided. Bidder to note that for restricted width of pipe line corridor (8m available at some points as shown in tender drawing) , he has to plan activities like movement of vehicle, storage of pipe, equipments and excavated materials etc. accordingly. Extra Depth and Clearance			
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	At points where the contour of the earth may require extra depth to fit the minimum radius of the bend as specified or to eliminate unnecessary bending of the pipe according to customary good pipelines practice, or where a deep trench is required at the approaches to crossings of roadways, rails, rivers, streams, drainage ditches, and the like, contractor shall excavate such additional depth as may be necessary. Contractor shall excavate to additional depth where the pipeline approaches and crosses other pipelines, sewers, drain pipes, water mains, telephone conduits, and other underground structures, so that the pipeline may be laid with atleast 500 millimeters free clearance from the obstacle or as specified in the drawings, or such greater minimum clear distances as may be required by authorities having jurisdiction. Where the pipeline crosses areas, which specifically require greater than normal depths of cover, the trench shall be excavated to extra depth in accordance with the Right-of-Way Agreements or as required. Additional excavation should be made at each coupling /joint to ensure that the pipe will have continuous support. The pipe shall not rest on the coupling for support. However, it shall be assured that the coupling area is properly bedded and backfilled after the joint assembly is completed Grades, Bends and Finish of Trench The trench is to be cut to a grade that will provide a firm, uniform and continuous support for the pipe. Bends shall be made in the pipe at significant changes in grade of the trench. The owner reserves the right to set the grade of the trench and locate the bends if so desired, in which case contractor shall excavate, at no extra cost, the trench and bend the pipe to such a grade. Number of field bends to lay the pipe to conform to the general contour of the ground and maintain a normal cover shall be kept to a minimum. This can be accomplished by cutting the trench slightly deeper at the crest of ridges and by gradually deepening the trench in approaches to crossings. Encroachments and working near other utilities In locations, where pipelines has to be laid in the body of a road, canal, dyke, etc. or other locations under jurisdiction of Government/Public Bodies, the bidder shall perform such work without extra compensation, according to the requirement of concerned Authorities. When it becomes necessary that contractor has to resort to hand digging, well point dewatering, sheet piling or any other special construction method in these areas, no extra compensation shall be paid. Contractor shall contact the Authorities concerned in order to become familiar with their requirements. In locations, where the pipeline has to be laid more or less parallel to existing pipeline, cable and/or other utilities in the Work Areas, contractor shall perform the work to the satisfaction of the Owner/Authority of the existing pipeline cable/utility. In such locations contractor shall perform work in such a way that even under the weather and flooding conditions, the existing pipeline/utilities shall remain stable and shall neither become undermined nor have the tendency to slide towards the trench. Contractor shall be liable for any damage occurring to other pipelines, underground structures/utilities. Protection of Trench		
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5.18.02.12	Contractor shall keep the trench in good condition until pipe is laid, and no claim is to be made to the Owner for reasons of its caving either before or after pipe is laid. All timber, sheet-piling jacks or other materials, that may be necessary to shore the trench, in order to prevent caving are to be furnished and removed by contractor after completion of laying. Contractor shall dewater if necessary, using well point system or other suitable systems, shore or do as required to excavate the trench, install the pipe in it and backfill the trench in accordance with these specifications at no extra cost to Owner. Protection of underground utilities and special methods. Contractor shall obtain plans and full details of all existing and underground services from the relevant Local Authorities & Owner and shall follow these plans closely at all times during the performance of work. Contractor shall be responsible for location and protection of all underground lines and structures. Temporary under-pinning or any other type of supports and protective devices necessary to keep the interfering structure intact shall be provided by the contractor at his own cost and shall be of such design as to ensure against their possible failure. Despite all precautions, should any damage to any structure/utility etc. occur, the Owner/Authority concerned shall be contacted by the Contractor and repair shall forthwith be carried out by contractor at his expense under the direction and to the satisfaction of Engineer, the concerned Owner/Authority. If contractor fails to repair in reasonable time, Owner reserves the right to have the repair executed at the cost of the contractor.			
	Excavation			
	Excavation in Soil			
	Generally any strata, such as soil, sand, gravel, loam, clay, mud, black cotton, moorum, shingle, river or nallah bed boulders, siding of roads, paths etc. and hard core, macadam surface of any description (water bound, grouted tarmac etc.), lime concrete, mud concrete and their mixtures which for excavation yields to application of picks, showels, jumper, sacrifiers, ripper and other manual digging implements			
	Excavation in Rock			
	For the work of excavation in rock, the excavation shall be carried out by mechanical means and or controlled blasting. Contractor shall engage specialised agency having experience of excavation in rock by mechanical means and or controlled blasting.			
	Blasting shall be resorted to only with the written permission of the Engineer. All the statutory laws, (Explosives Act etc.) rules, regulations, Indian Standards etc. pertaining to the acquisition, transport, storage, handling and use of explosives etc. shall be strictly followed.			
	The contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per Explosives Act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive materials.			
	Excavation below ground water table			
	The Contractor shall dewater and maintain dry working conditions by maintaining the water table at least 0.5m below the bottom of the excavation level by suitable dewatering system.			
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5.18.02.13	Contractor shall continue dewatering i.e. maintain dry working condition till excavation, pipe laying, jointing, testing, back filling / filling and all other operations included in the scope of work, which require dry condition in the area, are completed. Excavation below Water other than Ground water (i.e. Surface water) The Contractor shall control the ground in the vicinity of all excavations so that the surface of the ground will be properly sloped or dyked to prevent surface water from running into the excavated areas during construction. The Contractor shall have to constantly pump out any water collected in excavated pits and other areas due to rain water, springs, drain, nala, reservoir etc. and maintain dry working conditions at all times until the excavation, concreting and backfilling is completed. The Contractor shall remove all slush / muck from the excavated areas to keep the work area dry. Sludge pumps, if required, shall be employed by the Contractor for this purpose.			
	Backfilling Backfill Material for Mild Steel/ Ductile Iron Pipes Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) so as to be proved an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822 & IS 3114 for MS and IS: 12288 for DI pipes respectively. Bed preparation and back filling of excavated trenches for buried pipes depend on type of soil. Soil types are classified into following 3 categories: I. Rocky Soil II. Sandy/ Silty soil (including non-expansive clay) III. Expansive soil (including water logged/ marshy soil) The bidder shall note that the piping may travel underground through all types of soils and combination of soils described above. The type of trench preparation/ bedding and back filling for each are specified below. In case of agricultural land, it is suggested that the soil may be classified as fertile (top strata) and non fertile (sub strata). During the excavation for laying the pipeline both these layers may be heaped separately so that while back-filling the non-fertile soil is filled first followed by the fertile strata, thus restoring the fertility of the soil in the excavated area on our right of way. (a) Rocky Soil (1) Trench shall be excavated to a depth of 100mm below pipe invert. (2) A bed of 100mm shall be laid with granular material (passable through 12.5mm aperture sieve - IS-2405 part-2) which shall be well rammed to form a fair and clean bed for pipe. (3) Back filling shall be done with the excavated material/ borrow earth after ensuring that it is free of cinders, ashes, slag, refuse, lumpy/ frozen material, rocks etc. to the satisfaction of the Project Manager. The back fill from pipe invert upto 300mm above pipe crown shall be done with material passable through 20mm aperture			
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	sieve (as per IS2405 part-2 1980). Total mass of loam and clay shall not be more than 10%. Back fill above this zone upto trench top shall be with similar material but may contain stones with 200mm as their maximum dimension (4) Back filling upto 300mm above pipe crown shall be done by hand without moving or injuring the pipe. Above this zone upto trench top back fill may be by hand/ approved mechanical method. (5) Any extra/ additional back-filling resulting from unintended rock blasting even while carrying out controlled blasting shall be done by the Contractor without any extra cost to the Employer (b) Sandy/ Silty Soil (1) Trench shall be excavated to the exact gradient required by the pipe invert so that no bedding is required. The trench bottom shall be made free of refuse and stones etc. so as to provide a smooth, uniform and continuous bearing surface (2) Back filling shall be done with the excavated material after ensuring that it is free of cinders, ashes, slag, refuse, lumpy/ frozen material, rocks etc. to the satisfaction of the Project Manager. Back filling upto 300mm above pipe crown shall be done by hand without moving or injuring the pipe. Above this zone upto trench top back fill may be by hand/ approved mechanical method (c) Expansive/ Poor Support Soil (1) Laying of pipes in such soil shall be avoided as far as possible. One possible method is to increase trench depth in case the expansive soil occurs at the surface. The method can then be one of the above (a or b) depending on soil encountered below the layer of expansive soil. The expansive soil shall not however, be used for back filling the trench bottom to 300mm above the pipe crown. This shall however, be studied techno-economically (i.e., the aspect of increasing the trench depth to encounter non-expansive soil and follow a or b above for bed preparation and back filling). (2) Where expansive soil occurs at a great depth the trench & bed shall be prepared as at a (1) & (2) above. (3) Back filling around pipe upto 300mm above top of pipe crown shall then be done with sand/ gravel conforming to clause 8.2.1/ 8.2.2 of IS-3114 or with borrow earth. However, expansion soils having medium degree of expansion or having marginal degree of severity, as per IS:1498, may be used for backfilling around pipes with approval of Engineer. (4) In case of marshy/ water logged soil, the pipes shall be laid on underground concrete pedestal (M25) installed at a spacing to ensure that the pipe is adequately supported. Prior to construction, design of the pedestal shall be got approved from Engineer-in-Charge. During backfilling, it shall be made certain that the granular material flows completely under the pipe to provide full support. Proper backfilling shall be done in 150mm to 300 mm lifts, depending on backfill material and compaction method. Between each lift, the proper compaction shall be attained to ensure that the pipe will have adequate side support. Backfilling shall not be done until the pipe and appurtenances have the proper fit and the pipe is following the trench profile at the required depth. Backfilling of trench in water courses shall be carried out as per the relevant specifications.		
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	Backfilling shall be carried out immediately after the pipeline has been laid in the trench, inspected and approved by the Engineer, so as to provide a nature anchorage for the pipeline, thus avoiding long exposure of coating to high temperature, damaging actions of adverse weather conditions, sliding down of trench sides and pipe movement in the trench. In generals the trench shall be dry during backfilling. The surplus material shall be neatly crowned directly over the trench and the adjacent excavated areas on both sides of the trench to such a heightwhich will, in the opinion of the Engineer, provide adequately for future settlement ofthe trench backfill during the maintenance period and thereafter. Surplus material, left from this operation shall be disposed off to the satisfaction of Engineer-in-Chargebeyond the Work Area to a place suitably identified by the contractor himself at no extra cost to the Owner. At the end of each day's work, backfilling shall not be more than 500 meters behind the head end of lowered-in pipe, which has been padded and approved for backfill. The backfill shall be maintained against washouts etc., until the completion and final acceptance of the work by engineer. When backfilling the trenches the sloping terrains or steep areas, where in the opinion of the Engineer the backfill may be washed out of the trench, sheet piling orother effective water breakers across the trench shall be provided. This is to divert the flow of water away from the trench into normal drainage followed before laying ofthe pipe line. In no case, the water is to be drained via the trench or via channels other than those followed before the line was laid. Contractor shall leave the pipe uncovered at certain locations to allow the engineer to survey the centre line of the pipe and the level of the pipeline in the backfilled trench. Temporary markers shall be installed during backfilling to locate the pipeline axis. These markers shall then the replaced with permanent pipeline markers			
5.18.02.14	Anchor Blocks/ Encasement RCC thrust blocks should be provided at bends and at places of reduction in cross section to take care of thrust forces as per approved designs/ drawings. Thrust blocks are to be installed at all locations where movement of pipe is envisaged. If higher water table is encountered, uplift to shall be checked for pipe empty condition and if there is any uplift, pipe shall be encased with reinforced cement concrete (M25) of minimum 250 mm thick around the pipe.			
5.18.02.15	Permanent Markers Permanent pipe line markers made of concrete (of grade M25) shall be installed at every 500m and at every bend/turning point. The markers shall be 500 mm wide and75 mm thick and shall project 1200 mm above ground level. The marker shall be grouted in M-10 cement concrete mixture to correct line, level and direction all-alongthe pipe line. The work also includes necessary excavation for grouting of marker, cleaning, painting etc. The bidder shall furnish drawing of marker to Engineer for hisapproval before installation of the same. The mark shall show name of Owner, Chainage of pipe line, Ground elevation, invert level of pipe, direction of flow, etc.			
5.18.03	Clean-Up And Restoration Of Work Areas			
5.18.03.01	Bidder shall restore the Work Areas and all sites used for the construction pipelines, water crossings and other structures in accordance with the instructions of the engineer.			
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5.18.03.02	Disposal All surplus and defective materials supplied/ excavated by contractor and all trash, refuse and spoiled materials shall be collected and disposed off to the satisfaction of Engineer-in-Charge beyond the Work Area to a place suitably identified by the contractor himself at no extra cost to the Owner. The Work Areas shall be cleared of all rubbish, broken skids, empty cans, card board, sacks, stumps, trash, and leftover construction material. All burnable matter shall be burned, but only after obtaining appropriate permits for such burning. If burning is not allowed, bidder shall haul the clean-up material to an approved dumping area. All scrap metal and unburnable material shall be disposed off, in an appropriate manner, but never be buried in the Work Areas. Surplus soil can only be removed from the work area after authorisation by Engineer. All dumping fees connected with the disposal of materials shall be to the account of contractor. All loose stones and rock exposed by the construction operations and scattered over the Work areas or adjacent ground shall be removed and transported to a location considered suitable by land-owner and/or tenant, or by authorities having jurisdiction, for satisfactory disposal. For gravel or other hard material which may be buried in the trench, the provisions of the specifications shall apply with the understanding that the use of the land by the land-owner and/or tenant will not be interfered with.			
5.18.03.03	Temporary Structures All auxiliary structure such as bridges, culverts, sheet piling, posts, signs, etc., which were erected or installed by bidder as temporary measure, shall be removed.			
5.18.03.04	Repair of Damages Damages to roads, bridges, private property shall be repaired by contractor. All fences and other structures which are damaged during construction shall be restored to original condition. Slopes, water course sides or banks which have been partially or totally demolished during the execution of the works shall be properly consolidated and restored without waiting for their natural consolidation and settling. All boundary stones which have been moved or removed during the work must be reset in their original location to the specification of the land-owner concerned. On completion of clean-up, the work areas shall be restored to such stable and usable condition as may be reasonably consistent with the condition of the Work Areas prior to laying the pipeline. The Owner shall be completely indemnified and held harmless by contractor from any and against all claims, demands, losses, expense etc. that may arise on this behalf. The Engineer may require from the contractor signed Releases from land owners regarding satisfactory indemnification and restoration of their lands.			
5.18.04	Cutting And Removal Of Paving/ Water Bound Macadam Road			
5.18.04.01	Whenever it is permitted by Authorities and/or Owner to open cut a paved/WBM road crossing, or where the line is routed within the road pavement, bidder shall remove the paving in accordance with the restrictions and requirements of the authorities having jurisdiction there of or as directed by the Engineer. After laying the pipeline, backfilling shall be immediately performed and all the area connected with the works shall be restored.			
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5.18.04.02	Throughout the period of execution of such works, contractor shall provide and use warning signs, traffic lights or lanterns, barricades, fencing, watchman etc. asrequired by the local authorities having jurisdiction and/or owner.			
5.18.04.03	For all roads, paths, walkways etc. which are open-cut, contractor shall provide temporary diversions properly constructed to allow the passage of normal traffic withthe minimum of inconvenience and interruptions. The paving/ WBM shall be restored to its original condition up to the satisfaction ofconcerned authorities/ Engineer after the pipeline is installed.			
5.18.05	Structural Steel Bridges For Make-Up Water Pipes Crossing At Irrigation Canal/Nallah/ Samal Barrage Reservoir Submergence Area General Structural steel bridge shall be provided for make-up water pipes crossing at irrigation canal/nallah/ drain/samal barrage reservoir submergence area and any other water bodies/other submergence areas. The deck of bridge has been sized for two (2) make-up water pipes, etc. Tender drawing indicates minimum size of the approach bridge. The deck shall be of structural steel. Handrail for the structure shall be provided. The deck shall be supported on longitudinal beams and cross beams. Bottom of girder including deck shall be above the MWL of canal/nallah or HFL of Samal Barrage reservoir with adequate clearance as per relevant IRC codes. The entire deck shall be supported on piers. The piers shall be supported on piles and pile cap. Under water piling shall be carried out in reservoir submergence area in accordance to IRC standards. Necessary precautions like sheet piling, etc., shall be taken while executing piling works in the canal bund area to protect the canal structure. The deck slab shall be designed for the live loads and pipe loads over the approach. Apart from the specified loads, any other equipment or possible overloading during construction/ erection/ installation of pipe line/ equipment and maintenance shall also be considered in the design. The critical deflection shall be limited such that it shall not produce difficulties in serviceability conditions nor shall it cause damage to the structures and pipelines supported on the bridge, and its components etc. The horizontal deflection shall be checked for wind/ earthquake and current loading and the maximum value shall be limited to L/350, where 'L' is the average distance between bridge support points. The bridge shall be designed to accommodate transverse and longitudinal differential movement between supports. Predicted maximum relative deflection shall be calculated based on "Worst case" situation, i.e., the sum of the maximum absolute deflections of the adjacent segments/ platforms. One end of the bridge shall be designed as hinged support and the other end as a sliding support. The sliding support shall provide guide restraints in the vertical and lateral support. The sliding support shall provide guide restraints in the vertical and lateral deflections. The sliding support shall be a self-lubricating bearing element. 150% of the total predicted translation shall be allowed for the end connection and bridge design. The hinged connection shall be designed to withstand 150% of the expected axial thrust. Bridge support shall be capable of accommodating a tolerance in all directions for final support location. The tolerance shall be determined based on the accuracy of construction of support. In certain stretches of the pipeline corridor along the irrigation canal, pipes will have to be laid along the slope of the embankment due to space constraints. In such cases, suitable retaining wall shall be provided on the downstream side of canal embankment to retain the pipelines as well as overburden fill above pipelines. In no case, pipelines shall be laid by excavation/cutting the embankment slope.			
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5.18.06	Regarding requirement of corridor for power supply line laying in areas of canal crossing, road crossing etc. following shall be applicable: a. Wherever culverts is being used for crossing of existing roads highways etc. necessary space provision for laying of 2 nos. 200mm dia HDPE/hume pipe shall be considered along both sides of pipe line for laying of cables. b. At locations where canal/nallah/submergence area crossing is involved, necessary space provision shall be considered for laying of cable trays (vertical formation) along both sides of the trestle structure. c. At other areas, cable (wherever applicable) shall be directly buried in ground, a space provision of 800mm on both sides of pipe shall be required.			
	Make-Up Water Pipe Crossings At National Highway / State Highway / Railway Pipe crossing through culverts (Culverts to be constructed by owner) There are two railway crossings (TP 132 to TP133 and TP 24 to TP25), one no. road crossing (TP 35 to TP 36), and one no NH Crossing (TP 101 to 102), as mentioned in tender drawing no 4540-001-POC-A-010) for which culverts (Box culvert/pipe culvert) will be constructed by the owner, However, pipe line laying along with associated RCC pedestal/thrust block and RCC pits at entry/ exit points shall be in bidder's scope. Pipe crossing through culverts (Culverts to be constructed by Bidder) There are 4 no. road crossings (of PWD/R&B department) 1) TP 30 to TP 31, 2) TP 109 to TP 110, 3) TP 114 to TP 115, 4) TP 120 to 121, as mentioned in tender drawing no 4540-001-POC-A-010, shall be constructed by Bidder. The following works pertaining to culverts required for crossing of roads/state highway shall be in Bidder's scope. a) Design of culvert considering the applicable superimposed load for roads/ highways b) Getting the design /drawing approved from the PWD/R&B department c) Preparation of design/drawing of diversion road as per PWD standards required during construction period of the culvert and getting the same approved from PWD/ R&B. d) Construction of culverts, diversion roads etc. There is one road (Bund Road of Samal Barrage) crossing (between TP 11 and TP 12) maintained by Samal Barrage Authority-WRD. This crossing work is also in the scope of Bidder. This road crossing shall be through casing/hume pipe by pipe pushing method as per requirement/approval of concerned authorities (i.e.Samal Barrage Authority-WRD). Kuccha village road crossings will be through hume pipe / box culverts by open cut & fill method. In addition to these, there are many other minor/metalled road crossings (approx. 18 Nos. crossings) in the scope of bidder, for which, bidder has to take permission/approval from the concerned authority and lay the pipe lines through casing/hume pipe / culverts as per approval. Between TP 43 & TP 44, the pipelines are to be laid below & along the service/inspection road of the irrigation canal, which is in the scope of Bidder. In this stretch, the pipelines shall be encased in RCC or laid through box/pipe culvert as per the approval from the concerned Authority. Bidder to note that, necessary permission for Right of use for laying the pipe line is being obtained by NTPC Ltd. However, Bidder has to submit the final design and accord necessary permission from Railways, NHAI, WRD, Irrigation, R&B Department, MCL Authorities, Govt. before start of the work for all rail, road, river, nallah, and canal crossings.			
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	For any other additional works, bidder have to make their own assessment too of the quantity/ number of culverts, existing pipe pedestal crossings, nallah crossings etc., based on their site visit before quoting. For any boundary wall crossings, pipe shall be laid through casing pipe / RCC culvert. After laying the pipe, the boundary wall shall be restored. NTPC will provide assistance in getting approvals such as signing the application for submission to concerned authorities etc. as an Owner of the power project. However, expediting and obtaining all approvals shall be the responsibility of the Bidder. All statutory fees/payments required to be deposited to the concern authorities for approval/permissions of rail/road/canal crossings shall be paid by NTPC on submission of demand letters from concerned authorities.		
5.19.00	WATER TREATMENT PLANT-DM Plant, PT Plant, ETP and CW Chemical Treatment Civil Works, CSSP etc		
5.19.01.00	Design Concepts for Buildings/ Shed		
	i. All buildings shall have framed super structure. ii. Equipment/facilities with shed shall have structural steel superstructure with permanently colour coated metal sheeting at roof and side open. However, kerb wall shall be provided all around the plinth/ floor area above the Finished Floor Level (FFL). For other buildings brick wall cladding on exterior face shall be provided. iii. Unless specified, the wall cladding for buildings shall be with minimum one brick thick on exterior face. However, brick wall for buildings adjacent to transformers shall be minimum 345mm thick.		
5.19.01.02	Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion, etc.		
5.19.01.03	The load and load combinations and design criteria shall be as specified elsewhere in the specification.		
5.19.01.04	All liquid retaining structures shall be designed for following load conditions. Underground structures: a. Water filled inside up to design level and no earth outside. b. Earth pressure with surcharge of 2.0 T/m² and ground water table up to FGL outside and no water inside. c. Stability against uplift shall be checked for completed structure and under construction stage with no water inside and ground water table up to FGL, with a minimum factor of safety of 1.20 against uplift. Installation of pressure relief valves shall not be permitted in the base slab of any liquid retaining / conveying structure. d. The structure shall also be checked for normal working condition with water filled inside up to design level and earth pressure outside with no effect of surcharge and ground water table. For design of over - ground liquid retaining structures appropriate load cases shall be considered.		
5.19.01.05	All liquid retaining and conveying structures shall be designed by working stress method as given in clause 4.5 of IS 3370(Part2):2009.		
5.19.01.06	In the wall of liquid retaining structures with cylindrical shape such as clarifiers, vertical reinforcement shall be checked assuming the walls were fully fixed at the base, and the		
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	horizontal reinforcement shall be provided to resist horizontal (hoop) tension assuming hinged condition at the junction of the base slab & wall.																			
5.19.01.07	Wherever sandwich slabs are provided in liquid retaining structures to take care of stability against uplift, only well graded sand of approved quality shall be used as fill material. The sand compaction shall be done with plate / disc compactors in such a manner that the bottom slab is not structurally damaged.																			
5.19.01.08	Clear free board of at least 300 mm above design (total) water level shall be provided in all liquid retaining / conveying structures.																			
5.19.01.09	Coefficient of active earth pressure shall be considered for design of free standing retaining walls and coefficient of earth pressure at rest shall be considered for design of top propped retaining walls.																			
5.19.01.10	The minimum grade of concrete for all RCC structures associated with DM plant, PT plant, ETP and CW chemical treatment and CSSP shall be of grade M30.The minimum concrete clear cover to reinforcement bars in all RCC structures shall be as per IS:456(2000) and IS:3370(Part II) for water retaining structures. Durability of concrete shall conform to moderate exposure conditions as per Table-3 of IS 456 except noted specifically otherwise.																			
5.19.01.11	Factor of safety against overturning and sliding The structure shall be checked for minimum factor of safety of 1.5 against overturning conditions (ratio of stabilizing moment to overturning moment) and 1.4 against sliding conditions as per IS: 456.																			
5.19.01.12	For detailing of Reinforcement IS 5525, IS 13920, IS 4326 and SP 34 shall be followed.																			
5.19.01.13	Two layers of reinforcement (on both faces) shall be provided for RCC sections having thickness of 150 mm and above.																			
5.19.01.14	Minimum diameter of main and distribution Reinforcement bars in different structural elements shall be as follows: <table><tr><th>Sl. No.</th><th>Structural Element</th><th>Main Reinforcement</th><th>Distribution Reinforcement / Stirrups/ ties/ Anchor Bars</th></tr><tr><td>a)</td><td>Foundation</td><td>12 mm</td><td>12 mm</td></tr><tr><td>b)</td><td>Beams</td><td>12 mm</td><td>8 mm</td></tr><tr><td>c)</td><td>Columns</td><td>12 mm</td><td>8mm</td></tr></table>				Sl. No.	Structural Element	Main Reinforcement	Distribution Reinforcement / Stirrups/ ties/ Anchor Bars	a)	Foundation	12 mm	12 mm	b)	Beams	12 mm	8 mm	c)	Columns	12 mm	8mm
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a)	Foundation	12 mm	12 mm																	
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5.19.01.15	Spacing of reinforcement bars in walls and slabs of liquid retaining / conveying structures shall not be more than 200 mm.																			
5.19.01.16	Suitable shrinkage reinforcement shall be provided at top face of foundations. Minimum shrinkage reinforcement shall be 10 mm dia. @ 200mm c / c.																			
5.19.01.17	Minimum Reinforcement in all elements of liquid retaining / conveying structures shall be 0.24 % of cross sectional area distributed equally over top and bottom faces.																			
5.19.01.18	Minimum tensile Reinforcement in each direction for all foundation slabs / rafts shall be 0.2% of cross sectional area.																			
5.19.01.19	Minimum thickness of foundation slab / raft and base slab of all liquid retaining tanks / pits shall not be less than 250 mm.																			
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5.19.01.20	Minimum thickness of all elements of RCC liquid retaining / conveying structures (except effluent drains, launders and aerator waste slab) shall be 200mm. Effluent drains (depth more than 500mm), aerator waste slab and launders shall have minimum element thickness of 150mm.			
5.19.01.21	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter. Edge protection angles shall be provided as specified elsewhere.			
5.19.01.22	All water retaining structures shall be tested for water tightness as per provisions of IS: 3370 and IS: 6494.			
5.19.01.23	2.0m wide walkway with concrete paving shall be provided connecting all structures, buildings and facilities. The top of walkway shall be minimum 200mm above FGL.			
5.19.02.00	Architectural Concepts and Finishing Schedule Architectural concepts and finishing schedule shall be as specified elsewhere in architectural specification.			
5.19.02.01	Acid / Alkali Resistant Treatment: Acid / alkali resistant lining treatment shall be provided in different areas as follows: Neutralization Pit: The walls shall be provided with one coat of bitumen primer, followed by 18 mm thick bitumastic layer, 115 mm thick A.R. bricks, 6 mm thick under bed of potassium silicate mortar, pointing the joints of bricks with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. Suitable pilasters shall be provided with A.R. bricks at regular intervals depending upon the height of lining, as per the specification. The floor of neutralization pit shall be provided with acid / alkali resistant lining treatment as given in the above para, except that the 115 mm thick A.R.bricks layer shall be replaced by 75 mm thick A.R. tile layer and pilasters shall be omitted. The ceiling of neutralization pit shall be provided with one coat of epoxy primer followed by 2 coats of epoxy paint (150 micron). Acid / Alkali storage area / projections above the floor, pedestals projecting from the floor / saddles. The floor shall be provided with one coat of bitumen primer followed by 12 mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick under - bed by potassium silicate mortar, 6mm thick pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar up to a depth of 20 mm and bitumastic end sealing. Dado of 1.0M high with above treatment shall also be provided if applicable in case of walls nearby. Alum/Lime Storage area and first floor of Chemical House : One coat of bitumen primer followed by 12mm thick bitumastic layer, 20 mm thick A.R. tiles, 6 mm thick underbed of potassium silicate mortar, 6mm thick pointing of joints of tiles with acid /alkali resistant epoxy /furane mortar up to a depth of 20 mm and bitumastic end sealing. Alum solution preparation tank: The wall shall be provided with one coat of bitumen primer followed by 12 mm thick bitumastic layer, 75 mm thick A.R. tiles, 6 mm thick underbed by potassium silicate mortar, pointing of joints of tiles with acid / alkali resistant epoxy / furane mortar upto a depth of 20 mm and bitumastic end sealing. The floor shall be provided with acid / alkali resistant lining treatment as given in the above para except that the 75 mm thick A.R. tile layer shall be replaced by 12 mm thick A.R. tile layer. Basket of Alum Solution Preparation tank: 5mm thick epoxy lining over a coat of epoxy primer. Curved surfaces of saddles shall have minimum 12 MM thick bitumastic layer to support the vessel / tanks.			
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	Effluent Drains: Acid Resistant lining treatment indicated for the storage area shall be provided on the bed as well as walls of the drains with 38 MM AR tiles. The underside of the pre-cast slab cover shall be applied with one coat of epoxy primer and two coats of epoxy coating, total DFT 150 microns. Lime tank: Two coats of bitumen paint conforming to IS : 9862, with total DFT 150 microns. Guarantee The Contractor shall give a guarantee for satisfactory functioning of the lining for a period of 36 months from the date of completion of the work or date of handing over the site to the Engineer, whichever is later. The Contractor shall replace / rectify defects is any, observed in the lining to the satisfaction of the Engineer without any extra cost during this period.		
5.19.02.02	DM Tank Foundation		
5.19.02.02.01	General Requirements		
	The tank foundation shall be as per IS:803 and as specified in Cl. No.7.01.04.		
5.19.02.02.02	Sub Grade Preparation		
	The surface of natural soil shall be thoroughly compacted by rolling or other means, as directed by Engineer, to obtain 95% of max. laboratory dry density for the soil, as per IS:2720 (Part-VII).		
5.19.02.02.03	Anti Corrosive Layer		
	Anti-corrosive layer shall consist of dscreened coarse sand, mixed with 80/100 bitumen or equivalent 8% to 10% by volume.		
	Bitumen shall be heated to a temperature 175 ^o C to 190 ^o C, with 3% kerosene, if required. Sand shall be thoroughly mixed with it in a mixing drum to obtain uniform mixture and shall be laid over the compacted surface, laid in line, grade and levels and as directed by the Engineer. Bitumen shall not be heated beyond the temperature limits given above.		
	The premix carpet shall be laid in two layers of 3 cm and 2 cm respectively. After compacting and laying the first layer of 3cm, a tack coat of hot bitumen at the rate of 1 Kg. per Sq.m. shall be uniformly applied to the surface, by means of Sprayer and the Second layer of 2cm thick shall be laid, tamped and compacted to the satisfaction of the Engineer.		
	Sand shall be spread on the final surface at the rate of 0.5 Cu. m per 100Sq.m.		
5.19.02.02.04	Premix Materials		
	Sand		
	Sand shall be clean, dry, coarse, hard angular, free from coatings of clay, dust and mix of vegetable and organic matters and shall conform to IS 383 (Grade -III).		
	Stone Chippings		
	Stone chippings shall be hard black trap or granite or approved locally available stone and shall conform to IS 383. The grading shall be of normally 12mm down size and 6mm down size, in the ratio of 3:2 respectively.		
	Bitumen		
	Bitumen required for the work shall be 80/100 grade or its equivalent quality.		
	Laying		
	Areas on which the premix is to be laid shall be thoroughly cleaned of all dust and loose materials. On the cleaned surface, a tack coat at the rate of 1.0 Kg. per Sq.M. of hot Bitumen shall be uniformly applied by Sprayers. The applied Binder shall be evenly brushed.		
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5.20.00	The Binder bitumen 80/100 shall be heated to the temperature of about 190° C with 3% kerosene, if required and mixed with stone chippings of size, as mentioned above, at the rate of 400 KG, with Six (6) Cu. M. of stone chips, for 100 Sq.M. of surface. The total mixed quantity, as mentioned above, is the quantity required for the total 50mm thick for 100 Sq. m. of area. Mixing shall continue until the aggregate is well coated. Switchyard Civil Works			
5.20.01	Civil works for switchyard includes: a. Towers, girders, lightning masts and equipment supporting structures including proto type assembly etc., b. Foundations and supporting pedestals for towers, lightning masts, equipment supporting structures etc., c. GIS/Control room/Auxiliary building as required for switchyard, foundation for AC Kiosks etc. d. Foundations for transformers and reactors including oil pit, stone filling, laying and fixing of rails for movement of Transformers / reactors, rail track, jacking pad and fire walls as required, arrangement for cabling etc. all complete e. Earthing mat, single lane roads and R.C.C. drains in switchyard area including road/drain/trench crossings etc., f. All necessary embedments, inserts, supporting structures & supporting members as required etc. g. Cable trenches in switchyard and inside GIS/Control room/Auxiliary building including civil works for panel fixing etc.			
5.20.02	Design Criteria			
5.20.02.01	Gantry structure, which consists of open web towers connected by girders, shall be made of structural steel conforming to IS 2062 and duly galvanized conforming to IS: 2629 and IS 4759. All joints shall be bolted connections. All bolts for connections shall be of 16mm dia conforming to IS 12427 and of property class 5.6 as per IS 1367 (Part 3). Nuts shall conform to IS 1363 (Part 3) of property class 5. Foundation bolts shall conform to IS 5624 and property class shall be 4.6 as per IS 1367 (Part-3). Butt splice shall be used for splicing the main members and splice shall be located away from the node point. IS 802 “Code of practice for use of structural steel in overhead transmission line towers” shall be followed for design of structures. Height & type of towers shall be established based on electrical requirements. A provision of ± 30 degree angle of deviation of line in horizontal plane and ± 20 degree deviation in vertical plane is considered and the resulting worst combination of forces shall be considered for design. For all outgoing and incoming feeders, the conductor span shall be taken as 200m for design purpose. The analysis of towers and gantries shall be carried out with combined model of critical configurations of towers and gantries using any established structural analysis software like STAAD Pro. etc.			
5.20.02.02	Switchyard structures shall be designed for the worst combination following loads: 1) Dead loads (load of wires/conductors, insulator, electrical equipment and structural members), 2) Live loads, 3) Wind loads a. Switchyard gantries, towers, equipment supporting structures and lightning mast shall be designed as per IS 802. The wind load calculations shall be made as per IS: 802 except the parameters basic wind speed (Vb) and terrain category as stipulated in			
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	“Criteria for wind resistant design of structures and equipment”. b. All other structures shall be designed as per IS 456 / IS 800. The wind load calculations to be made as per IS: 875 shall be with the parameters as stipulated in “Criteria for wind resistant design of structures and equipment”. 4) Seismic loads, 5) Loads due to deviation of conductor (gantries shall be checked for ± 30 deg. deviation in horizontal plane and ± 20 degree deviation in vertical plane), 6) Loads due to unbalanced tension in conductor/wire, 7) Torsional load due to unbalanced vertical and horizontal forces, 8) Erection loads, 9) Short circuit forces including snap in case of bundled conductors, etc. Note: i. The occurrence of earthquake and maximum wind pressure is unlikely to take place at the same time. The structure shall be designed for either of the two. However, temperature stresses can be ignored, as these towers are freestanding structure in open space. ii. Short Circuit forces and Wind pressure shall be considered to act together for design of switchyard structures iii. Direction of wind shall be assumed such as to produce maximum stresses in any member for the combination of wind load with conductor tensions. The wind acting perpendicular and parallel to bus conductor and shield wire shall be considered separately. iv. The conductor tension shall be assumed as acting on only one side of the gantry for the analysis and design of switchyard gantries. v. The distance between terminal and dead end gantry shall be taken as 200 meters.			
5.20.02.03	Factor of safety: The factor of safety for the design of members shall be considered as 2.0 for normal condition and broken wire condition, 1.5 for combined short circuit and broken wire condition. Foundation shall be designed for a factor of safety of 2.2 for normal and broken wire condition and 1.65 for combined short circuit and broken wire condition.			
5.20.02.04	Design consideration for switchyard equipment support: The supporting structure for B.P.I., LA, CVT & Isolator equipments shall be comprised of GI (ERW) pipe of grade YST:210 or of higher grade conforming to IS: 1161 & shall be designed as per IS 806 “Code of Practice for use of steel tubes in general building construction”. Minimum diameter of the pipe type support for 765kV structure shall be 300NB, 400kV structure shall be 250NB, for 220kV & 132kV structures shall be 200NB and that for 66kV & 33kV shall be 150 NB. The supporting structure for CT, CSE & Wave Trap equipment shall be comprised of lattice structural steel conforming to IS 2062 and shall be designed as per IS: 802. Common raft foundation shall be provided for each pole of isolator.			
5.20.02.05	Special design consideration for lightning Mast: Diagonal wind condition shall be considered for lightning masts. Diagonal wind shall be taken as 1.2 times the wind calculated on Longitudinal/Transverse side. Lightning mast shall be provided with minimum two nos. of platforms as per requirement and an\ ladder for climbing			
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5.20.02.06	purpose shall be provided up to platform at top level. Top of platform shall have grating, railing and toe guard plates. The minimum width of platform shall be 900mm. Live load of 300kg/m2 above platforms shall be considered for design of Lightning Mast. Design Criteria for structures not covered under Cl. 5.20.02.01 to Cl. 5.20.02.05 The Switchyard Control Room building shall have RCC framed super structure with one brick thick wall cladding on exterior face. The Control room building shall consist of rooms/facilities/ equipment/ monorail as per system requirement. An open space of one meter width (minimum) shall be provided on the periphery of the panel rows and equipment to allow easy operator movement and access for maintenance purposes. The design of RCC structures shall generally be carried out using limit state method of design as per IS 456. The minimum grade of concrete shall be of RCC M25 as per IS 456. The GIS building shall be a Steel framed superstructure with troughed permanently colour coated sheet wall cladding and roof sheeting. However, brick cladding shall be provided up to a height of 900mm from Finished Floor Level (FFL). Above 900mm brick wall, the sheet metal cladding shall be provided with adequate overlapping with brick wall. Steel framed structures shall be made of rolled steel section or built-up section. The GIS building shall consist of rooms/facilities/equipment/EOT crane as per system requirement. Design of steel superstructure of GIS Building shall be carried out as per IS:800 and other relevant IS standards.			
5.20.03	The architectural features including roof water proofing, rain water down comers and RCC parapet walls etc. shall be as specified elsewhere in the specifications.			
5.20.04	The fabrication and erection of the switchyard works shall be carried out generally in accordance with IS 802 and IS 800. All materials shall be completely shop fabricated and galvanised.			
5.20.05	All structural steel members including stub members, bolts, nuts, spring washers, etc., shall be hot dip galvanised after fabrication. Minimum section thickness should not be less than 4 mm. Weight of zinc coating shall be at least 0.610 kg/m2 and foundation bolts shall have heavier zinc coating at least 0.80 kg/m2.			
5.20.06	Cable Trenches Cable trenches shall be provided for routing of cables as required and shall be of adequate size. The trenches located within switchyard shall project at least 300 mm above the finished formation level so that no storm water shall enter into the trench. The bottom of trench shall be provided with a longitudinal slope of 1:500. The downstream end of cable trenches shall be connected to sump pits. The precast covers shall not be more than 300mm in width and shall not be more than 65 kg. Lifting hooks shall be provided in the precast covers. Trenches shall be given a slope of 1:250 in the direction perpendicular to the run of the trenches. Angle of size 50x50x6 mm (minimum) with lugs shall be provided in the edges of RCC cable trenches and any other place where breakage of corners of concrete is expected. All cable trenches shall be provided with suitable insert plates for fixing support angles of cable trays. All internal cable trenches shall have minimum 6mm thick (o/p) chequered plate covers while external cable trenches shall have pre - cast RCC covers. However, the portion of the cable trench behind and sides of control panel / MCC shall be provided with suitable chequered plate covers as directed by the Engineer. Cable trenches inside switchyard, having depth more than 500mm, shall have wall thickness of minimum 150mm with two layer reinforcement.			
5.20.07	PCC Layer & Gravel Filling: PCC Layer and Gravel filling shall be provided as specified elsewhere in the specifications. Before laying of PCC layer, the subgrade shall be properly compacted and the top layer of the soil shall be treated for anti-weed considering the type of weeds found in the vicinity. The anti-weed - soil sterilization details such as manufacturer's name, their specification, test certificate, etc. shall be furnished for Owner's approval. Any modification if required in the proposed anti-			
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5.20.08	weed treatment chemical shall have to be done by the contractor at no extra cost to the Owner. The contractor shall be required to furnish a performance guarantee of three years for the anti-weed treatment. This guarantee shall be commenced from the date of completion of work or date of handing over, whichever is later. Stone/gravel shall be chemically inert, hard, strong durable against weathering, of limited porosity and free from deleterious materials. It shall be properly graded and shall meet the requirements of IS: 383. Transformer/reactor foundations Foundations of transformers/reactors shall be designed for seismic and wind loads in addition to other applicable loads. Solid RCC block foundation shall be provided for the main transformer/reactor block. Alternatively, transformer shall be supported on a RCC foundation comprising of common raft for rail supporting walls up to rail-cum-road along with pedestals for jacking pad, roller lock etc. Tie beams connecting roller lock pedestals at rail level shall also be provided. Common raft/solid RCC block shall be supported on soil or pile based on requirement specified elsewhere in the specification. Oil soak pit / oil water separation pit for transformer/reactor shall be provided as envisaged elsewhere in the specification. The oil soak pit shall be provided for each transformer and shall be filled with gravel of size 40mm. The volume of the soak pit shall be sufficient to store one-third (1/3) of the oil volume of transformer/reactor considering only 40% of the volume as available voids between gravel filling. The oil soak pit shall also be provided with a sump at the corner to allow drainage of water/oil from the soak pit. The Oil-water Separation pit shall be designed for an effective capacity of complete oil of one transformer having highest volume of oil along with 10 minutes of firewater. For calculating effective capacity of oil-water separation pit, effective depth excluding 200 mm freeboard below invert level of inlet pipe shall be considered. Plan area and depth of oil-water separation pit shall be decided based on above consideration. Oil-water Separation pit shall be provided with five separate chambers interconnected by pipes. First chamber shall be for collecting oil-water mix from transformers' soak pits in case of fire. After entering into first chamber, oil being the lighter in density floats above the water. The water from lower elevation flows in to subsequent chambers interconnected through galvanized MS pipes. The accumulated oil in the first chamber to be pumped out for subsequent usage or disposal. Water collected in the last chamber to be pumped out for subsequent disposal after treatment. Invert level of inlet Hume pipes (of NP-3 grade and adequate capacity), carrying oil and water from transformers soak pits, shall be designed for gravity flow. Freeboard of 200 mm shall be provided below the invert level of inlet pipes. Invert levels of interconnecting pipes of subsequent chambers shall be decided accordingly. Arrangement for moving the transformer into place using rail cum road, jacking pads and pulling blocks including inserts, as required, shall be provided along with the transformer/reactor foundations. RCC Firewall shall also be provided between the transformers wherever required. 300 mm thick PCC M20 encasement all around the Pylon supports inside soak pit for fire fighting system shall be provided up to top of Stone filling. Coarse aggregate filling inside the transformer oil soak pit shall be carried out only after construction/erection of Pylon supports and PCC encasement.		
5.20.09	The switchyard roads, drains, fencing and gate shall be as specified elsewhere in the specification.		
5.21.00	FIRE WATER PUMP HOUSE, FIRE WATER BOOSTER PUMP HOUSE& FOAM SYSTEM Salient Features: The scope of the Bidder shall be design and construction of Civil, Structural, Architectural, Water Supply, Plumbing and Sanitary Works of Fire Water Pump House, Fire Water Booster Pump House and Foam system including supply of all materials. The fire water Pump House shall be single storeyed and single bay RCC superstructure		
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	provision for a structural steel monorail. MCC /switchgear rooms, control room etc. shall have RCC framed structure with cast-in-situ RCC roof slabs with brick cladding. The building shall be fully covered with external brick wall with provision for doors, windows, rolling shutters and exhaust fans. The Fire Water Booster Pump House shall be structural Steel Shed superstructure with provision for a structural steel monorail. Control room shall have RCC framed structure with cast-in-situ RCC roof slabs with brick cladding. . The shed and building shall be fully covered with external brick wall with provision for doors, windows, rolling shutters and exhaust fans. Steel shed with roof covering with provision for a structural steel monorail shall be provided for foam system including associated civil works for foam bladder tank foundations, grade slab, pipe pedestals etc. Control room shall have RCC framed structure with cast-in-situ RCC roof slabs with brick cladding. The shed and building shall be fully covered with external brick wall with provision for doors, windows, rolling shutters and exhaust fans. Fire water storage tank foundation shall be provided as detailed elsewhere. Fire water pipes shall be provided with either RCC trench or buried underground as per requirement. Tender drawings shall also be referred. Fire water trenches shall be open RCC type trench with removable RCC cover. Interlocking concrete block paving shall be provided over the buried fire water pipes as specified elsewhere in the specification. At road/rail/ drain crossings of fire water pipes, the fire water pipes shall be provided with minimum 200mm thick PCC encasement all around the pipe.			
5.22.00	DELETED			
5.23.00	COAL, LIMESTONE & GYPSUM HANDLING SYSTEM			
5.23.01	Track Hopper, Reclaim Hopper, Underground TP's & Tunnel Track Hopper, Underground portion of TP's and Underground Tunnel shall be of RCC. Structural steel Shed shall be provided over Track Hopper. The vertical and inclined portion of coal hopper and beams in reclaim hoppers shall be provided with 50 mm thick guniting (shotcreting). Details of shotcreting have been given elsewhere in this specification. Expansion joints shall also be provided at locations wherever tunnel connects with Underground TP's, penthouse etc. width of 600mm water stop fabricated with 22G copper plate with bitumen board fillers and polysulphide sealing compound as specified elsewhere shall be used as expansion joint material. Reinforcement detailings at the expansion joint shall be done in such a way that there is no obstruction to copper plate installation. Track hopper, machinery hatches shall consist of underground portion, which shall be of RCC, and above ground portion, which shall be of structural steel shed covered with permanently Colour coated profiled steel sheets. The structural arrangement to be adopted for the design and construction of underground portion of track hopper and machinery hatches shall be as shown in tender drawing. It essentially consists of RCC frames spaced at approx. 3.0M centers with RCC wall panels on the sides and RCC raft/ raft and beam arrangement at the bottom, fixed to the frames. The top beam of the RCC frame supports the rail supporting beams and the coal hopper. Minimum			
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thickness of RCC raft at bottom shall be 600 mm. Minimum thickness of RCC side walls shall be 600 mm at bottom and 300 mm at top.

No columns shall be provided inside the Machinery Hatches.

Foundation of all underground structures like underground TP's & tunnels shall be of solid RCC raft. Raft cum beam/sandwich slab arrangement shall not be acceptable.

The vertical and inclined portion of coal hopper, the beams and top of coal tray in the track hopper structure as shown in the tender drawing shall be provided with 50 mm thick guniting (shotcreting). Details of shotcreting have been given elsewhere in this specification.

Expansion joints shall be provided in track hopper at a maximum distance of 40m unless otherwise shown in the tender 600 mm wide water stop fabricated with 22G copper plate with bitumen board fillers and polysulphide sealing compound as specified elsewhere shall be used as expansion joint material. Detailing of expansion joints and the reinforcement shall be coherent.

Floor shall be provided with cross slope not flatter than 1 in 50 towards side drains. Side drains shall be sloped towards sump where sump pumps as specified elsewhere, shall be provided. The slope of side drains shall not be flatter than 1 in 400. Side drains and sump shall have removable type steel grating cover. Gratings shall be galvanized to grade 610 gm/m².

Water proofing / Damp proofing of underground portion of Track Hopper, reclaim hoppers, tunnels, underground (i. e. basement) portion of transfer houses shall be done by providing the following treatments:

(A) Chemical injection grouting for inner faces (details as specified elsewhere)

(B) Polymer modified cementitious coating on earth side face as per the following :

- (1.) On the outer surface of walls, frames and roof slabs coming in contact with earth, polymer modified cementitious coating in two layers as specified and as per manufacturer's specifications shall be provided directly on the concrete surface.
- (2.) 50 mm thick PCC (1 : 2 : 4 with 10 mm nominal size stone aggregates) shall be provided under the raft i.e. over the lean concrete, followed by polymer modified cementitious coating in two layers (slurry mix application) as per manufacturer's specification. 50 mm thick PCC (1 : 2 : 4) with 10 mm nominal size stone aggregates shall then be laid over the polymer modified cementitious coating before laying the raft.

Steel gratings of mesh size 300 mm x 320 mm for track hopper shall be provided. The grating shall be built of min. 200mm x 28mm thick flats in main direction and min. 100mm x 20mm thick in secondary direction. The hopper and gratings shall be designed for movement of front end loader/ bulldozer over them. Bull-dozer weight shall be considered as about 35T. No painting/galvanization shall be provided in gratings. However, two coats of Red oxide Primer to be provided immediately after fabrication.

Earth pressure to be considered for design shall be due to earth pressure at rest (K_0) condition only. Earth pressure due to surcharge intensity of Railway Loads (where applicable) or Uniformly Distributed Load (U. D. L) of intensity 2 T / Sq. M. whichever is critical, shall be

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5.23.02	considered in the design. A minimum safety factor of 1.2 against uplift of wagon tippler/track hopper, transfer points (underground or with basement) and tunnels, due to ground water shall be ensured during execution and after execution, considering dead weight of the structure to be 0.9 times only, ground water table at adjoining formation level and soil wedge angle of not more than 15 degrees. Also, FOS against uplift, to be taken as 1.0, considering the dead wt. of structure and soil resting on side projections if any in the vertical plane. Inclined wedge action of soil shall not be considered in this case. Wherever, slope of tunnel exceeds 10°, RCC steps shall be provided for the entire width of each walkway.			
	Overhead / Ground Conveyor Galleries and Trestles Overhead conveyors for trough belt conveyor shall be located in a suitably enclosed gallery of structural steel. The overhead gallery shall consist of two vertical latticed girders having rigid jointed portal frame at both ends. Cross beams at floor level supporting conveyor stringer beams shall be made of single rolled steel beam or single channel section (ISMB or ISMC) or plate girder. Horizontal bracings are to be provided at top & bottom plan of the gallery (latticed girders shall be braced together in plan at the top and bottom). Common end portal frame shall not be used for adjacent conveyor spans. Roof truss shall be provided at upper node points of latticed girders to form an enclosure. The maximum span of overhead gallery shall be limited to 25 meter unless higher span is required due to site conditions, which shall be subject to approval of the Engineer. The gallery should as far as possible be erected as a box section keeping all the vertical and horizontal bracing tied in proper position. The gallery should be checked for all erection stresses that are likely to develop during handling and erection and if required, temporary strengthening of gallery members during erection shall be made. Contractor can also use tubular steel sections for roof truss of conveyor galleries only. The tubular steel section shall be of circular/rectangular/square shape. The circular steel tube shall conform to IS:1161 and rectangular/square steel sections shall conform to IS:4923. The steel structures using tubular sections shall be designed and fabricated as per IS:806 – “Code of Practice for use of steel tubes in general building construction.” and EN 1993-1-8:2005. Seal plates under the conveyor galleries shall be provided in such a way that complete gallery bottom shall form a leak proof floor. Grade slab with brick toe wall and plinth protection along with drains shall be provided throughout the length of the ground conveyors. Top of pedestal for ground conveyor portals shall be 300mm above FFL. Bottom of the base plate of the columns of the trestles in Main Plant Block Area shall be kept 1.2m below the finished floor level of ground floor of Main Power House. For double stream conveyor gallery, two side and one central walkway of minimum width 800 mm and 1100 mm respectively shall be provided. The minimum width of two side walkways for single stream conveyor gallery shall be 800 mm and 1100 mm respectively. Both sides of central and side walkways shall be provided with pipe handrails all along the conveyor gallery.			
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	Hand railing should not be supported on conveyor supporting stringers. The walkways shall be chequered plate construction with anti - skid arrangement. The anti - skid arrangement will consist of welding of 10 mm square steel bars at a maximum spacing of 500 mm along the length of the gallery. Where the slope of walkway is more than 10°, chequered plate steps with nosing and toe guard shall be provided. The floor of conveyor gallery all along the gallery length, shall be provided with minimum 12 gauge thick seal plates (suitably stiffened) and other drainage arrangements as specified elsewhere. Trough belt conveyor gallery shall have permanently colour coated steel sheet covers on roof and both sides. However, in roof, a panel of minimum 1.5 m x 1.5 m area at about 6.0 m center alternatively on both slopes, shall be provided with translucent sheets of polycarbonate material for natural lighting. A continuous slit opening of 500 mm shall be provided on both sides just below the roof sheeting. Adequate provision of windows shall be kept on both sides of conveyor gallery as appended in Mechanical Section (Belt conveyor system). Windows shall be provided with wire mesh as specified elsewhere in this specification. Cross - over with chequered plate platform and ladder for crossing over the conveyors shall be provided at approximately every 90m intervals of conveyor. Crossover shall preferably be located over four-legged rigid trestle location. For railway tracks passing below overhead conveyor gallery and along conveyors, the railway clearances both underground as well as over ground shall have to be adhered to for design, execution and erection of foundations, trestles, galleries etc., so that movement of locomotives and wagons is not hampered in any way during execution and afterwards. However, at the location where the overhead conveyor gallery crosses road / rail line, minimum clearance of 8.0m above the road crest / rail top shall be provided. For calculation of material load on moving conveyor, a multiplication factor 1.6 shall be used to take care of inertia force, casual over burden and impact factor etc. Thus material load per unit length of each moving conveyor shall be 1.6 X Rated Capacity of Conveyor system X F Conveyor Belt Speed Where, F = 1100/800 for coal, 1700/1400 for lime & 1250/900 for gypsum It should be noted that for structural design, unit weight of lime shall be considered as 1700 kg/cu. m, unit weight of gypsum shall be considered as 1250 kg/cu. m. It should be noted that for structural design, unit weight of coal shall be assumed as 1100 kg/cu. m. Conveyor Gallery structure shall be designed considering both conveyors operating simultaneously. Conveyor gallery and supporting trestles located between transfer houses / buildings shall be		
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	arranged in any one of the following ways. a) All gallery supporting trestles shall be four legged type only. One end of each gallery span shall be hinged to the supporting trestle and the other end shall be slide type. Slide type support shall be with PTFE bearings to allow both rotation & longitudinal movements. OR b) In between transfer houses / buildings, four legged trestles shall be placed at a maximum interval of 90 metres. The arrangement shall be such so as to ensure that force in the longitudinal direction (i. e. along the conveyor length) of conveyor gallery of length not more than 90 m is transferred to any four legged trestle. In the space between each successive four legged trestles, two legged trestles shall be provided at regular intervals. The end supports resting on the four-legged trestle can have either ends hinged or one hinge and the other on slide type depending on the arrangements. Slide type support shall be with PTFE bearings to allow both rotation & longitudinal movements. End of conveyor gallery which will be supported over transfer house, shall be so detailed that only vertical reaction is transferred from conveyor gallery and no horizontal force in longitudinal direction is transferred from conveyor gallery to transfer house structure and vice - versa.			
5.23.03	For trestles and trestle foundations for conveyor galleries located adjacent to existing structures, over ground and underground facilities, location and details of these trestles and foundations shall have to be decided such that there is no interference both underground as well as over ground with existing structures and facilities. Base plates of trestle columns shall be kept 300 mm above the finished ground level.			
5.23.04	Transfer Houses The over ground portion of all transfer houses shall be framed structure of structural steel work with permanently colour coated profiled steel sheet side cladding (from lowest working floor level till top) and RCC floors comprising of RCC slab over profiled metal deck sheets (to be used as permanent shuttering without considering any composite action effect of metal deck sheet) over structural beams. Shear anchor studs shall be provided through metal deck at regular interval on all top flange/flange plate of structural beams.However, the lower portion of side cladding, at ground, for a minimum height of 0.9 m above the finished floor level shall be one brick thick wall plastered on both side. In some areas like MCC floors etc., one brick thick wall cladding shall be provided. Brick wall cladding shall be supported on encased wall beams and suitably anchored to adjoining columns and beams. Vertical bracings shall be provided only on four sides along the periphery. Grade slab with brick cladding of 0.9 m height, plastered on both sides shall be provided for all transfer houses. Bottom of the base plate of the columns of the transfer houses in Main Plant Block Area shall be kept 1.2m below the finished floor level of ground floor of Main Power House. Adequate steel doors and windows for proper natural lighting and ventilation shall be provided. In addition to steel windows, panels of suitable size to suit the architectural treatment and made of translucent sheets of polycarbonate material shall also be provided on the side cladding for natural lighting. The roof of Transfer points shall be provided with pre-fabricated insulated metal sandwich panels. Pre-Fabricated Insulated Metal Sandwich Panel for Roofing shall be laid to specified slope. Composition of Insulated Metal Sandwich Panels shall be as described in relevant			
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5.23.05	section of Technical Specification. Adequate slope shall be provided for quick drainage of rain water. For Lime handling transfer house RCC floors comprising of RCC slab over profiled metal deck sheets (to be used as permanent shuttering without considering any composite action effect of metal deck sheet) over structural beams. Crusher Houses The crusher house shall be framed structure of structural steel work with permanently colour coated profiled steel sheet side cladding. However, panels of suitable size to suit the architectural treatment and made of translucent sheets of polycarbonate material shall also be provided on the side cladding for natural lighting. The lower portion of side cladding, at ground, for a height of minimum 0.9m above the finished floor level shall be of one brick thick wall plastered on both faces. Floors shall be of RCC comprising of RCC slab over profiled metal deck sheets (to be used as permanent shuttering without considering any composite action effect of metal deck sheet) over structural beams. Shear anchor studs shall be provided through metal deck at regular interval on all top flange/flange plate of structural beams. Within this building, cubicles for resting room of operators shall be constructed with one brick thick brickwork having both sides plastered and roof slab. Adequate steel doors and windows for natural lighting and ventilation shall be provided. Vertical bracings shall be provided only on four sides along the periphery. The roof of crusher house shall be provided with pre-fabricated insulated metal sandwich panels. Pre-Fabricated Insulated Metal Sandwich Panel for Roofing shall be laid to specified slope. Composition of Insulated Metal Sandwich Panels shall be as described in relevant section of Technical Specification. Adequate slope shall be provided for quick drainage of rain water. If any equipment to be located on the roof of lime crusher house, roof shall comprise 150 mm thick RCC slab(measured over crest of the metal deck) over profiled metal deck sheets (to be used as permanent shuttering without considering any composite action effect of metal deck sheet) over structural beams. Crushers shall be supported on RCC deck, which in turn will rest on suitable vibration isolation system consisting of springs and dampers. This RCC deck shall be isolated from the floor. However, the vibration isolation system consisting of springs and dampers may rest on main building framework. Detailed specification of vibration isolation system including the unbalanced force, frequency and amplitude criteria and other design requirements are appended elsewhere in this specification.			
	5.23.06	Stacker Reclaimer Foundation Stacker – Reclaimer (S/R) foundation shall be in RCC and shall be designed as RCC framed structures (in longitudinal & transverse direction). Lateral tie beams between two rail supporting elements shall be provided at a regular interval of approx. 3.0 m center. Conveyor short posts shall be supported on RCC beams at grade level. The foundation shall be designed for the most critical combination of loads as furnished by the equipment supplier. RCC retaining wall on both sides of the S/R foundation shall be provided as shown in the tender drawing.		
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5.23.07	The portion between the two rails and between rail and retaining wall on both sides shall be paved in concrete as per specification for grade slab of ground level specified elsewhere. However no metallic hardener finish over RCC slabs is to be provided. Drains shall be provided along the rails for drainage of rain / dust suppression / floor washing water. Drains shall be routed on both sides of the foundation along the rail as shown in Tender Drawing. Drains shall be connected to the network drainage system for finally discharge into coal settling tank. RCC drains shall be provided in Coal stockyard area with precast RCC covers. Control building, M. C. C. Buildings These shall be steel or RCC framed building with RCC roof and floor. For steel framed building roof/floor comprise of RCC slab over profiled metal deck sheets (to be used as permanent shuttering only) over structural beams. Shear anchor studs shall be provided through metal deck at regular interval on all top flange/flange plate of structural beams. Cladding shall be of brickwork/concrete block work with plastering on both sides. Bidder has also the option to supply and construct pre-engineered buildings. Roof shall be provided with roof water proofing treatment, as specified elsewhere in the Technical specification. Suitable arrangement shall be provided so as to prevent ingress of water into the cable trenches inside the building from cable entry locations. All air - conditioned areas, shall be provided with the false ceiling system(details specified elsewhere) with under deck insulation. Adequate aluminium doors and windows shall be provided for natural lighting, ventilation and view. All windows in air conditioned rooms shall have hermetically sealed double glazing.			
5.23.08	Pump Houses These shall be framed structure of structural steel work with permanently colour coated profiled steel sheet roof, grade slab and RCC foundations etc. Roof shall be provided with troughed profile permanently colour coated sheet with slope of 1 in 5 for quick drainage of rain water. Brick wall cladding (1m height above FFL) shall be provided all around the periphery of pump houses			
5.23.09	Pent House These shall be of RCC framed structures with columns, beams, slabs and foundations etc. Cladding shall be of brickwork with plastering on both sides. Roof shall be provided with roof water proofing treatment as specified elsewhere. Adequate nos. of steel doors and windows shall be provided for natural lighting and ventilation.			
5.23.10	Gypsum Storage Shed The Gypsum storage shed shall be RCC framed structure with RCC wall (upto Tripper floor) and structural steel shed with permanently colour coated profiled steel sheet roof and side cladding (above Tripper floor). Roof shall be provided with troughed profile permanently colour coated sheet with slope of 1 in 5 for quick drainage of rain water. At grade level Heavy duty paving as detailed elsewhere in the specification shall be provided inside the shed. Finished floor level of Gypsum storage shed shall be kept at least 500mm above the finished			
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5.23.11	ground level. The building shall be provided with 750 mm wide plinth protection all around as detailed elsewhere in the specification.			
	Toilets			
	Toilet with potable water line facilities shall be provided in each of the following locations:			
	(A) Crusher House (Ground Floor) – (Gents Toilet – 1 No for each.)			
	(B) In CHP/LHP/GHP Control Room building – (Gents and Ladies Toilets-1 No. each)			
	(c) Wagon Tippler control room building- (Gents Toilet-1 No for each.)			
	Each Gents toilet shall have brick enclosure, and the following fittings.			
	i)	Wall mounted glazed vitreous china European water closet with low flush having flow rate of 6.0 litres and 3.0 litres of water per flush, dual flush adopters for standard flushing for solid waste and a modified smaller flush for liquid waste flushing valves shall be provided.	1 no.	
	ii)	White glazed vitreous china flat back lipped urinal 390x375x610 mm (approx.) fitted with photovoltaic controls for flushing system and all requisite fittings.	1 no.	
	iii)	Wash Basin 450x550 mm (approx.) mounted over 18 mm thk granite beveled edge counter fitted with photovoltaic control system for water controls, bottle trap with two taps and all requisite items.	1 no.	
iv)	Mirror 600x900x6mm thk. with beveled edges (Superior sheet glass) mounted with teak wood beading and minimum 12 mm thk. plywood backing.	1 no.		
v)	C.P. Brass Towel Rod 600 x 20 mm	1 no.		
vi)	Liquid Soap Container	1 no.		
vii)	Washing Tap (CP Brass)	1 no.		
viii)	Overhead Polyethylene water tank (min. 500 litres capacity)	1 no.		
ix)	Suitable provision for installation of drinking water cooler.	1 no.		
x)	Space for Janitor room	1 no.		
	Ladies toilet shall be similar to gent’s toilet as detailed above, except item at s.no. ii and ix (urinal and provision for drinking water cooler). Package type STP shall be to be provided.			
	No other facilities shall be provided below toilet block except toilet. Toilet facilities shall be provided at control room floor level.			
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5.23.12	Staircases All floors of transfer houses/crusher houses and roof/floors of all multistoried MCC/Control room buildings shall be accessible through staircase and mumty of staircase of mcc/control room shall be accessible through cage ladder. Cage ladders (min. 450mm wide) shall be provided for access to roof of penthouses & MCC/control room (with only ground floor). All stairs of over ground portion of transfer houses & crusher house shall be of steel (minimum 1200 mm wide) and maximum rise should not be more than180 mm and minimum tread width- 250 mm. Stringers shall be of rolled steel channel (minimum ISMC 250) and tread shall be of electro forgedsteel gratings. Stairs shall be provided with 32 mm dia nominal bore medium duty M. S. pipe hand rail. Handrails (for staircases, around openings, in walkways etc.) shall be of standard weight steel pipe of flush welded constructions, ground smooth using 32 mm nominal bore medium class pipe provided with double rail, top rail about 1.0 metre, minimum above platform level (upto height of 12m the height handrail shall be 1.0 m and above 12m height the height of handrail on staircase landing and around cutouts and openings shall be 1.2 m) and pipe posts spaced not more than 1.5 metres apart. Angle handrail post may be provided when specifically called for in drawings approved by Engineering. Toe guard of size 100mm x 6mm shall be provided along the railing for all steel platforms/landings and RCC staircases. Smooth uniform curves and bends shall be provided at stair returns and also where so ever required. Posts connected to curb plates shall have a neat closure at the bottom and a 6 mm thick plate neatly welded to posts for attachment to curb plate. All necessary fittings including inner dowels at splices, brackets, belts, bends, flanges and chains, where required shall be plugged and welded. A minimum radius of 3 times the pipe diameter shall be provided at all points of direction changes in the handrail. Treads and landing shall be suitable for the prescribed loading. The maximum width of openings in gratings shall not exceed 40 mm. The minimum size of main bars shall be 25 x 6 mm and cross bar shall be 6mm. The usual span of grating will not generally exceed 1.5 meters. Stair case gratings shall be galvanized to grade 610g/m². All gratings shall be electro forged types. Outside stairs to transfer points shall be open type. However, sheeting shall be provided at the top. Stairs of MCC/control room, wagon tipplers/track hopper and underground TP's shall be of RCC construction. The minimum width of stairs for MCC/Control room, wagon tippler, reclaim hopper/underground TP's shall be 1200 mm. Maximum rise should not be more than 180 mm and minimum tread with 250 mm. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection for treads of stairs in wagon tippler/underground TP's. Numbers and arrangement (including enclosures etc.) of stair cases shall be such as to meet the fire safety requirement as per guide lines of statutory regulatory bodies. External fire escape staircase along with internal staircase shall be provided for crusher house and multi-storied MCC cum control room building. Minimum headroom in all staircases and all levels shall be 2200mm from floor finish level.			
5.23.13	Trenches			
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	All trenches for cables or any other underground facility as detailed out elsewhere shall be of RCC Cable trenches shall be provided with pre - cast RCC covers / chequered plate cover. Cable trenches as well as pre - cast covers shall be provided with edge protection angles. Lifting hooks shall be provided for all pre - cast RCC covers. All embedments / block outs as required and specified elsewhere in these specifications shall be provided. Trench pre - cast cover weight shall not be more than 65 Kgs. At road crossings & entry locations, RCC trench covers designed for 10 T wheel load at centre shall be provided. Pre - cast covers shall be designed for central point load of 75 Kgs. RCC cable trenches shall be filled with sand after erection of cables, up to top level and covered with pre - cast RCC covers. For cable trenches outside buildings, top level shall be 200 mm above G.L and sand filling shall be overlaid with 50 thk. PCC. Minimum 50 x 50 x 6 mm size angles with lugs shall be provided as edge protection all around cut outs / openings in floor slabs, edges of drains supporting grating/precast RCC covers, edges of RCC trenches supporting pre - cast covers, supported edges of pre - cast cover.			
5.23.14	Cable gallery/trestles			
	Cable galleries/trestles shall be made of structural steel. The contractor can use either rolled sections or tubular steel sections. The tubular steel section shall be of circular/rectangular/square shape. The circular steel tube shall conform to IS:1161 and rectangular/square steel sections shall confirm to IS:4923. The steel structures using tubular sections shall be designed and fabricated as per IS:806 – “Code of Practice for use of steel tubes in general building construction.” and EN 1993-1-8. Glavanised gratings shall be provided for walkways as per approved electrical drawings. Ladders shall be provided for access from ground to cable galleries at maximum 100m intervals.			
5.23.15	Structural shed over stock pile area			
	Space frame Structure for stockpile area shall cover the complete stockpile area. The structure shall have suitable arrangement for fixing of solar panel over its surface. Walkway at the regular interval and staircases (at every 100 m interval along the length of the shed and on both side) shall be provided for the maintenance of solar panels. Maintenance walkway shall also be provided inside the stockpile area. The complete structure shall be covered with cladding as mentioned elsewhere in specifications. However, on the both sides, till 2.1 m for NGL, structure may be left open. Polycarbonate sheet of 2 mm thick for 5% of the total area shall be provided for skylight in the matching profile. Structural steel pipes/tubes to be used shall be electric resistance or induction butt welded (ERW) as per IS 1161/1239/3589/4923. Bolts shall be high tensile bolts as per IS 1363/1364 of minimum 10.9 grade. Pipes shall be designated by their normal bore. These shall be light, medium or heavy as specified depending upon the wall thickness. Pipes shall be clean finished and reasonably free from scale. They shall be free from cracks, surface flaws, lamination and other defects. The ends shall be cut clean and square with axis of the pipe unless otherwise required per design/drawing. Minimum thickness for tubular section shall be 4 mm. Minimum section thickness for Purlin shall be 2.5 mm. The tubular section shall be effectively send at the end to avoid any corrosion. SOLID NODES: Only full solid spherical nodes as per design should be used throughout the work. The node shall be made of EN9 equivalent material or higher grade.			
5.23.16	Limestone Storage Silo			
	The supporting structure for silo shall be of structural steel. Enclosure with side metal cladding is to be provided above Limestone Storage Silos for limestone handling equipment. Side metal cladding is also to be provided for outgoing conveyors below limestone storage silos.			
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5.23.17	Stored Limestone load shall be treated as dead load for analysis and design of silo supporting structure. Drainage & Water Supply Works			
5.23.17.01	Drainage System:- The drainage arrangements shall be so planned so as to ensure quick disposal of drainage water without stagnation and / or overflow. It is envisaged to clean the conveyor galleries, transfer points, crusher building, penthouse etc. with water periodically. Minimum 4 nos. down comers shall be provided in each transfer house / crusher house. In case of conveyor galleries, the down comer shall be provided at every trestle location. Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the owner's coal slurry settling pond. For all coal Conveyors, each down comer shall lead the water / coal slurry to RCC pit (of 2 Cu.M capacity) to allow settling of coal. The water from the pit shall overflow into contractor's R.C.C drain, which will lead the discharge finally into coal slurry settling pond. For Crusher House, pent house, transfer house each down comer shall lead the water / coal slurry into the peripheral drains (Brick drains with steel gratings provided around the building) which will lead the water / coal slurry to water / coal slurry to RCC pit (of 2 Cu.M capacity) to allow settling of coal. The water from the pit shall overflow into contractor's R.C.C drain, which will lead the discharge finally to the coal slurry settling pond. For Wagon Tippler & transfer houses peripheral drains (Brick drains with steel gratings provided around the building) shall lead the water / coal slurry to a local RCC pit (of 2 Cu. M. capacity) near each facility to allow settling of coal. The water from the pit shall overflow into contractor's R.C.C drain, which will lead the discharge to a coal slurry settling pit. In case of Control rooms and MCC buildings, Pump houses, etc water / coal slurry coming from down comers shall discharge into peripheral drains (Brick drains with steel gratings provided around the building) which will lead the water / coal slurry into contractor's RCC drain, which will lead the discharge finally into coal slurry settling pond. Suitable kick plates/Curb beams shall be provided around the floor openings, stair case landings, in the transfer points, crusher house and other buildings. Contractor's scope shall also include construction of necessary culverts under the rail lines / roads as per railway / IRC standards and approval of Railway culverts from concern Railway authorities.			
5.23.18	Internal and external water supply, drainage etc.:- The scope for potable water supply includes all distribution systems, tanks, pipes, fittings etc. as required and as described here or elsewhere in these specifications. The scope for service water supply and dust control water supply shall be as described elsewhere in these specifications.			
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For water supply, medium class galvanized mild steel pipes conforming to IS: 1239 shall be used.

The scope for drainage of surface water shall include design, layout and construction of drains for and from buildings and drains required for coal stockyard area, drainage up to main coal slurry settling tank including connection with the tank. Drainage system shall be designed for maximum intensity of rainfall as 75 mm/hr and 60 % runoff coefficient. Moreover, the drainage system shall also comply to detail mentioned in project information chapter. All buildings (including transfer houses, crusher house, MCC rooms, pump house etc.) shall be provided with open surface brick drains of minimum size of 300 mm width and 300 mm depth with removable steel gratings all around the periphery. All drains excepting the peripheral drains around the transfer points, crusher house, control / MCC. buildings, pumps house etc., shall be of RCC construction. All open RCC drains shall have removable steel gratings designed for loads as specified under loading clause. Minimum size of main bar of steel grating (Galvanised to 610 gm/m²) shall be 25 mm x 5mm and cross bars 6mm. At all entry or road/rail crossing point's RCC box/pipe culvert shall be provided. The opening size of grating shall not be more than 90 mm x 35 mm. All drains as well as pre - cast covers shall be provided with edge protection angles and lifting hooks.

However, drains in coal stockyard area shall have pre cast RCC covers. RCC pre - cast cover weight shall not be more than 65 Kgs. RCC pre-cast covers near entry or at road crossings shall be designed for 10 T wheel load at centre. RCC pre - cast covers shall be designed for central point load of 75 Kgs.

The scope for foul water from toilets shall include layout and laying of sewers for sewerage system together with all fittings and fixtures and inclusive of ancillary works such as connections, manholes and inspection chambers within the building and from the building to the terminal point.

For rain water down comer and those to be used for conveying water / coal slurry generated from cleaning of walkways/floors, Galvanized MS pipes conforming to IS: 1239 (for 150 mm NB Medium grade pipes) with welded joints shall be provided for MCC buildings, penthouse, control rooms and Galvanized steel ERW pipes (273mm OD, 4mm thk) of steel grade Fe330 conforming to IS: 3589 with welded joints shall be provided for all TP's, Crusher house, and Conveyor galleries.

Galvanizing shall be as per IS: 4736. The minimum mass of zinc coating shall not be less than 360 gms/sq.m. as per IS:6745. The zinc coating shall be smooth and shall be subjected to testing as per IS: 2633, for uniformity of coating. The zinc coating shall be free from all defects as per IS: 2629.

All rain water down comers shall be provided with roof drain heads and complete with shoes bends, junctions, sockets, adapters, brackets and finished with anti-corrosive painting over a coat or primer.

For design of building drainage system IS: 1742 shall be followed.

For sanitary / sewerage pipes above ground, sand cast iron pipes conforming to IS : 1729 with leak proof lead joints.

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5.23.19	For underground drain pipes, minimum class NP - 2 pipes conforming to IS: 458. At road crossings, concrete pipes of class NP 3 conforming to IS: 458 and at rail crossing RCC box culvert to be provided. For sewerage below ground stoneware pipes conforming to IS: 651 with concrete bedding and haunch. Roof Details Roof slabs for CHP, LHP and GHP buildings shall be minimum 150 mm thick(in case of metal decking thickness shall be measured from crest top) and shall have minimum 10 dia HYSD reinforcement bars placed at 200 mm center both ways at top and bottom. 1000 mm high and minimum 100 mm thick RCC parapet wall shall be provided over roofs of all buildings. However, for mumty, 600mm high parapet wall shall be provided. Parapet wall shall have suitable coping. External face of parapet wall of the buildings provided with metal cladding shall also be finished with metal cladding of design and colour as per approved architectural drawings. Junction of roof and parapet shall be provided with 150 x 150 mm size concrete fillet. Drain level shall be provided with 45 x 45 cm size khurras having minimum thickness of 30 mm of M-15 concrete over PVC sheet of 1 m x 1m x 400 micron and finished with 12 mm 1 : 3 cement : sand plaster. Roofs of all M. C. C./control rooms, crusher house and TP(if applicable), penthouse etc., shall have roof water proofing treatment. Roof water proofing treatment shall be as mentioned else where in specification. Roof of pump house shall be provided with single skin troughed profile permanently colour coated sheet with slope of 1 in 5 for quick drainage of rain water.			
	5.23.20	Floors and Grade level details		
5.23.20.1	DELETED			
5.23.20.2	The floor slabs shall be minimum 150 mm thick(in case of metal decking thickness shall be measured from creast top) and shall have minimum 10 dia HYSD reinforcement bars placed at 200 mm center both ways at top and bottom. The RCC slab shall be designed without considering any composite action effect of metal deck sheet (ie the structural strength of metal deck sheet shall not be considered for RCC slab design). Floors of transfer points shall have cross slope of not flatter than 1: 80, towards the floor washing drainage outlets, for efficient drainage. For ground conveyor & crusher house slope shall be 1:100. Chequered plates (used for floors, walkways etc.) shall be minimum 6 mm thick o/p or as indicated on drawings. The chequered plate pattern shall be approved by Employer / Engineer. Mild steel flats/angles of suitable size shall be welded to the bottom portion of chequered plates at a designed spacing to stiffen chequered plates to restrict deflection within span/200. Chequered plates shall be fixed by staggered welding of suitable size. Toe guard of size 100 x 6 mm shall be provided at various openings provided in floors e.g.			
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5.23.21	around stair case openings, chute openings and other similar cutouts. For conveyor walkways, angle runner to act as toe guard shall be provided. All along the periphery of RCC floors (where no brick masonry walls are provided) 100 mm thick 300 mm high RCC wall and 900 mm high steel hand rails all around over this RCC wall shall be provided. The grade slab shall consists of 230 mm thick rubble soling (63 mm downgraded hard stone aggregate as per IRC specification, watering and compaction to minimum of 90% Standard Proctor density, including filling the interstices of stone aggregates with sand), over well compacted earth, overlaid by 75 mm thick P. C. C. M-7.5 and 100 mm thick RCC of grade M-20 with minimum 8 mm dia bars placed at 200 mm C / C in either direction respectively. There will be minimum 50 mm thick metallic hardener finish over the RCC slab. All buildings (including Wagon Tippler and machinery hatches, truck hopper, penthouse, MCC rooms, pump houses, transfer houses and crusher house) and ground conveyors shall be provided with 750 mm wide plinth protection all around. It consists of 50 mm thick P.C.C. M-20 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed, consolidated and grouted with fine sand. An area of 5 m width all round the water tanks near pump house, transfer houses and crusher house, Gypsum storage shed, truck tippler area, lime storage silo shall be paved. This paving will be in addition to plinth protection. The paving construction shall be as per specifications for the grade slab at ground level. However, 50 mm thick metallic hardener finish is not required to be provided in paved area. Paving shall also be provided in HGTU and VGTU area. Heavy duty paving shall be provided inside the building(Gypsum storage shed) if any vehichular movement is envisaged. Finished Floor level of all buildings shall be kept at least 500 mm above the finished grade / formation level.			
	Brickwork and allied masonry works			
	Brickwork cladding for various structures shall be so provided that there is a clear gap of 40 mm between inside face of external brick wall and outside face of column flange. Structural steel wall beams supporting brickwork shall be provided at a maximum spacing of 3m and suitably encased with plaster or 1:2: 4 concrete as the case may be. In case of box type steel beam, encasement shall be done with cement sand plaster in specified thickness and proportions over G. I. wire netting of 0.9 mm thickness. 50 mm thick Damp proof course shall be provided at plinth level for all brick wall.			
	CONCRETE			
	Refer General Specification.			
5.23.22				
5.23.23	De-watering of Deep Excavations			
	For deep underground structures like track hopper, tunnels and underground transfer houses, requiring open excavation with extensive de - watering, completely dry working conditions during excavation, shuttering, placement of reinforcement, concreting, water proofing of structures, backfilling and any other operation shall be maintained by suitable de - watering method of suitable capacity.			
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5.23.24	Galvanising All burrs and irregular edges of the structural steel members to be galvanised shall be ground smooth before galvanising. Purity of Zinc to be used for galvanising shall be 99.5 % as per IS : 209 (latest edition). The weight of the zinc coating shall be at least 610 Gms. / m ² unless noted otherwise.		
5.23.25	CHEMICAL INJECTION GROUTING Minimum, 12 mm dia (NB) threaded nozzle of suitable length, shall be provided over the surface and along the construction joint line in a grid pattern at a spacing not exceeding 1.5 m c / c before concreting operation. Adequate precaution shall be taken to keep the nozzles plugged at both ends to prevent them from getting closed by concrete. For fixing of any nozzle in set concrete suitable size hole shall be drilled, preferably by using percussive hammer drill electrically operated, in grid pattern and grouting nozzle shall be fixed in these holes. After the nozzles are fully set, neat cement slurry admixed with water soluble non - shrink polymer / monomer based chemical shall be injected through the net - work of nozzles with low pressure grout pumps at a pressure of about 2.0 Kgs. / cm ² . Cement slurry shall be prepared by mixing cement with non-shrink polymer/monomer @ 500 gm/50 kg bag of cement and water, ensuring that Water: Cement ratio does not exceed 2 (by weight). Wetter the structure, lesser should be the water cement ratio. The property of the polymer/monomer should be such that when it is mixed with water @0.5% by weight of water, the viscosity of the resultant solution (water and polymer/monomer) should not be more than 1.2 centipoises. Plasticizing agent shall be added wherever required. The grouting shall be started at very low pressure and increased gradually to a required pressure. The grouting shall continue, till the hole refuses to take any further grout, even at an increased pressure. Applied pressure shall not be more than the designed strength of the concrete. After completion of grouting operation, the nozzles shall be sealed properly to the satisfaction of the Engineer.		
5.23.26	POLYMER MODIFIED CEMENTITIOUS COATING		
5.23.26.1	Materials Modified liquid polymer blend shall be a dispersion containing 100 % acrylic based polymer solids. Polymer shall be mixed in the ratio of 1 cement: 0.5 polymer (for minimum solid content of polymer 30%). Portland cement based dry powder. Clean, fine specially prepared quartz sand approximately 0.6 mm size.		
5.23.26.2	Mixing The liquid polymer shall be stirred well and cement based powder shall then be added slowly to make a Slurry Mix. For preparation of Brush Topping Mix, quartz sand shall be added slowly and mixed well till a homogeneous mixture is obtained. The mix shall be used within half an		
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5.23.26.3	hour of the preparation. Addition of quartz sand may not be necessary, in case dry power contains the same. Properties of Polymer Modified Cementitious Coating It must adhere to wet surface. It should develop adequate bond strength, with the concrete surface, not less than 2 N / Sq. mm. Co - efficient of permeability shall be about 5×10^{-10} Cm / Sec. Water absorption after continuous soaking shall not be more than 1 %. The materials shall be permeable under water vapour. The material shall be resistant to acids and alkalies present in the soil and underground water with normal pH value between 4 and 14. The co - efficient of thermal expansion of the material shall be close to that of concrete.			
5.23.26.4	Application The concrete surface shall be cleaned and made free from grease, oils or loosely adhered particles. The surface shall be damp without any free water. For exterior underground part, application (b) pertaining to Brush topping Mix shall be followed. (a) For Slurry Mix A minimum of 2 coats shall be applied on the surface. The first coat being applied, when the surface is still damp and left to harden for 4 to 6 hours. After 4 to 6 hours of the application of second coat, it shall be finished by rubbing down with a soft dry sponge. The coverage shall not be less than 1 : 1 Kgs. / m² in the 2 coats. A lap of 75 mm shall be provided at the joints. The coating shall be air dried for 4 to 6 hours and, thereafter, cured for 7 days after the application of last coat. (b) For Brush Topping Mix This shall be applied in two coats. A primary coat of slurry mix can also be first applied on the surface as first coat. After the coating has dried up, a coat of Brush Topping Mix shall be applied over it with a push broom or any other similar brush. It shall be left in broom finished condition. The nominal thickness shall be 1.5 mm and minimum thickness shall be 1.0 mm. A lap of 75 mm shall be provided at the joints. It shall be ensured that no pinhole exists and rebrushing shall be done to cover the pinholes, if any. The Coating shall be air dried for 4 to 6 hours and thereafter cured for 7 days after the application of last coat.			
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	Rate of application of coating shall be established to achieve the required thickness.		
5.23.27	Miscellaneous		
5.23.27.1	Ordinary form work shall be used in roofs and floor slabs in transfer houses, footings, pedestals, cable trenches, pits etc., Plywood form work shall be used for all over ground exposed work like columns, beams, floors and ceilings in control room and M. C. C. buildings.		
5.23.27.1	Monorail girders and fixtures shall be provided for monorails at the locations as required and as described elsewhere in these specifications or drawings. Monorail openings in the walls shall be provided with steel frame doors preferably sliding type or otherwise open able inside, access platforms and ladders.		
5.23.27.1	Steel frame around openings in roof and on external walls for mounting of exhaust fans shall be provided. Ready mix non - shrink cementitious grout of reputed manufacturer as approved by the Employer shall be used for grouting of block outs and foundation bolts, underpinning of base plates and machine bases. Crushing strength of grout shall be one grade higher than the foundation concrete. Minimum crushing strength shall be 30 N / mm² unless higher strength requirement is specified by the equipment supplier or the grout manufacturers. The bottom of steel in case of cable / pipe galleries and trestles shall be generally 3m above the ground except for rail / road crossing where it shall be 8m above the rail top / road crest/ground. Further in bunker areas it shall be 8 m above the ground. Polysulphide Sealing Compound shall be two-part polysulphide sealant and shall be from approved manufacturer, conforming to IS : 12118. Materials shall consist of polysulphide polymer and a curing agent. Gun grade material shall be used unless otherwise specified. The application of the sealant shall be strictly followed as per manufacturer's guidelines.		
5.23.28	SHOTCRETING General Requirements Generally, shotcreting shall be done in accordance with IS : 9012. Reinforcement for shotcreting shall be as detailed below, unless specified otherwise. (a.) Reinforcement in one direction consisting of 6 mm M. S. bars at 750 mm c / c shall be connected to the lugs for fastening of the wire fabric. This shall be used in case of 50 mm or above thick shotcreting. (b.) Wire fabric conforming to IS : 1566 shall be used as reinforcement and shall consist of wire, 3 mm diameter, spaced 50 mm both ways and shall be electrically cross welded. Wire fabric shall be securely tied to 6 mm bars for 50 mm thickness. Adjacent sheet of wire fabric shall be lapped at least 100 mm and tied. (c.) Clear cover to reinforcement mesh shall not be less than 15 mm. Minimum thickness of shotcreting shall be 50 mm for abrasion resistant work and 25 mm for ordinary surface protection work. Material		
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5.23.29	Generally, the materials shall be in accordance with aggregates specification given here under. Fine aggregate shall consist of natural sand or crushed stone from a known source and shall be strong, hard, coarse, sharp, chemically inert, clean and free from any coating. It shall be free from clay, coal or coal residue, organic or any other impurities that may impair the strength or durability of the concrete and shall conform to IS : 383. Fine aggregate (Sand) shall be well graded and particles shall range in size within the following limits. The Engineer, may approved the use of any other grading as per requirement or as per IS : 9012. The fineness modulus shall be preferably between 2.5 and 3.3. Any other value can be used, with prior approval of the Engineer. Application After the placement of reinforcement and / or welded mesh and not more than six hours prior to the application of shotcrete, the surface shall be thoroughly cleaned of all loose materials and dirt. The Contractor shall properly prepare the surfaces, reinforcement and / or welded mesh to receive the shotcrete. Cleaned surfaces shall be wetted not more than hour prior to shotcreting. The mix as placed on surface shall be one part cement to three parts approved sand by mass. Cement and sand shall be dry mixed; not water shall be added after mixing and before using in the gun. The quantity of water when added shall be only that which is sufficient to hydrate the cement. For average atmospheric conditions, the water cement ratio for shotcrete in place shall be between 0.35 and 0.5 by mass. Suitable admixture shall be used wherever required. A uniform pressure of not less than 3 kg/cm² at the nozzle shall be maintained. Necessary adjustments shall be made to ensure this pressure, taking into account the length of hose and height of the place to be shotcreted, above location of the machine. The application shall proceed in an upward direction. Beams, stiffeners and intermediate walls, if any, shall be wrapped with wire fabric and completely covered with shotcreting. All rebound shall be removed from the area of application as the work progresses and such rebound material shall not be reused. As soon as the freshly shotcreted surface shows the first dry patches, a fine spray of water shall be applied to keep too moist. After the surface has hardened, it shall be kept continuously moist for minimum seven days. If there is extreme heat, especially when accompanied by hot winds, the shotcreted surface, immediately upon completion, shall be covered with burlap or similar covering, which must be kept continuously moist for 14 days after shotcreting. The temperature of the lining shall not be permitted to exceed 38°C during placing and curing. VIBRATION ISOLATION SYSTEM These specifications are meant for the design, supply and erection of vibration isolation system for supporting coal/limestone crushers. Supporting Arrangement		
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	The crushers shall be supported on vibration isolation system consisting of steel helical springs and viscous dampers. The supporting arrangement for each crusher shall consist of an RCC deck supported on steel helical spring units and viscous damper units which in turn shall be supported on girders. The girders shall be an integral part of the crusher house building. The part of the structure consisting of the RCC deck, springs and viscous dampers shall hitherto be referred to as “spring supported foundation”. The part of the structure, which is below the spring shall hitherto be called “supporting structure”. The Contractor should do the Engineering / design, supply and erection of vibration isolation system consisting of steel helical spring units and viscous dampers supporting the top deck which in turn would support the coal/limestone crushers. The vibrations isolation system supplied shall be of a proven make. The Contractor or his sub - contractor who designs and supplies the system should have designed, supplied and installed such systems for not less than five machines of speeds and unbalance forces comparable to the machine proposed by the vendor. The vibration isolation systems installed by the contractor or his sub - contractor in such machines should have been working satisfactorily for atleast five years			
5.24.00	CHP Workshop cum Office Building This shall be RCC framed structure having two storeys in office area and single storey (double height) in workshop area. Total floor area of the building shall be 900 Sq.m (700 Sq.m. Office area and 200 Sq.m. Workshop).			
5.25.00	O&M WORKSHOP BUILDING The O&M Workshop Building shall be a two bay fully covered building. The two bays shall comprise of workshop bay and office complex bay. The minimum span of workshop bay shall be 25m with RCC columns with structural steel roof truss and purlins supporting pitched roof. Roofing shall be permanently colour coated insulated sandwiched metal roofing sheet. The Gantry girder for the EOT crane in the workshop building shall be structural steel plate girder supported on RCC corbels at column locations. The gantry girder shall be complete with chequered plate walkways (at both sides) and the cage ladder. The Central Workshop Building shall be designed considering EOT crane of 50T capacity. The adjacent Office Complex bay shall have RCC superstructure. The minimum bay width shall be 6.50m. Architectural Features: The building shall be fully covered with brick wall masonry in office portion. For workshop portion brickwall shall be provided upto lintel level and permanently colour coated insulated sandwiched metal cladding sheet above lintel level upto the roof. Provision of doors, windows & Rolling shutters shall be included based on architectural detailed drawing to be developed by the bidder. The rainwater down comers shall be provided at every column location and they shall be suitably connected to the building surface drain. The minimum operating floor area for the workshop bay shall be 20mX50m. The minimum head room of workshop bay shall be evaluated by the bidder based on approved EOT Crane Clearance diagram and crane rail level. The office complex shall be 6.50mX110m in plan area. The office complex shall be made 2 storied for adequate space for operating personnel, MCC room, stores, Laboratories, Toilets, Conference room & Tool room. The floor to floor/ roof clear height shall be 4.50m.			
5.26.00	CANTEEN Salient Features			
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5.27.00	The Canteen Building shall be a RCC framed superstructure with large span roof system. The building shall be designed as per the latest guidelines of IS:456, IS 1893 & IS 13920(for seismic ductility requirement) Architectural Features This building shall be of RCC Frame structure& Autoclave Aerated Concrete Block masonry. The area of building shall be 1100 sq.m. The building shall have entrance lobby, dining hall for staff, dining room for executives, pantry, kitchen, office, stores, wash areas, rest room for kitchen staff, toilets, etc. External finish shall be of Premium Acrylic Smooth Paint with Silicone additives. There shall be separate service road and entrance for supply of cooking materials and garbage disposal.			
	FIRE STATION BUILDING Salient Features The Fire Station Building shall be a RCC framed superstructure. The building shall be designed as per the latest guidelines of IS:456, IS 1893 & IS 13920(for seismic ductility requirement) Architectural Features It shall be of RCC Frame structure& Brick masonry. The building shall be provided with area 600 sq. m required to accommodate Fire tenders and fire personnel including Dy./Asst. Commandant's (Fire) office. The number of fire tenders shall be provided as per CISF norms. The number of fire tenders/equipments shall be provided as given in else where in specification. One drill tower per station shall be provided. Facilities for the staff including Kitchen, Dining Hall, Rest Rooms, Stores, First Aid Room shall be provided as applicable. External finish shall be Premium Acrylic Smooth Paint with Silicone additives.			
	5.28.00	DOZER SHED Architectural Feature This building shall be prefabricated steel framed structure with brick wall up to window sill height & prefabricated insulated double skin metal sheeting cladding above it. Roof of the building shall be prefabricated insulated double skin metal sheeting on steel roof truss. The building shall provide for Dozer shed space, Workshop space, Office Rooms, Stores, Toilet & Pantry as per functional requirement. Minimum size of the dozer shed shall be 500 Sq.m. Metal side cladding shall be composed of different colour shades to match with the other buildings. External finish for brick walls shall be of Premium Acrylic Smooth Paint with Silicone additives.		
		OWNER’S CONSTRUCTION OFFICE The construction office shall be single storey building. The floor area for owner’s construction office shall be 1025 Sqm. The building should be as per the tender drawing.		
	5.30.00	ADMINISTRATION BUILDING Salient Features The Administration Building shall be a multi–storied RCC frame superstructure. The building shall have an RCC Lift structure accommodating the Lifts. The structural framing plan and elevations shall be based on the architectural concept to be developed by the bidder. The minimum thickness of Lift Superstructure RCC Wall shall be 230mm. Design Concept The building shall be designed as moment resisting RCC sway frame in both the orthogonal		
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	directions. For general design guidelines IS 456 shall be followed and for ductile detailing (against seismic load) IS: 13920 shall be followed. Architectural Features This building shall be three storeyed (G+3 stories above)and area 2800 sq.m. with RCC Frame structure& Autoclave Aerated Concrete Block masonry. Floor-to-floor height shall be minimum 4.50m. The building shall be designed based on Tender drawing of Administration Building. It shall have features of local architecture. Hermetically sealed double glazing with toughened Glass to be provided for external glazing. There shall be provisions for Exhibition Hall, Conference Room for 50 persons, Canteen for 30 persons, Bank, Bank ATM space, AHU.,MCC Room, First Aid Centre, Library, offices. Separate toilet facilities shall be provided for ladies and gents in each floor. One toilet shall be provided for physically handicapped at each floor. The building shall have provision of attached toilet with the cabin for senior executives and conference rooms. 2Nos Lifts and minimum 2Nos stairs shall be provided. Lift shaft shall be of R.C..C wall. Covered parking space for 25 nos. cars shall be provided. Covered parking shall be of RCC construction. Open parking space for 40 nos. cars & 75 nos. scooters shall be provided. Minimum 23 sq.m./car (including circulation area) and 5 sq.m./Scooter (including circulation area) shall be considered for working out parking space. The Admin building shall be fully IT enabled. 300x40 mm GI Raceway with standard length 2500 mm single compartment trunking raceways made from 14 gauge (minimum) pre-galvanised sheet including fasteners, floor support, connectors, bends cross-way, earthing stud for fixing etc. complete as per requirement, drawings and instructions of EIC shall be laid under floors of service building for IT enablement. 350x350x50 mm Junction boxes of pre-galvanised sheet with cover plate for raceways shall also be provided. Minimum 70mm Floor finish margin shall be kept for installing metallic raceways. The rain water down comers shall be provided as per General architectural specification.The rain water down comers shall be suitably concealed by the external wall enclosure. Structural Glazing shall have hermetically sealed double glazing. Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting. External finish shall be combination of GRC Tile & aluminium composite panel.			
5.31.00	FQA BUILDING FQA building shall be RCC construction of single or double storey. Total area shall be decided based on the requirements based in QA chapter, however, minimum area shall not be less than 800 Sqm. Apart from space required to accommodate and operate all the equipments mentioned in the equipment list, office space for 5 executives, one meeting room, spectroscopy room, NDT lab, storage room, welding booth, welding simulator area, platforms for instruments/equipments, ladies and gents toilets, space for water cooler and pantry has to be provided as per specifications mentioned elsewhere in the technical specifications.			
5.32	RAILWAY SIDING SYSTEM Talcher is a 'B' Class station located at Km: 469.069 which is the serving station for the existing siding of the TTPS. The siding takes off from Talcher Railway Station at the Rajatgarh Jn. end of the station. The present Talcher Station is also a terminus station and is the facilitating serving station for the Talcher Thermal Power station and its rail yard. Talcher is having eleven lines. A High-Level Passenger platform along with a station building and other passenger amenities exists adjacent to Line No.1.			
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5.32.1	The private siding of Talcher Thermal Power Station siding is taking off from the Down Main Line of Talcher station east end at Ch. 861.865M from Centre line of Talcher station. The lead line of the private siding is 691.765m from proposed take-off point. Dead end of the siding is at Ch: 2529.200m from proposed take-off point.. Survey The bidder shall carry out detailed topographical survey along the selected alignment of siding as per the approved FSR. This survey shall include field data for preparation of index plans, engineering scale plan, longitudinal section & cross sections, detailed engineering of bridges and culverts, opening and level crossings, foot over bridges, drains for the rail track, determination of road crossings at grade or grade separators, road diversions, utility shifting etc.		
5.32.1.1	The alignment of Railway Siding is to be accommodated within the available NTPC land as per the FSR. The assessment of additional land requirement (if any), which may crop up during preparation of Engineering scale plan/ construction stage of the Railway siding, including preparation of land requirement plan with details such as private, govt., forest etc. on Khasara map (including schedules & cadastral map) shall also be in the scope of the Bidder. Identification of structures/buildings required to be demolished and its cost estimate including compensation to be paid to the owner of structure/buildings, if any, shall also worked out by the Bidder and submitted to NTPC.		
5.32.1.2	Identification of culverts for drain, pipe crossings, level crossings, bridges, Foot Over Bridges etc.		
5.32.2	System Design System Design shall include the following:		
5.32.2.1	a) Consolidated traffic study for coal and non-coal movement to the project in view of receipt of coal through BOY, BOX, BOXNHA, BOY25, BOXNLW, BOXNHL, BOXN25, BOX32.5 BOXN and BOBR wagons (in line with RDSO G33, Rev 1 latest guidelines) for Talcher Stage-III (2x660MW). b) Study of additional facilities required inside plant , siding and serving station including the drainage system and other facilities crossing the proposed railway tracks. Study the requirement of locomotives for marshalling /shunting of rakes inside plant, recommended numbers and rating of locomotives required. Finalise the location of track hopper and disposition of inhaul & outhaul tracks. c) Optimize the track work and use of facilities to achieve designed unloading rate on a long term basis. Suggest procedures to deal with exigencies during shunting/marshalling. Study is required for engine on load scheme. d) The system should have capability to release the coal rakes received at the project within the free permissible time. e) Arrangements for Communication system in consultation with Indian Railways, Provision of FOIS (Freight Operation Information System) to know the rake status for Power station at any time. f) Study the manpower requirement/ railway staff requirement to be posted at the cost of Talcher STPP and facilities to be provided. Study should elaborate the advantages and disadvantages on liberalized siding rules and possibility of handling of heavy haul rakes (longer rakes) g) Assessment of electrical (OHE) and S & T requirement h) Assessment of locos and workshop facilities, if any, as required. i) Preparation of detailed system of working and station working rules. The report should		
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5.32.3	contain the traffic study/turnaround time etc. the study may also indicate number of crossing stations/block sections/facilities required for movement			
	j) Construction methodology for the execution of work.			
5.32.4	Detailed Project Report			
5.32.4.1	Preparation of Detailed Project Report (DPR) as per the latest Policy guidelines of Indian Railways, for the proposed railway siding and augmentation of serving station it includes finalization and submission of Detailed Project Report based on final survey results, system design, manpower requirement etc. The detailed project report shall identify the cost estimates inclusive of the work executed through Railways as deposit works and the time schedule for execution of the works.			
	Detailed Engineering			
	Detailed Engineering of complete railway siding system for Stage III project from Railway serving station(s) to the plant including in-plant yard & augmentation of serving station. This covers in general the electrified and non-electrified track, bridges, culverts, buildings, control rooms etc. This will include but not limited to the following:			
	a) Preparation and submission of detailed technical specifications with applicable tender drawings, BOQ, cost estimates with unit rates for each and every item of civil work in tender schedules covering all types of bridge/ culverts, banks and cutting, drainage works, cable trenches, gummies, control rooms, station buildings, track and permanent way including rails,sleepers, points and crossings, fish plates and other track fittings etc.			
	b) Preparation of schedule of quantities of materials for which advance procurement action will be necessary viz. Cement, sleepers, track fittings, rails, ballast, etc. schedule of quantities forworks to be done through deposit work shall also be prepared and submitted separately.			
	c) Preparation and submission of detailed design and construction drawings for each and every item of civil work as elaborated above including geo-technical investigation as required for detailed design of bridges, culverts, embankments etc. All clarifications/ queries on theconstruction drawings during execution including any revision thereof shall be furnished.			
	d) Preparation of detailed design and drawings (and obtaining the approval of Railways and other concerned authorities) for the following.			
	i. Permanent-way			
	ii. Yard Modifications			
	iii. Formation of bank and cuttings			
	iv. Bridges, culverts, crossovers etc.(Incl. Proof checking from concerned Institutes/body's)			
	v. All civil and structural works pertaining to OHE and S&T works(Incl. inspection & commissioning)			
	e) For design of bridges following shall be considered:			
	i. The rainfall storm and catchment area considered for determining flood discharge and criteria for fixing waterway. The expected afflux and its impact on nearby habitated areas should also be examined.			
	ii. Calculations of scour depth for foundation design of bridges.			
	iii. Upstream, downstream and bed protection design and criteria, if any.			
	iv. Design of bridge across canal shall be done as per requirements of the Water Resources Department of Odisha. In addition to obtaining approval of the Railways, the Bidder shall submit the detailed design of the bridge to WRD of Odisha and obtain their approval prior to start of the construction work.			
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5.32.5	Signalling & Telecommunications Existing Signalling arrangements at Talcher Station Existing Talcher Station is on double line electrified section. Signalling is controlled by Electronic Interlocking with of Multiple Aspect Colour Light Signals (MACLS), electrical Motor operated points, track detection with digital axle counters. Traffic monitored and controlled by a Electronic Interlocking Console/VDU with standard III interlocking under Khurda Road division of East Coast Railway. 1.0 Proposed Signalling arrangements: 1.0.1 It is proposed to take off siding from CH.861.865 from central line of Station building. with the Insertion of crossover point and provision of signalling arrangement for trains to proceed towards NTPC proposed In plant yard with all compliments of signalling gears at par with existing signalling at Talcher station in agreement with ECOR including alterations to existing installation 1.0.2 Preparation of detailed system design for signalling, telecommunication works from serving station to In-Plant yard at par with Talcher Station of ECoR and as per the latest RDSO/ Railway specifications. 1.0.3 Construction of Signalling Cabins as finalised in the above scheme for controlling and monitoring of complete traffic from serving station to Talcher plant and rake handling/shunting operation at in-plant yard. It is proposed to install Electronic Interlocking system, Absolute block working system with BPAC(Block Proving by digital Axle Counter) using UFSBI(Universal Fail Safe Block Instrument), console and VDU(Visual Display Unit) with same type and specifications of signalling gears such as Motor operated Points, LED Colour Light Signals, Turn outs, Digital Axle counters, SSDAC(Single Section Digital Axle Counter),MSDAC(Multi Section Digital Axle Counter) for detecting railway track occupancy in plant yard as per latest RDSO specifications. 1.0.4 All the Control communication available at Talcher station which is extended to proposed Signaling cabins at proposed Railway Siding through OFC and Quad cable including Emergency communication. 1.0.5 Approved ESP and SIP for the proposed NTPC Talcher siding takeoff from station and New proposed cabin to be followed while execution of proposed work. Signaling cables as per RDSO specifications and practice followed in ECOR to be followed.			
5.32.6	OVER HEAD ELECTRIFICATION(OHE) EXISTING TRACTION ARRANGEMENTS AT TALCHER STATION Presently Talcher Station is on double line electrified section with 25 kV OHE which is tapping power from the nearest substation under Khurda Road division of East Coast Railway.			
5.32.6.1	PROPOSED TRACTION ARRANGEMENT 1. The Proposed siding of 2x660 MW of NTPC is to be fully electrified with 25 KV Overhead Electrification which is taking off from CH.861.865 from central line of Talcher Station building of Khurda Road Division of ECR. 2. The total track length for overhead electrification is about 7.10 Tkm. It also includes charging of complete OHE of 7.1 Tkm and trial run of electric locomotive. 3. It is proposed to do the Survey and Design for Overhead Electrification work and General Electrification work for NTPC siding line including Testing & Commissioning.			
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	4. The OHE will be Regulated Conventional type as per RDSO design. 5. The OHE masts will be of fabricated/Rolled type. The proposed OHE will be supported by single masts/portals with minimum implantation of 2.8/3.10 meters on tangent track and considering the versine & degree of curvature. 6. Railway Approved ESP(Engineering Scale Plan), SWD(Sectioning Wiring Diagram), LOP(Lay Out Plan), CSD(Cross Section Drawing) and SED(Structural Erection Drawing) for the proposed NTPC Talcher siding take off from station to be followed while execution of proposed work.		
5.32.7	Construction of Railway Siding System		
5.32.7.1	Construction of the Railway siding system is to be undertaken as per Latest Railways guidelines under supervision of Railway approved agency/consultant.		
5.32.7.2	Construction of the complete railway siding system including in-plant rail yard for stage-III (2x600MW) including augmentation of siding from serving station to plant, Augmentation of serving station as per Railways' requirement, in-plant rail yard, Bridges/ culverts, necessary drainage arrangements, including S&T, OHE and other associated works such as panel buildings, TXR building etc as per railways requirement. Suitable drainage arrangements with connections up to final disposal points are to be provided to avoid water-logging.		
5.32.7.3	Facilities of in-motion weigh bridge (150T capacity) for weighment of all inward & outward rakes is in the scope of bidder. In-motion weigh bridge to be provided as per RDSO specifications. The location of the weigh bridge is to be finalized by the bidder.		
5.32.7.4	Safe access is to be provided to various facilities/ yard.		
5.32.8	General Requirements		
5.32.8.1	Preparation and submission of Detailed Project Report incorporating above details to obtain approval from NTPC/Railways. The report should include recommendation clearly based on a techno-economic study bringing out tangible/intangible benefit to NTPC on the subject.		
5.32.8.2	Complete co-ordination and liaison with Railway, state/central govt. including the approval of the scheme from Railways and other agencies would be in the scope of Executing Agency.		
5.32.8.3	Traffic study, Staffing study for O&M, railway staff to be deployed at the proposed TTPS at NTPC cost.		
5.32.8.4	All coordination with any other agency whose facilities have interface with the Railway siding/coal transportation system.		
5.32.8.5	The consultant appointed for the DPR, Detailed Engineering and Construction should have valid enlistment with the concerned Railways till the validity of this contract.		
5.32.8.6	The geo technical investigations shall be done strictly as per RDSO/ Railway's guidelines. Copies of RDSO/railway's guidelines (latest revisions) required for the detailed Engg work shall be made available to NTPC.		
5.32.8.7	The Bidder shall be responsible to provide all necessary services, documents and technical information consisting of and relating to detailed engineering, procurement, construction, and supervision and commissioning activities of the PROJECT as applicable in accordance with Standard Engineering Practice/ Railways/RDSO guidelines. Documents shall also include all relevant RDSO drawings required for inspection and execution of the job.		
5.32.8.8	5(five) sets of all relevant RDSO drawings OHE, S&T manuals and IRPWM etc shall be handed over to NTPC upon commissioning of the Project.		
5.32.8.9	The Bidder would be required to supervise the operations for a period of 12 months beyond the successful commissioning of the system for stabilizing of the system and resolution of		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT
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5.32.9	problems/ issues arising out of the same including coordination with concerned agency/ Railways. Deliverables The Bidder shall submit, the following documents to NTPC: <table><tr><td>i.</td><td>Draft DPR including drawings and land planassessment.</td><td>Three (03) Sets</td></tr><tr><td>ii.</td><td>Final DPR & ESP along with the drawings</td><td>Six (06) Sets</td></tr><tr><td>iii.</td><td>Construction drawings & As-built drawings:</td><td>Four (04) Sets</td></tr><tr><td>iv.</td><td>Reproducible copy of Draft DPR, final DPR along with the ESP, Construction Drawings and As built drawings</td><td>Electronic Format</td></tr></table> Note: The above requirement is exclusive of submissions required for clearance/approvals from Railways/ State/ Central Govt agencies/ NH etc.			i.	Draft DPR including drawings and land planassessment.	Three (03) Sets	ii.	Final DPR & ESP along with the drawings	Six (06) Sets	iii.	Construction drawings & As-built drawings:	Four (04) Sets	iv.	Reproducible copy of Draft DPR, final DPR along with the ESP, Construction Drawings and As built drawings	Electronic Format
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iv.	Reproducible copy of Draft DPR, final DPR along with the ESP, Construction Drawings and As built drawings	Electronic Format													
5.33.00	Safety Control Room Safety control room shall be a single storyed RCC framed building of minimum area 60sqm to accommodate equipments and personals as mentioned in C&I chapter for 24X7 operation. Additionally, it shall have ladies and gents toilet, space for water cooler and Pantry.														
5.34.00	BIO TOILET Bio-Toilet shall be provided near all the modular worker’s sheds/accommodation, the makeup water pump house building, CHP building outside the plant boundary and near AWRS building. Besides these areas, any toilet block provided in area far from plant boundary shall be a Bio-toilet. Bio-toilets shall be made for anaerobic bacterial decomposition of human waste. After decomposition and treatment of the human waste, the residual water from Bio-Toilet shall be: colorless, odorless , devoid of any solid particles and shall have pathogen inactivation by 99%. The water thus obtained shall require no further treatment / waste management and shall be used for irrigation purposes. Bio toilet shall have all fixtures that shall include following fixtures besides the requirements stipulated by DRDO standards. a) One number wall mounted colored (excluding premium colors) glazed vitreous China European water closet and flushing valve system, water faucet, toilet paper holder as per IS:2556 or One number white glazed vitreous China Orissa pan (580 x 440 mm) and flushing valve system, toilet paper holder as per IS:2256 b) One number colour (excluding premium colors) glazed ceramic oval shaped wash basin 450x 550 mm (approx.) mounted over 20mm thick granite beveled edge counter fitted with photo-voltaic control system for water controls, bottle trap as per IS:2556. For common toilets, number of washbasins shall be as per requirement. However, for Pump Houses the same shall be provided without photo voltaic control system for water control. c) For Male Toilets Urinal as per requirements, with all fittings with photovoltaic control flushing system as per IS: 2556. d) One number looking mirror 600 x 900 x 6 mm, edge mounted with teak beading and														
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	minimum 12 mm thick plywood backing, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser Bio toilet/Bio digester shall be comprised of four compartments and a soak pit. The size of the tank shall be as per the number of users. This four-compartment tank shall be constructed underground and shall be made of FRP with required strength as stipulated by DRDO norms. The bio-toilet constructed shall have S-trap and ball valve for ease of operation and maintenance. It shall have all necessary arrangement and fixture for future operation and maintenance as per manufacturer guidelines.			
5.35.00	WORKER’S ACCOMODATION BUILDINGS Worker’s Accommodation shall be provided as per NBC requirement and Local factory act. The Building design shall be as per Tender Drawing. It shall have Brick wall around the Kitchen, Toilet, bathroom and washing area. It shall have Aerated Concrete panel wall with steel structure having sandwich panel roof sheeting.			
5.36.00	OTHER BUILDINGS For all other buildings mentioned in the scope of work but requirement not furnished in this chapter, the Bidder shall develop the details of such buildings based on the functional and statutory requirements.			
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D-1-6	DESIGN CRITERIA			
6.01.01	General			
	The design criteria given herein is applicable for all sub-structure, super-structure works/ buildings/ facilities and various other works included in the scope of the Bidder.			
6.01.02	Structures shall be designed for the most critical combinations of dead loads, imposed loads, equipment loads, crane loads, piping loads (static, friction and dynamic), earth pressure & surcharge loads, hydrostatic & hydrodynamic loads, wind loads, seismic loads and temperature loads. In addition, Erection loads, loads and forces developed due to differential settlement shall also be considered.			
6.01.03	i) All the buildings shall have framed super structure. If the superstructure of building is a steel structure, the framed superstructure shall be moment resisting sway frame in the lateral direction and axially braced in the orthogonal direction. For columns having depth of 1000mm & above, the longitudinal bracings shall comprise a pair of members (spaced) with spacing equal to the column depth. Columns having depth less than 1000mm may have bracing in single plane and at the centerline of column. In both the cases (single bracing or pair of bracing) detailing shall be adequate to restrain the entire column cross-section including both the flanges. Only where axial bracing to one vertical plane is to be waived due to functional requirement, columns in that vertical plane may be allowed to undergo biaxial bending. Beam column joints shall be detailed as per seismic resistant joint with adequate ductility. All 2-legged structural steel trestles shall be completely braced in the vertical plane. All 4-legged structural steel trestles shall be completely braced in all four vertical planes. In addition, specified horizontal planes shall be completely braced to provide stiffness against torsional sway. If the superstructure is RCC structure, the superstructure shall be moment resisting sway frame in both orthogonal direction and all the members shall be designed for biaxial bending. Design of RCC structures shall be done as per IS 456. Detailing for ductility shall be followed as per guidelines of IS13920 to be effective against seismic load. Design of liquid retaining structures shall be done as per IS 3370. ii) The Bunker building, transfer towers, conveyor galleries and trestles, crusher house, boiler, ESP Control Building, ESP supporting structures, including inlet and exhaust duct support structures, Compressor House, Pipe cable Gallery shall have structural steel framed super structure. iii) All other buildings may have either RCC or structural steel framework. iv) All buildings having RCC framing shall have masonry cladding of minimum one masonry unit thickness (not less than 225 mm.) on exterior face.			
6.02.00	Loading			
	For consideration of loads on structures IS : 875 - 'Code of practice for structural safety of buildings' shall be followed. In addition to the dead load, live load, equipment load (including impact / vibration), Temperature loads etc. various loading conditions arising due to operation and maintenance of equipment shall be considered in the design.			
6.02.01	Dead loads			
	Dead loads shall include the weight of structure complete with finishes, fixtures and partitions and shall be taken as per IS: 875 (Part-I)			
6.02.02	Imposed loads			
	Imposed loads in different areas shall include live loads, erection, operation and maintenance loads. Equipment loads (which constitute all loads of equipment to be supported on the building frame) are not included in the imposed loads furnished below and shall be considered in			
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	addition to imposed loads. For consideration of imposed loads on structures, IS:875 (Part-2) “Code of practice for design loads (other than earthquake) for buildings and structures” shall be followed. The following minimum imposed loads as indicated for some of the important areas shall however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered. <table><tr><th>Sl.No.</th><th>Location</th><th>Imposed Loads (T/Sq.m.)</th></tr><tr><td>A)</td><td>Mill and Bunker Bay</td><td></td></tr><tr><td>i)</td><td>Ground floor</td><td>2.5</td></tr><tr><td>ii)</td><td>Feeder floor</td><td>0.50</td></tr><tr><td>iii)</td><td>Tripper floor</td><td>0.50</td></tr><tr><td>iv)</td><td>Roof</td><td>0.15 (Where no equipment are located) 0.50 (Where equipment are located)</td></tr><tr><td></td><td></td><td>0.075 (For Inaccessible roof)</td></tr><tr><td>B)</td><td>Turbine Building</td><td></td></tr><tr><td>i)</td><td>Ground floor (general)</td><td>2.50</td></tr><tr><td>ii)</td><td>Ground floor (heavy equipment storage area)</td><td>5.00</td></tr><tr><td>iii)</td><td>Mezzanine floor</td><td>1.00</td></tr><tr><td>iv)</td><td>Operating floor</td><td></td></tr><tr><td></td><td>a) Rotor Removal area</td><td>5.00</td></tr><tr><td></td><td>b) Equipment lay-down area</td><td>3.50</td></tr><tr><td></td><td>c) Other areas (corridors, etc.)</td><td>1.50</td></tr><tr><td>v)</td><td>Gratings, chequered floors, walkways, platforms, stairs, etc.,</td><td>0.50</td></tr><tr><td>vi)</td><td>Roof (Where no equipment is located)</td><td>0.15</td></tr><tr><td>C)</td><td>Deaerator and Heater Bay</td><td></td></tr><tr><td>i)</td><td>H.P/L.P. heater floor</td><td>1.00</td></tr><tr><td>ii)</td><td>Deaerator floor</td><td>1.00</td></tr><tr><td>iii)</td><td>Cable gallery (In addition to this, actual cable load</td><td>0.50</td></tr></table>			Sl.No.	Location	Imposed Loads (T/Sq.m.)	A)	Mill and Bunker Bay		i)	Ground floor	2.5	ii)	Feeder floor	0.50	iii)	Tripper floor	0.50	iv)	Roof	0.15 (Where no equipment are located) 0.50 (Where equipment are located)			0.075 (For Inaccessible roof)	B)	Turbine Building		i)	Ground floor (general)	2.50	ii)	Ground floor (heavy equipment storage area)	5.00	iii)	Mezzanine floor	1.00	iv)	Operating floor			a) Rotor Removal area	5.00		b) Equipment lay-down area	3.50		c) Other areas (corridors, etc.)	1.50	v)	Gratings, chequered floors, walkways, platforms, stairs, etc.,	0.50	vi)	Roof (Where no equipment is located)	0.15	C)	Deaerator and Heater Bay		i)	H.P/L.P. heater floor	1.00	ii)	Deaerator floor	1.00	iii)	Cable gallery (In addition to this, actual cable load	0.50
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	shall be considered)		
	iv) MCC, switchgear and Control building floors	1.00	
	v) Roof (Where no equipment are located)	0.15	
	(Where equipment are located)	0.5	
	vi) A.H.U Room, Battery Room, Air Washer Room	1.0	
D)	Coal, Gypsum,Limestone handling structures		
i)	Roofs	150 kg. / Sq. M. for accessible roofs and 75 kg. / Sq. M. for non - accessible roofs. In addition to this coal dust load (Dead load) of 150 Kg. / sq. m. on flat roofs & 25 kg. / sq. m. on inclined roofs shall also be considered.	
ii)	Conveyor galleries	In addition to the live loads, loads due to cable trays, fire fighting / service water pipes shall also be considered @ 125 kg. / m (minimum) on each of the longitudinal girder. Roof-truss members are to be checked for supporting fire fighting pipes/ Service water pipes. Tentative locations and diameter for pipes are shown in Tender Drawing. In addition to this coal dust load (Dead load) of 50 kg. / sq. m. on walkway way shall also be considered.	
iii)	Covers for trenches / channels/ drain	Covers for channels & trenches, shall be designed for a live load of 0.4T Sq. M. and loading as mentioned under clause in trenches, whichever is critical.	
iv)	Sumps and tanks and other underground basement type structures/ drain	In addition to earth pressure with a surcharge of 2T / Sq. M. (or surcharge due to Railway loading whichever is critical for Railway load bearing structures etc.) and sub - soil water pressure etc. These are also to be designed for the following conditions : i) Water / liquid inside and no earth outside (applicable only to such structures which are liable to be filled up with water or any liquid). ii) Earth with surcharge outside and no water / liquid inside iii) For underground (basement) structures protection against buoyancy during execution and after execution shall	
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	be ensured without superimposed loadings with minimum factor of safety of 1.2 against buoyancy. v) Unit weight of bulk materials a) For structural design i) Lime stone 1700 kg. / Cu. M. ii) Gypsum 1250 kg. / Cu. M. iii) Coal 1100 kg. / Cu. M. For sizing calculation iv) Lime stone 1400 kg. / Cu. M. v) Gypsum 1100 kg. / Cu. M. vi) Coal 800 kg. / Cu. M. E) Boiler/ ESP Support Structures i. Operating Floors 1.00 ii. Separator Floor 1.00 iii. Elevator Machine Room 1.00 iv. Maintenance Platforms 1.00 v. Equipment Laydown Loads As per Equipment supplier or 1.00 whichever is more. vi. Lift Structure As per Equipment supplier with 100% impact factor F) Pump Houses Operating floor 1.50 G) Underground Structures such as Channels, Sumps, Underground Pump House, Tanks, Trenches, Reservoirs, C.W. ducts etc. In addition to earth pressure and ground water pressure, the surcharge load of 2T/sq.m. shall also be considered for design of all underground structures. H) Road Culverts/Bridges and its allied structures including RCC Pipe Crossings and Road Crossing of Trenches. Design for class 'AA' loading (wheeled and tracked both) and checked for class 'A' loading as per IRC Standard. I) Covers for Channels/trenches 0.40 (General) or central point load of 75 kg whichever is higher As per IRC Standard (at road crossings for vehicular traffic) H) Railway Supporting Structures, Rail Culverts As per Railway 'Bridge Rules'		
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6.02.03	I)	Conveyor Galleries	In addition to the live loads, loads due to cable trays, firefighting / service water pipes shall also be considered @125kg/m (minimum) on each of the longitudinal girder. Roof-truss members are to be checked for supporting firefighting pipes/ Service water pipes.
	J)	General (Unless Specified Otherwise)	
	i)	Stairs, Landings and Balconies	0.50
	ii)	Toilets	0.20
	iii)	Chequered plates, grating floors, etc.	0.50
	iv)	RCC floors (General)	0.50
	v)	a) Flat Roofs (where no equipment are located)	0.15
		b) Flat Roofs (where equipment are located)	0.50
		c) Inaccessible roof	0.075
	vi)	Inclined Roofs	As per IS : 875 (Part-II)
	vii)	Dust load on roof	0.050
	viii)	Walkways (General)	0.50
	ix)	Walkways of conveyor galleries, DM & PT	0.30
	x)	Floor of control room of switchyard control building	1.00
	xi)	Cable and pipe trestles	0.40 for walkway and in addition, friction loads as applicable
	xii)	Grating covers/ Precast RCC covers for drain, trench, sump pit in Ground floor/ paving of BTG area	2.50 As per IRC standard (at road crossings for vehicular traffic)
	Notes:		
a) If erection load is higher than the specified imposed loads on any floor or part thereof, then the erection loads are to be considered for the design.			
b) Additional load for cable, piping/ducting, shall be considered as applicable. For any other structures, the loads specified for those structures elsewhere in the specification shall be followed.			
Equipment, piping and associated loads			
Equipment loads shall be considered over and above the imposed loads. Equipment loads			
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6.02.04	shall be considered as given by equipment supplier. Crane load For crane loads, an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to the provisions of IS:875. The longitudinal crane surge shall be 5% of the static wheel load. Longitudinal surge and lateral surge shall not be considered to act simultaneously.			
6.02.05	Seismic load For design of all structures, the site specific seismic design criteria as attached in Annexure-E shall be followed.			
6.02.06	Wind load For design of all structures, the wind loads shall be taken as per the site specific wind data specified in Annexure–D of this specification.			
6.02.07	Temperature Load For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average maximum annual variation in temperature for this purpose shall be taken as the difference between the mean of the daily minimum ambient temperature during the coldest month of the year and mean of daily maximum ambient temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation. Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns. The maximum distance of the expansion joint shall be as per the provisions of IS 800 and IS 456 for steel and concrete structures respectively.			
6.02.08	Differential Settlement Loads Structures shall be designed considering an additional load on account of differential settlement of 1 in 1000 between any two adjacent columns, subject to a maximum differential settlement of 8 mm in case of foundations resting on soils & 4mm in case of foundations resting on rock/ pile. These differential settlement loads shall be taken into consideration for design of footings & structures of Boiler & Mill Bunker, ESP supporting structure and Main Power House building. Further, in the analysis of differential settlement loads, adjacent columns interconnected with bracings are preferably to be provided with combined footing. In such cases, where rigid combined foundations are provided below braced columns, differential settlement between those columns needs not be considered. Moreover, when rigid raft is provided, the differential settlement amongst the columns supported on the rigid raft need not be considered. However, the differential settlement between the raft and the adjacent column footing of the same structure are to be considered. In the structural analysis for differential loads, following approach may be considered: All the alternate columns in structure shall be applied downward displacement as described above and analyzed at a time. The resultant forces/ reactions shall be considered with reversible effects for design of structures and footings.			
6.02.09	Additional Loads Following Minimum additional Loads shall be considered in the design of Steam generator structures, Mill & bunker buildings, Coal handling Transfer points and Trestles (in BTG island) and ESP structure. (a) Cantilever Loads of not less than 2000 kg/m at a distance of 1200 mm from the external face of the columns, on both sides of the ESP, for Cable trays and Walkways.			
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	(b) Cantilever Loads of not less than 500 kg / M at a distance of 1200 mm from the external face of the columns, on both sides of the Steam Generator, for Cable trays and Walkways. (c) Cantilever Loads of not less than 2000 kg / M at a distance of 2500 mm from the external face of the Mill & Bunker Building columns, CHP transfer point columns/ VGTU columns & conveyor gallery trestles (on one side) for Cable trays and Walkways. (d) Dry Fly Ash Piping Loads. (e) Ash Water Piping Loads. (f) Supply Air and Instrument Air Piping. (g) Service Water Piping (h) Loads associated with Coal Handling Plant equipment			
6.03.00	Civil Design Concepts			
6.03.01	Individual members of the frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion, etc.,			
6.03.02	The different load combinations shall be taken as per IS: 875 (Part-5) and other relevant IS Codes. a) Wind and seismic forces shall not be considered to act simultaneously. b) For the design of main plant structures during seismic condition, the deaerator feed water tank shall be considered full upto operating level. However, for other load combinations, deaerator feed water tank in flooded condition shall be considered. c) 'Lifted load' of crane shall not be considered during seismic condition. d) In case two cranes are provided and tandem operation is not envisaged, the load shall be taken as one crane fully loaded and second crane without lifted load but standing idle adjacent to first crane all through the building length (lifted load near to A/B Row). e) In case two cranes are provided and tandem operation is envisaged then the crane wheel loads shall be taken as both the cranes fully loaded to capacity and travelling side by side al through the building length. f) Permissible stresses for different load combinations shall be taken as per relevant IS and IRS codes. g) For the design of pipe/cable supporting structure, the soil weight shall be considered as backfilled up to grade level for the condition of pipe running full/cables in position. h) Frictional forces between the pipes and supporting structure in longitudinal direction need not be considered along with seismic or wind forces. i) Paving in crane corridor shall be designed for the maximum load due to movement of crane. j) In TG bay at crane rail level, chequered plate walkway with handrails shall be provided for entire column sectional depth for full length of the building. Walkway width clearance from the face of the column to the edge of the crane shall be as specified elsewhere in the specification. k) For checking against uplift / tension case, 90% of Dead Loads with no Imposed Loads shall be considered along with other Loads. l) The Structures shall be Designed for most unfavorable Combination of Dead Loads, Imposed Loads, Equipment Loads, Piping / Cables / Ducts Loads, Wind / Seismic Loads, Temperature Loads, Ash Loads, and other applicable Loads without exceeding the Permissible Stresses. No reduction in equipment loads, piping loads, ash loads and loads due to other			
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	permanent facilities shall be considered for calculation of seismic weight of the building/structure and for load combinations thereof. m) In all Loading Combinations, the Loads that have reduction effect on design condition shall not be taken into account in the Combination concerned. n) Where wind load is the main load acting on structure, no increase in stresses is to be considered for design of Structure and Foundation bolts. This includes structures like Transfer Points and Conveyor Trestles. o) In all Load Combinations, differential settlement loads (with reversible effects) are to be considered.			
6.03.03	Design of steel structures shall be done by the working stress method. Design shall be as per provisions of IS:800:1984 and other relevant IS standards. For design of coal bins and loading hopper IS:9178 (part I to III) shall be followed.			
6.03.04	Shop connections will be welded type and all field connections will be bolted. Field permanent bolts wherever provided will be high tensile bolts of property class 8.8(min) as per 1367 for all major connections. However, nominal connections in the field like purlins, stairs, wall beams will be done by means of M.S. black bolts of grade 4.6 conforming to IS-1367. The bolted joints will be designed for friction grip or bearing type. For friction grip type connections, bolts will be tightened to develop the required pretension during their installation. For bolted Connection, IS 4000, IS: 3757, IS: 6623 and IS: 6649 shall be followed. IS 814, IS 816, IS: 1024, IS 4353 and IS: 9595 shall be followed for welding of structures.			
6.03.05	All structures close to railway line shall have clearances conforming to Railway norms.			
6.03.06	For calculation of coal load on moving conveyor, a multiplication factor of 1.6 shall be used to take care of inertia force, casual over burden and impact factor, etc. Thus coal load per unit length of each moving conveyor shall be 1.6 x (rated capacity of conveyor system) Conveyor speed x 1100 800			
6.03.07	a) Conveyor gallery structure and trestles shall be designed considering both conveyors operating simultaneously b) Dynamic analysis of conveyor galleries and conveyor supporting system shall be carried out for spans greater than 25 m. c) All structures close to railway line shall have clearances conforming to Railway norms.			
6.03.08	Coal, Limestone and Gypsum handling structures: The loads for all railway load bearing structures e. g. wagon tippler, tunnel, culverts and under ground transfer houses etc. and the analysis and the design of these structures shall be made strictly in accordance with the provisions of Indian Railway Bridge rules (latest edition), and Indian Railway Codes of practice (latest edition) with all amendments up to the date of opening of bids. The axle load for analysis and design shall be considered as “DFC loading (32.5t axle load)” of Heavy mineral loading as per Indian railway standard. Coal heap of 1.2m height shall be considered above hopper top for design of hopper and supporting elements of wagon tippler. The analysis, design and detailed drawing for tunnel, under ground transfer houses, culverts etc. coming directly below the railway track shall be got approved by the contractor from the concerned railway authorities before taking up construction. All necessary payment for the above work shall be made by the bidder to the railway authority. The steel structures shall be designed and fabricated as per ‘code of practice for use of structural steel in general building construction’, IS : 800 and other relevant IS Standards.			
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	Minimum size of the angle section to be used as structural members shall be 50 X 50 X 6. Minimum weld size shall be 6 mm. The steel structures using tubular sections shall be designed and fabricated as per IS:806-"code of practice for use of steel tubes in general building construction." and EN 1993-1-8:2005. Minimum grade of steel & thickness of Tubular/Hollow sections shall be Yst 240 Mpa & 4.0mm respectively. Minimum thickness for rolled/ built up section shall be 6mm. Slotted holes shall not be assumed to act as expansion joint for relieving of stresses and suitable bearings shall be provided at the supports. All gallery supporting trestles shall be so proportioned that the transverse deflection of gallery due to wind / seismic load should not exceed trestle height / 1000 as stipulated in IS: 11592. Peak wind speed method shall be considered for checking the transverse deflection. Longitudinal deflection for all conveyor trestles (along the conveyor direction) shall be Height/500 for peak wind speed. Vertical & horizontal deflection of conveyor gallery shall be restricted to span/500. The crusher and transfer house structures shall be so designed that transverse deflection at places where conveyor galleries meet, should be equal to the respective transverse deflection of conveyor supporting trestles. For transfer house and crusher houses monorail loads of two floors having highest capacity of monorails shall be considered in addition to other gravity loads along with wind/seismic load. Wind load/seismic load shall be considered along with Running belt tension for the analysis of transfer house and crusher house, however monorail load may not be considered. Stresses for all CHP structures shall be checked for the higher of the forces obtained from gust factor method and the peak wind speed method. The permissible vertical deflection for beams supporting drive machinery shall be restricted to span / 500 and for other beams it shall be within span / 325. Horizontal bracing system shall be provided at floor levels around the openings for plan area greater than 2 sqm. Shear force in steel columns shall be transferred to the pedestals / foundations exclusively either through foundation bolts or the shear key arrangement. Contractor can also use tubular steel sections for roof truss of conveyor galleries/cable trestle only. For design of liquid retaining structures, IS : 3370 (Part - I to IV) (latest) shall be followed. Face of the structure in contact with liquid shall be designed as un - cracked section. For design of RCC pipes for culverts, latest editions of IS: 458, IS: 783 should be followed. For design of all underground structures / foundations, ground water table shall be assumed at the formation level (i. e. the adjoining ground level).For all underground structures like wagon tippler, tunnels and underground transfer points crack width shall be restricted to 0.2 mm. Design of Hopper walls shall be done for both Static & Dynamic flow condition using Walker's theory.		
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	For foundations of transfer points, crusher house & trestles, pedestals of isolated footings/pile caps shall necessarily be tied with RCC beams. For all RCC buildings, tie beams shall be provided at lintel level. Design of masonry walls shall be made as per IS : 1905. For metal roofing and side cladding, the spacing of purlins/runners shall be such that the deflection of metal sheet used is limited to span/250 under adverse loading condition. Minimum reinforcement (0.12% of total coss sectional area in each direction) shall be provided at the top face of the footing, even if, no reinforcements are required as per design			
6.03.08.01	All liquid retaining structures shall be designed for following load conditions. Underground structures: a. Water filled inside up to design level and no earth outside. b. Earth pressure with surcharge of 2.0 T/m2 and ground water table up to FGL outside and no water inside. c. Stability against uplift shall be checked for completed structure and under construction stage with no water inside and ground water table up to FGL, with a minimum factor of safety of 1.20 against uplift. Installation of pressure relief valves shall not be permitted in the base slab of any liquid retaining / conveying structure. d. The structure shall also be checked for normal working condition with water filled inside up to design level and earth pressure outside with no effect of surcharge and ground water table. For design of over - ground liquid retaining structures appropriate load cases shall be considered.			
6.03.08.02	All liquid retaining structures shall be designed by working stress method as given in clause 4.5 of IS 3370(Part2).			
6.03.08.03	In the wall of liquid retaining structures with cylindrical shape such as clarifiers, vertical reinforcement shall be checked assuming the walls were fully fixed at the base, and the horizontal reinforcement shall be provided to resist horizontal (hoop) tension assuming hinged condition at the junction of the base slab & wall.			
6.03.08.04	Wherever sandwich slabs are provided in liquid retaining structures to take care of stability against uplift, only well graded sand of approved quality shall be used as fill material. The sand compaction shall be done with plate / disc compactors in such a manner that the bottom slab is not structurally damaged.			
6.03.08.05	Clear free board of at least 300 mm above design (total) water level shall be provided in all liquid retaining / conveying structures.			
6.03.08.06	Coefficient of active earth pressure shall be considered for design of free standing retaining walls and coefficient of earth pressure at rest shall be considered for design of top propped retaining walls.			
6.03.08.07	The minimum concrete clear cover to reinforcement bars in all RCC structures shall be as per IS:456 and IS:3370(Part II) for water retaining structures. Durability of concrete shall conform to moderate exposure conditions as per Table-3 of IS 456 except noted specifically otherwise.			
6.03.08.08	Factor of safety against overturning and sliding The structure shall be checked for minimum factor of safety of 1.5 against overturning conditions (ratio of stabilizing moment to overturning moment) and 1.4 against sliding conditions as per IS: 456.			
6.03.08.09	For detailing of Reinforcement IS 5525, IS 13920, IS 4326 and SP 34 shall be followed.			
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6.03.08.10	Two layers of reinforcement (on both faces) shall be provided for RCC sections having thickness of 150 mm and above.			
6.03.08.11	Minimum diameter of main and distribution Reinforcement bars in different structural elements shall be as follows:			
	Sl. No.	Structural Element	Main Reinforcement	Distribution Reinforcement / Stirrups/ ties/ Anchor Bars
	a)	Foundation	12 mm	12 mm
	b)	Beams	12 mm	8 mm
	c)	Columns	12 mm	8mm
6.03.08.12	Spacing of reinforcement bars in walls and slabs of liquid retaining / conveying structures shall not be more than 200 mm.			
6.03.08.13	Buildings shall also comply to IS 4326 requirement-			
6.03.08.14	Minimum Reinforcement in all elements of liquid retaining / conveying structures shall be 0.24 % of cross sectional area.			
6.03.08.15	The sizing of foundation, design criteria & clear cover shall conform to IS:1904, IS:456 and other relevant Indian codes. However, minimum 0.12% of reinforcement shall be provided on the top face of the foundation concrete on either direction and minimum percentage of reinforcement at bottom face of foundation shall be same as that stipulated for beam as per IS:456.			
6.03.08.16	Minimum thickness of foundation slab / raft and base slab of all liquid retaining tanks / pits shall not be less than 250 mm.			
6.03.08.17	Minimum thickness of all elements of RCC liquid retaining / conveying structures (except effluent drains & launders) shall be 200mm. Effluent drains (depth more than 500mm) and launders shall have minimum element thickness of 150mm.			
6.03.08.18	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter. Edge protection angles shall be provided as specified elsewhere.			
6.03.08.19	All water retaining structures shall be tested for water tightness as per provisions of IS: 3370 and IS: 6494.			
6.03.08.20	2.0m wide walkway with concrete paving shall be provided connecting all structures, buildings and facilities. The top of walkway shall be minimum 200mm above FGL.			
6.03.08.21	Design Requirements for Crusher Foundation			
6.03.08.21.2	Dynamic Analysis			
	Detailed dynamic analysis shall be done for the top deck together with springs and dampers and the natural frequencies and amplitudes of vibration shall be determined. A mathematical model of the top deck shall be formulated with three - dimensional beam / plate finite elements for the purpose of analysis with the spring idealised with vertical and horizontal stiffnesses. The mass of the machine together with that of the top deck shall be considered for the analysis.			
	Natural frequencies upto at least 10 % above the operating speed shall be determined and			
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	these frequencies shall be checked against the design criteria. Forced response dynamic analysis shall be carried out for the operating condition unbalance forces using a sinusoidal forcing function. Unbalance forces as given by this specifications shall be used for his purpose. The amplitudes shall be checked against the design criteria. The dynamic forces from this analysis shall be used for structural design with a suitable fatigue factor. Isolation Efficiency The vibration isolation system shall be designed for about 90 % isolation efficiency. De-coupling A ratio of the least 10 (ten) shall be ensured between the stiffness of the supporting structure and the stiffness of the spring system in the vertical direction to achieve de-coupling between the two (the stiffness of the spring system being lower). This ensures that dynamic analysis of the supporting structure need not be carried out. Frequency Criteria The frequency criterion has already been laid down implicitly by the isolation efficiency criteria and de-coupling required. The first bending mode frequency of the top deck shall be at least 20 % above the operating speed. Unbalance Forces Unbalance forces arising out of all the following cases shall be considered for checking the design and amplitudes. I. Balance quality grade G 16 as per IS/ISO:21940-11. II. One hammer broken condition. The missing hammer shall be assumed to be closest to the crusher non - drive end of the crusher. III. Three hammers broken condition. All the three hammers broken shall be assumed to be from the same suspension bar and located at the non - drive end of the crusher. Amplitude Criteria The calculated amplitudes (mean to peak values) shall not exceed following limits under the specified conditions. Operating speed of 750 RPM I. 150 microns for an unbalance force arising out of balance quality grade G 16 as per IS/ISO:21940-11-2016. II. 300 microns in case of a one hammer broken condition.			
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6.03.09	III. Amplitudes need not be checked for a three hammer broken condition. Operating speed of 450 RPM I. 200 microns for an imbalance force arising out of balance quality grade G 16 as per IS/ISO:21940-11. II. 400 microns in case of a one hammers broken condition. III. Amplitude need not be checked for a three hammer broken condition. For intermediate operating speed between 450 to 750 RPM the amplitude limits can be linearly interpolated. The amplitude limits mentioned above are in both vertical and horizontal directions. The amplitudes shall be calculated at critical points on the top surface of the RCC deck. The amplitudes shall be checked for the most unfavorable superposition of modes in any direction. However, phase difference between the maximum amplitude occurring in different directions due to the rotating vector may be considered while superimposing the modes. Transient Resonance Transient resonance, which may occur during the start - up or coasting down condition of the crusher, shall be checked, and the amplitudes in such a condition should not exceed one - and - half times those at operating speed for each design condition. Strength Criteria The following criteria shall apply for the design of top deck : a) Dead loads, live loads, Seismic loads and dynamic loads shall be considered for the design. The most unfavorable combination shall considered for design. b) Seismic loads shall be assumed to act together with dynamic loads for a one millimeter eccentricity in the rotor. However, seismic loads and dynamic loads arising out of hammer breakage need not be considered together c) Fatigue shall be considered while designing for dynamic forces. A fatigue factor of 2.0 shall be used on all dynamic forces to arrive at the equivalent static force for the purpose of design. d) Working stress method shall be used for the design of RCC deck. In survival condition, 10 % overstressing may be permitted. e) The RCC top deck shall be at least of M35 grade of concrete as per IS : 456. f) Fatigue need not be considered for the three hammer broken condition. g) For calculating unbalance forces, the heaviest hammer (plain or toothed) shall be considered. Horizontal Deflection criteria			
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	The maximum Horizontal Deflection for various structures shall not exceed and be limited to the following: <table><tr><th>Sl. No.</th><th>Description</th><th>Maximum value of</th></tr><tr><td>1.</td><td>For Trestles and transfer points (Transverse deflection at Conveyor gallery supporting level)</td><td>Height/1000 (For Wind load by Peak Wind Speed Method / Seismic Load)</td></tr><tr><td>2.</td><td>For ESP Control Building, Compressor House, and all other steel buildings envisaged in this specification</td><td>Height /325</td></tr><tr><td>3.</td><td>Vertical Metal Sheeting in Cladding</td><td>Span/250</td></tr></table>				Sl. No.	Description	Maximum value of	1.	For Trestles and transfer points (Transverse deflection at Conveyor gallery supporting level)	Height/1000 (For Wind load by Peak Wind Speed Method / Seismic Load)	2.	For ESP Control Building, Compressor House, and all other steel buildings envisaged in this specification	Height /325	3.	Vertical Metal Sheeting in Cladding	Span/250
Sl. No.	Description	Maximum value of														
1.	For Trestles and transfer points (Transverse deflection at Conveyor gallery supporting level)	Height/1000 (For Wind load by Peak Wind Speed Method / Seismic Load)														
2.	For ESP Control Building, Compressor House, and all other steel buildings envisaged in this specification	Height /325														
3.	Vertical Metal Sheeting in Cladding	Span/250														
	However, the maximum deflection of Grating / Chequered Plate Shall be limited to 6mm. Note: Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method. Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.															
6.03.10	a) Dispersion of load in any direction through soil shall be as per IS 8009 (relevant part). b) Dispersion of load through concrete shall be considered at an angle of 45 degrees with horizontal from the edge of contact area.															
6.03.11	a) Permissible deflection (unless specified otherwise in this specification) for latticed framework and beams of floors other than drive floor shall be span/325. b) The allowable deflection for beams directly supporting drive machinery and equipment shall be restricted to span/500 unless specified otherwise in this specification. c) The deflection for manually operated cranes & monorail supporting beams shall not exceed span/500. For electric overhead cranes : 1) upto 50 Tonne capacity : span/750 2) over 50 Tonne capacity : span/1000 d) The vertical deflection of beams supporting LP Heater, HP Heater and Deaerator shall be limited to Span/500. e) The vertical deflection of metal deck sheet for floor shall be limited to span/250. f) Permissible deflection for all purlins, cladding runners, roofing/cladding sheets and grating / chequered plates shall be span/250. However, the maximum vertical deflection of Grating/ Chequered plate shall be limited to 6 mm.															
6.03.12	Transverse coal pressure on Bunker/Silo/Hopper walls shall be calculated as per IS: 9178. The Coal Bunker/Silo/Hopper shall be designed for the following conditions i) The Bunker/Silo/Hopper is full up to its full capacity with top surface nearly horizontal. ii) The Bunker/Silo/Hopper is partially empty with the top surface of coal at an angle of															
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6.03.13 6.03.14 6.03.15	repose of 37 degrees. Design criteria for ash silo 1. The pressure due to ash filling on the side wall and the bottom portion of ash bins/silos shall be taken as the maximum of (a) static pressure determined in accordance with the Jansen's formula multiplied by an impact factor of 1.4 and (b) pressure determined as per Walker's formula for static as well as dynamic conditions. The silo shall be designed for the following conditions: (a) The silo is full up to its full height / capacity (b) The silo is partially empty with top surface of ash, at an angle of repose less than 30 degrees. 2. The following loads are to be considered for design. a) Density of bottom ash to be considered for volume calculation shall be 650 kg./cum. b) Density of bottom ash to be considered for load calculation shall be 1600 kg/cum. c) Density of fly ash to be considered for volume calculation shall be 750 kg/cum. d) Density of fly ash to be considered for load calculation shall be 1600 kg./cum. e) Density of dry fly ash, to be considered for the design of supporting structures for dry fly ash conveying pipes, shall be taken as 1000 kg/cum. The pipe shall be considered full with dry fly ash. 3. Other requirements are as follows: a) Independent supporting structure shall be provided for each silo. b) The joint between the wall and roof of the silo shall be properly sealed by welding or by any other approved means. c) Operating platform covering total plan area wise in silo structure made of grating shall be provided below the hopper outlet. d) The bracing system shall be provided in such a way that the trucks and closed tankers can have a clear passage to approach the underside of the silos for unloading dry ash from the silos. 4. Trestles supporting ash pipes shall be so proportioned that the transverse deflection of trestles due to wind/seismic load shall not exceed trestle height/325. 5. The corrosion allowance for design of Silo, Buffer Hopper, Bottom ash hopper, tanks etc. shall be considered as per IS9178 considering structure exposed to atmosphere. The corrosion allowance shall be provided in addition to the requirement of minimum thickness of steel plate as per IS9178. Coal Bunker (inside Mill Bunker Building) shall be of MS while the hopper shall be of MS with stainless steel (grade SS 304) lining. The minimum thickness of MS plate and SS lining in hopper portion shall be as per the design concept of Mill Bunker Building specified elsewhere in the specification. Pre-formed flexible open ended bellow strap of neoprene is to be provided between top of bunker and bottom of tripper floor to avoid coal dust leakage / escape. The bellow strap shall be of minimum 200 mm wide under un-stretched condition and shall be of minimum 2mm thick. The hopper angle with the horizontal plane be as specified elsewhere in the specification. The live storage capacity of each coal bunker shall be greater of the following: a) Total 10 hours coal requirement of the boiler for BMCR duty with worst coal firing,			
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	equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. b) Total 10 hours coal requirement of the boiler for BMCR duty with design coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. c) Total 10 hours coal requirement of the boiler for TMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required to be in service for this duty condition as specified elsewhere.			
6.03.16	For all capacity (volume) calculation and structural design (load calculation) unit weight of coal shall be assumed as 800 kg/cum. and 1100 kg/cum respectively.			
6.03.16	a) The design and construction of RCC structures shall be carried out as per IS: 456. Working stress method shall be adopted for the design wherever specifically mentioned in this specification. b) For design and construction of steel-concrete composite members, IS: 11384 shall be followed. c) For reinforcement detailing, IS 5525 and SP 34 shall be followed. d) Two layers of reinforcement (on both inner and outer faces) shall be provided for RCC wall sections having thickness 150 mm or more.			
6.03.17	a) Design of Foundation for Coal Mills and Fans Structural Arrangement of foundations for various machine foundations like TG, TDBFP, MDBFP, Coal Mills and Fans shall be as specified elsewhere in the specification. Analysis for the foundation For the foundations of the all equipment, details static and dynamic analysis shall be done. The static analysis shall include all operating condition, load cases and abnormal loads like short circuit, loss of blades & unbalance and seismic forces as per IS1893. The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. A minimum fatigue factor of 2.0 shall be considered for dynamic forces. The vibration amplitudes shall be calculated at the machine bearing locations and at any other points of interest by a forced response analysis. The unbalance forces used for this analysis shall correspond to the balance quality grade of the machine as per ISO 1940 /IS:11723 or the unbalance forces as provided by the machine manufacturer whichever is higher. It shall be ensured that the calculated amplitudes do not exceed the limits specified by the machine manufacturer and relevant Standards such as ISO 10816/IS:14817. Bidder to consider the acceleration at the top of the deck for the design of supporting / fixing arrangement of machine. Design criteria for steel helical springs and viscous dampers The isolation efficiency for steel helical springs and viscous dampers shall be at least 90%. The ratio of actual spring supported weight to the nominal spring capacity shall not exceed 0.80. At least 5% to 10% of critical damping shall be provided in the form of viscous dampers. Reinforcement Design Working stress method as per IS 456 shall be used for reinforcement design. The design shall be done for the worst load combination. Minimum reinforcement shall be provided as per IS 456 and IS2974 (Part-III), if the calculated reinforcement is less than the minimum. For TG Raft/ Pilecap, minimum percentage of reinforcement at top and bottom faces of foundation shall be same as that stipulated for beam as per IS456. c) Block Foundations:			
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	Block foundation resting on soil shall be analyzed using elastic half space theory. In case the foundation is supported over piles, Novak's approximation shall be used for determining the spring constant and damping ratio of pile groups. The mass of the RCC block shall be at least three times the mass of machine. Free vibration analysis of the foundation shall be carried out to evaluate the natural frequencies. The fundamental natural frequency shall be kept at least 20% away from the operating frequency (speed). Forced vibration analysis shall be carried out if the dynamic forces are made available by the machine supplier in which case the amplitude limits stipulated by the machine supplier and ISO 10816, whichever is lower, shall be satisfied. Reinforcement design shall be done by working stress method as per IS 456 and IS 2974 (Part-IV). For the foundations supporting minor rotating equipment weighing less than one ton or if the mass of the rotating parts is less than one hundredth of the mass of the foundation, no dynamic analysis is necessary. However, if such minor equipment is to be supported on building structure, floors, etc., suitable vibration isolation shall be provided by means of springs, neoprene pads, etc., and such vibration isolation system shall be designed suitably.			
6.03.18	If RCC floor/roof is assumed to act as diaphragm, transmitting lateral loads to braced bays, it shall be provided with shear connectors. The spacing of shear anchor studs on structural beams shall be minimum of the spacing required for i) Restraining the compression flanges of beams and ii) Transfer of the horizontal shear at floor/roof to the supporting beams. However, whenever large / more number of cut-outs are provided in the floor slab, horizontal floor bracings shall be provided below slab to transfer horizontal force to columns without considering diaphragm action from slab.			
6.03.19	All roads shall be rigid pavements specified elsewhere in this specification. The design traffic load shall be a minimum 4 million cumulative standard axle. The design of concrete pavement shall be carried out as per IRC-58.			
6.03.20	a) No cable/pipe trench is envisaged in the plant area. However, if required, pipe/cable trench can be provided inside the buildings and inside switchyard or some other localised areas. b) All pipes and cable shall generally be routed above ground. c) A minimum clearance (clear headroom) of 8m shall be kept for all over-ground pipe/cable trestles for all road/rail crossings. For other areas, the requirement of trestle height is specified elsewhere in the specifications. All trestles shall be provided with continuous walkway of minimum 600mm width with hand-rails and toe-guards all along the length of the trestle along with approach ladders near roads, passageways, etc. Before and after the road/rail crossings, a barrier of suitable height shall be constructed so as to prevent the approach of cranes (having height more than 8 m) etc., upto the pipe/cable racks/trestles. d) Within AB bay in Main plant area, generally grating shall be provided for Mezzanine floor except for valve room area, cable spreader floor, air washer units, feed water heaters, equipment foundations, miscellaneous skids, etc. where the floor shall be of RCC. Oil equipment room shall also have RCC floor below the grating floor.			
6.03.21	The maximum velocity for pipe drains and open drains shall be limited to 2.4m/sec and 1.8 m/sec. respectively. However, minimum velocity of 0.6m/sec. for self-cleansing shall be ensured. Bed slope not milder than 1 in 1000 shall be provided. The open drains shall be open rectangular drains of RCC unless required otherwise due to functional requirement. RC box culverts shall be provided at rail, road or other crossings.			
6.03.22	Sewers shall be designed for a minimum self-cleansing velocity of 0.75m/sec and the maximum velocity shall not exceed 2.4m/sec.			
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	Manual on sewerage and sewage treatment (published by Central Public Health Environment Engineering Organisation, Government of India) shall be followed for design purpose.																								
6.03.22	Foundations for all tanks shall be designed for as per IS: 803.																								
6.03.23	Footings shall be so proportioned to as to minimise the differential settlement.																								
6.03.24	Plinth level of all buildings shall be kept at least 500 mm above the finished grade/formation level.																								
6.03.24	Boiler/ ESP support structures shall be designed for: a. Dead load b. Live/Imposed loads c. Static and dynamic loads of piping, movable equipment and maintenance parts. d. Loads from cable trays and walkways supported on columns. e. Ash water piping supported on the outermost row of boiler columns. f. All ESP hoppers filled up with ash upto the top of the hoppers or the bottom of electrodes (whichever is more) using a bulk density of not less than 1350 kg/cu.m. for the ash, along with additional ash build-up from the end of the third field up to the inlet duct bottom level at a natural repose angle (not less than 30 degree to horizontal in any case). g. Ash load at bottom ash hopper and pent house of the boiler shall be as mentioned in the mechanical chapter of the specifications. h. Seismic and wind loads as specified elsewhere in the specifications. i. Temperature Loads. j. Temperature variations under ESP operating condition. k. The loads listed above indicate the minimum requirements. l. For the Design of ESP Supporting Structures for Seismic, Ash Load in Hoppers filled upto to the top of the Hoppers or bottom of the electrode (whichever is higher) shall be considered as permanent Loads along with other applicable Loads. m. Following Ash density shall be considered for the Design : <table><tr><th>Sl. No.</th><th>Description</th><th>Density (kg/Cu. M.)</th></tr><tr><td>a)</td><td>Bottom Ash for volume calculations</td><td>650</td></tr><tr><td>b)</td><td>Bottom Ash for Load calculations</td><td>1600</td></tr><tr><td>c)</td><td>Fly Ash for volume calculations (For Boiler)</td><td>750</td></tr><tr><td>d)</td><td>Fly Ash for volume calculations (For ESP)</td><td>650</td></tr><tr><td>e)</td><td>Fly Ash for Load calculations</td><td>1350</td></tr><tr><td>f)</td><td>Dry Fly Ash for dry fly ash Pipeline supporting Structures (Pipe to be considered full)</td><td>1000</td></tr></table>				Sl. No.	Description	Density (kg/Cu. M.)	a)	Bottom Ash for volume calculations	650	b)	Bottom Ash for Load calculations	1600	c)	Fly Ash for volume calculations (For Boiler)	750	d)	Fly Ash for volume calculations (For ESP)	650	e)	Fly Ash for Load calculations	1350	f)	Dry Fly Ash for dry fly ash Pipeline supporting Structures (Pipe to be considered full)	1000
Sl. No.	Description	Density (kg/Cu. M.)																							
a)	Bottom Ash for volume calculations	650																							
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-6 CIVIL WORKS DESIGN CRITERIA	PAGE 18 OF 24																					

CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.03.25	Boiler supporting structures shall be so configured that the temperature of steel does not exceed 60 °C unless specified otherwise. Brackets shall be provided on both sides of the outermost row of columns of both the boiler and ESP for supporting cable trays and walkways, at a height not exceeding 10.0 m. The exact levels shall, however, be decided during detailed engineering. Each ESP hopper shall be supported at four corners by providing four columns from the ground.			
6.03.26	The bracings in boiler structure shall be provided such that under no circumstance normal/convenient access to all points in the boiler is blocked or obstructed.			
6.03.27	In design of boiler/ ESP support structures, dynamic piping loads need not be considered acting simultaneously with wind or seismic loads. Increase in permissible stresses shall be allowed in load combinations where dynamic piping loads are considered and shall be as permitted under seismic load conditions.			
6.03.28	Design Criteria for foundations and some other facilities/areas are covered separately in this specification.			
6.03.29	Plinth level of all buildings shall be kept at least 500 mm above the finished grade/formation level. Finished floor level of boiler area paving shall be kept about 200 mm lower than the finished floor level of Main Plant buildings.			
6.03.30	Joints/Connections in steel structures: Steel structures shall be detailed and connection and joints provided as per the provisions of IS 800, IS 816, IS 9595, IS 1367, and IS 9178 and as per following requirements. a) Connection of vertical bracings with connection members and diagonals of truss members shall be designed for full tensile capacity of the bracings unless actual loads are indicated on the drawings. b) Size of fillet weld for flange to web connection for built up section shall be as follows: i) For box section weld size shall be designed for full shear capacity or actual shear whichever is more. Where fillet weld is not possible, full penetration butt weld shall be provided. ii) For built up I section, weld size shall be designed for 80% of full shear capacity or actual shear, (if indicated, in drawings) whichever is more. However, weld size shall not be less than 0.5 times the web thickness. Weld shall be double fillet. iii) All welds shall be continuous unless otherwise specifically approved. The minimum size of the fillet weld shall be 6mm. c) Shear connections shall be designed for 60% of section strength for rolled sections and 80% of section strength for built up section or rolled section with cover plates. However, if load is more than above, the connection shall be designed for actual load. d) Moment connections between beam and column shall be designed for 100% of moment capacity of the beam section. e) All butt welds shall be full penetration butt welds. f) The connection between top flange and web of crane girder shall be full penetration butt weld. Bottom flange, connection with web can be fillet weld or butt weld as directed by Engineer. g) Connection of base plate and associated stiffeners with the columns shall be designed considering the total load transferred through welds. However, minimum weld size (double fillet) shall not be less than 0.6 times the thickness of stiffeners. h) Splicing: All work shall be full strength. Field splicing shall be done with web and flange			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.03.31	cover plates for full strength. Shop splicing for all sections other than rolled shall be carried out by full penetration butt welds with no cover plates. Splicing for all rolled sections shall be carried out using web and flange cover plate. Pipe Pedestals, pipe supports and other structures for Ash handling system: a) The design of Pipe Pedestal and pipe supports shall be carried out considering Dead load, live load & seismic load / wind load. In addition to above, longitudinal forces equal to product of Co - efficient of friction (between contact surface of pipe and pedestal) with the load coming on each pedestal shall also be considered for the design of pedestal. In bends, suitable thrust block shall be provided to withstand the thrusts transferred from the pipelines. b) All RCC pipes carrying water under gravity shall be designed for earth pressure, water and surcharge. Minimum grade of pipe shall be of NP - 2 class or heavier required as per design / specification. c) The design and construction of RCC structures shall be carried out as per IS: 456. In general, limit state theory shall be followed for the design of RCC structures, however, working stress method shall be adopted for the design, wherever specifically mentioned in this specification. d) Two layers of reinforcement (on inner and outer face) shall be provided for RCC wall sections having thickness 150mm and above.			
6.03.32	Design Criteria of RCC Floors a) For Mill Bunker Building, Main Power House, ESP Control Building, Transfer Houses, and other structural steel framed buildings: These buildings being steel framed structure, all RCC floors shall comprise RCC slab supported on troughed, profiled metal deck sheet (to be used as permanent shuttering). The RCC slab shall be minimum 150mm thick above the top surface (crest) of the metal deck sheet. The spacing of structural steel secondary beams shall be based on the bending capacity of the metal deck sheet for self-weight of green concrete and additional construction load of 100 kg/m². The permanent metal deck sheets shall be fixed to the top flange of secondary beams by means of drawn arc welding of headed shear anchor studs directly through the metal sheet. The details of shear anchor studs are specified elsewhere in this specification. The RCC slab shall be designed without considering any composite action effect of metal deck sheet (i.e. the structural strength of metal deck sheet shall not be considered for RCC slab design). (b) For Service Building & other RCC buildings. These buildings being complete RCC framed structures, conventional RCC slabs of minimum thickness 150 mm shall be provided. The RCC slabs shall be monolithic with RCC beams and RCC columns			
6.03.33	Design Criteria of RCC roofs a) For Main Power House, Compressor House, ESP Control Building and Other Steel framed Buildings: The roof system shall comprise minimum 40mm thick RCC slab on top of profiled permanent metal deck sheet. The permanent metal deck sheets shall be fixed to the top flange of secondary beams by means of arc welding of headed shear anchor studs to the purlins directly through the metal sheet. The details of shear anchor studs are specified elsewhere in this specification. Water proofing treatment to roof slab shall be provided as per details specified elsewhere in this specification).			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-6 CIVIL WORKS DESIGN CRITERIA	PAGE 20 OF 24

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
6.03.34	The RCC slab shall be designed without considering any composite action effect of metal deck sheet (i.e. the structural strength of metal deck sheet shall not be considered for RCC slab design. b) For Mill Bunker Building, Transfer Houses. Insulated sandwiched metal sheet for roofing shall be provided comprising troughed permanently colour coated sheet at top and plain permanently colour coated sheet at bottom with 50mm thick insulation sandwiched between the two sheets, the details of which are specified elsewhere in this specification. c) Roofing system for Ash Handling Plant Pump Houses and Buildings shall be as specified in relevant clauses d) Other RCC Buildings. Cast-in-Situ RCC slab shall be provided using removable plywood shuttering. Water proofing treatment to roof slab shall be provided as per details specified elsewhere in this specification). Design Criteria for Foundation The founding depth / cut off level of piles shall be decided based on functional requirement. Where structural steel columns are envisaged, the bottom of the base plate shall be kept suitably below the paving level such that the top level of the gusset plate and foundation bolt remain at least 200 mm below the top level of paving except for Boiler Structure, Bunker Building Columns, TP & Trestle Columns, ESP Control Building Columns for which the requirement of levels for bottom of base plates is specified elsewhere in this specification. Further the gusset plate and foundation bolts are to be encased in concrete up to the top of the paving level. For outdoor structural steel columns, about 300 mm height of steel columns above the top of paving level shall be provided with at least 125 mm thick encasement with minimum reinforcement to prevent corrosion of the steel columns from surface water a) OPEN Foundations For foundations, the minimum founding depth and the minimum size of foundation shall be as per foundation system and geotechnical data specified in the foundation chapter include hereafter in this specification. For open foundations, the total permissible settlement shall be as per the criteria furnished under the foundation system specified elsewhere in this specification. The sizing of foundation, design criteria & clear cover shall conform to IS:1904, IS:456 and other relevant Indian codes. However minimum 0.12% of reinforcement shall be provided on the top face of the foundation concrete on either direction and minimum percentage of reinforcement both in case of bottom face and also for tension face of foundation shall be same as that stipulated for beam as per IS:456. b) PILE Foundations Minimum centre to centre spacing of the piles shall be as per IS: 2911. Incase single piles are used, these piles are to be interconnected with tie beams along both orthogonal directions perpendicular to each other. Minimum penetration of piles into Pilecap shall be 75 mm and clear cover to the main reinforcement at the bottom face of the pile cap shall be 100 mm. Structural design of pile cap and reinforcement shall conform to IS:2911 and IS:456. However minimum 0.12% of cross section of the pile cap shall be provided on the top face of the pile cap along two orthogonal directions and minimum percentage of reinforcement at bottom face of pile cap shall be same as that stipulated for beam as per IS:456. Detailed requirement of pile foundation have been presented in the foundation chapter specified hereafter in this specification.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
6.04.00	CORROSION PROTECTION											
6.04.01	General (a) All Steel structures shall be provided with painting as given in the specification. Further, painting system shall also meet the requirements of Corrosivity category (as mentioned in Part A IID Civil Works for the project as per ISO 12944). Painting system for steel surfaces embedded in Concrete is given separately. (b) All Painting shall be done as per Technical Specification Painting scheme shall submitted by the Bidder. (c) All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. Minimum thickness of metal for any structural steel elements shall be not less than 6 mm where steel is fully accessible for cleaning and repainting and where it is feasible to follow design criteria given in ISO 12944 part 3. However, where steel surfaces are inaccessible for cleaning and repainting or where it is not feasible to follow design criteria given in ISO 12944 part 3, corrosion allowance of 1.5 mm shall be kept in thickness (over the design thickness or 6mm, whichever is more). Minimum thickness of tubular/ hollow steel sections conforming to IS 4923 shall be 4.0 mm, provided the ends of such steel sections are effectively sealed unless higher thickness is specified elsewhere for specific structure.											
6.04.02	Painting of Steel Surfaces Embedded In Concrete a) For the portion of Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT). b) All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive fluid and during execution of civil works, the dried film of coating shall be removed using organic solvents.											
6.04.03	Painting of Steel Surfaces (Other Than Those Embedded In Concrete) <table><tr><th>CORROSSIVITY CATEGORY</th><th>PRIMER COAT</th><th>INTERMEDIATE COAT</th><th>FINAL COAT</th></tr><tr><td>C3</td><td>All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface</td><td>Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours</td><td>Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour</td></tr></table>				CORROSSIVITY CATEGORY	PRIMER COAT	INTERMEDIATE COAT	FINAL COAT	C3	All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface	Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours	Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour
CORROSSIVITY CATEGORY	PRIMER COAT	INTERMEDIATE COAT	FINAL COAT									
C3	All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface	Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours	Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour									
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CLAUSE NO.	TECHNICAL REQUIREMENTS 			
		profile 40-60 Micron. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.	(from the application of primer coat) by airless spray technique.	change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer.
	C5	All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.	Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 180 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique.	Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer.
Notes:				
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	1. For Primer, high quality surface preparation is necessary and good amount of moisture is required for proper curing. Below 70 % relative humidity, curing time may go up to 7 days or more. In such a case additional water sprinkling may be ensured for completion of curing. Additionally Inorganic zinc silicate cannot be recoated; even with itself. Typically it should be used when coating bare steel surface for first time. 2. The most frequent problem associated when top coating Primer is bubbling/pinholing especially with non-weathered zinc silicate coatings. To a great extent, this bubbling of finish paint can be eliminated by applying a mist coat of intermediate/topcoat as the first pass of the product, allow the bubbles to subside and then apply a full coat, as required. 3. In case top coating of zinc silicate with epoxy/polyurethane coatings, is expected to be delayed, it is advisable to use a suitable tie coat to avoid formation of white rust. However, if white rust forms then clean the surface with high pressure water, dry and apply the subsequent coats as required. 4. Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/emery paper etc. Minimum 6 inches peripheral area, adjoining to damaged area to be covered. If metal surface is exposed, it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.			
6.04.04	Coating for Mild Steel parts in contact with Water. a) All mild Steel parts coming in contact with water or water vapour shall be hot dip galvanised. The Minimum Coating of Zinc shall be 610 g/ Sq.m. for galvanised Structures and shall comply with IS: 4759 and other relevant Codes. Galvanising shall be checked and tested in accordance with IS: 2629. b) The galvanising shall be followed by the application of an etching Primer and dipping in black bitumen in accordance with BS: 3416, unless otherwise specified.			
6.04.05	Gratings All gratings shall be blast cleaned to Sa 2 ½ finish or cleaned by acid pickling as per ISO 8501-1 and shall be hot dip galvanized at the rate of 610 gm/sqm.			
6.04.06	Hand Railings and Ladders All Mild steel (MS) handrails and ladders in outdoor locations and in pump valve pits shall be galvanised at the rate of 610 gm/sqm as per IS 4736. All other MS handrails shall be painted as specified in clause 6.04.03 above. However, Stainless steel handrails shall be provided as specified in General Architectural Specification clause 9.00.00.			
6.04.07	Sea Worthiness All Steel Sections and fabricated Structures, which are required to be transported on sea, shall be provided with anti-corrosive Paint before shipment to take care of sea worthiness.			
6.04.08	DELETED			
6.04.09	For reinforced concrete work. i) The protection for concrete sub-structure shall be provided based on aggressiveness of the soil, chemical analysis of soil/sub-soil water and presence of harmful chemicals/salts. ii) The protection to super structure shall depend on exposure condition and degree of atmospheric corrosion. This shall require use of dense and durable concrete, control of water cement ratio, increase in clear cover, use of special type of cement and reinforcement, etc., coating of concrete surface, etc., Bidder shall furnish the details of corrosion protection measures.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
D-1-7	FOUNDATION SYSTEM AND GEOTECHNICAL DATA			
7.01.00	Soil Data Owner has carried out preliminary geotechnical investigation at the project site. Available borelogs in vicinity along with laboratory test results and ERT, are enclosed at Annexure-C for Bidder's reference. The geotechnical investigation report for nearby areas will be made available for the Bidder's study at the Owner's office, if required. Onus of correct assessment/ interpretation and understanding of the existing subsoil condition / data is on the Bidder. Bidder may refer enclosed topographical survey drawing and general layout plan along with borelogs for variation in existing/ natural ground level (NGL) and finished ground level (FGL). As per borelog data, near proposed Admin building, fire station, permanent store, Workshop building and gate complex area, carried out by owner ash/coal deposit is found. Wherever ash/coal deposit/brick-bats etc. is found the same shall be treated as filled up soil. Further, as per available borelog data of the above mentioned area, NGL is varying from RL(+) 64.9 m to RL(+) 67.0m and FGL is RL(+) 69.0 i.e. there may be filled up layer up to 2.0m to 4.1m of ash/coal deposit. As per borelog data, water table is varying from 0.4m to 4.5m at the time of field investigation and may fluctuate with season.			
7.00.01	Contractor shall carryout detailed geotechnical investigation for the facilities under this package. The scheme for geotechnical investigation shall be as given at Clause 7.10.00 and shall be approved by Owner before execution. Geotechnical investigation work may be got executed by the contractor through the suggested agencies as mentioned in Clause No. 7.09.03 or any other agency having adequate experience for carrying out such works and approved by engineering department of the owner. The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundation and allowable bearing pressure for various structures/ facilities and other soil parameters. The report shall be submitted for Owner's approval prior to commencement of design of foundation.			
7.00.02	The furnished borelog details are specific to the co-ordinates where the boreholes have been carried out and are provided for bidder's information only. Soil profile in the proposed area may vary with respect to the borelogs enclosed for bidder's information. Bidder has to consider all such variations in his estimation, over the extent of the work to be carried out. The Bidder should note that nothing extra whatsoever on account of variation between soil data collected by Owner and that found by the Bidder during geotechnical investigation by him or during execution of works, shall be Payable.			
7.00.03	Tank Foundations a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil, if any. b) Entire loose/ soft soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III. c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers, etc to achieve a relative density of not less than 80%. d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications.			
7.02.00	Foundation System The requirements for the foundation system to be adopted are as given in subsequent clauses. Depending upon the depth of competent strata/stratum, type of structures, functional requirement of facility, extent of cutting / filling, suitable open or pile shall be adopted with			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
7.02.01	approval of owner. General Requirements - All structures/equipment shall be supported on suitable open foundations (isolated, combined, raft) or pile foundations depending on type of structures/facilities, sub-strata, topography etc. - The roads, ground floor slabs, trenches, pipe pedestals (except thrust blocks), channels/drains and staircase foundation with foundation loading intensity less than 4 T / M2 may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil. - No other foundation (other than as mentioned in (b) above and (g) below) shall rest on the filled up ground / soil. - All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards. - The water table for design purpose shall be considered at Finished Ground Level. - A combination of open and pile foundations shall not be permitted under the same equipment / structure / building. - Foundation for equipments on ground floor For equipments of static weight upto 1.5 T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab shall be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 4T/m2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications. For equipment's of static weight between 1.5 T and 20 T, the equipment may be supported on compacted sand filling from Natural Ground Level (NGL) or excavation level of nearby footing whichever is deeper with the load intensity below the equipment limited to 4T/m2. The minimum depth of foundation is 1.0m below FFL. Other requirements of sand compaction below the foundation shall be adhered, as specified elsewhere in the specifications. For equipment of static weight more than 20 T, the equipment foundation shall be taken to the founding level or shall be built up with PCC from the level as mentioned in the Table 1. The pedestal of equipment foundation or the foundation Block shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment pedestal for the full depth of the floor slab. 7.02.02 Open Foundations In case open foundations are adopted, following shall be adhered to. - The minimum width of foundation shall be 1.0 m. - Minimum depth of foundation shall be 1.0m below Ground Level. - It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum. - Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC (1:4:8) up to designed foundation level. - Wherever the intended bearing stratum is weathered rock, but the actual strata encountered during excavation consists of both overburden soil and weathered rock at founding level, under such cases, the overburden upto the weathered rock level			
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- including 0.5 m into the weathered rock shall be removed and built up through PCC (1:3:6) upto the designed founding level. Thus, maintaining the same founding level for all the footings of a structure.
- f) The last layer of about 300 mm before reaching the founding level shall be excavated carefully by such equipment so that soil / rock at the required level will be left in its natural condition.
- g) Wherever the new facilities (excluding roads, ground floor slabs, trenches, pipe pedestals, channels/drain and staircase foundation) are to be constructed after dismantling existing facilities; it is to be ensured that the new foundations shall be taken at least 1m below the existing founding depth of the dismantled structures in case of soil and 0.6m below the existing founding depth of dismantled structures in case of rock.
- h) During design the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report and as per the values furnished in Table-1.

Table-1

Founding Depth/ Stratum	Net Allowable Bearing Pressure T/m2		
	Isolated and combined footings including raft for 25mm permissible settlement in case of soil and 12mm in case of rocky strata	Isolated and combined footings for 40mm permissible settlement in case of soil and 12mm in case of rocky strata	Rafts (width > 6m) for 75mm permissible settlement in case of soil and 12mm in case of rocky strata
	Width upto 6.0m		
In case of foundation stratum is soil			
1.0m below NGL	-	5	7
2.0m below NGL	-	8	12
3.0m below NGL	10	15	18
4.0m and below NGL	14	20	24
In case of founding stratum is rock			
0.6m embedment into rock	35.0	35.0	35.0
1.0m embedment into rock	40.0	40.0	40.0
2.0m embedment into rock	50.0	50.0	50.0

For FGL refer GLP (General layout plan)

For NGL of the proposed area GLP along with enclosed topographical survey drawing and borelog data may be referred. In case any loose/soft pockets is encountered at founding level, the same shall be removed completely upto the hard strata and filled up with PCC (1:4:8).

For the new facilities to be constructed after dismantling existing facilities; founding level of new facilities shall be taken at least 1.0m below the existing founding depth of the dismantled structures in case of soil and 0.6m below the existing founding depth of the dismantled structures in case of rock.

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7.03.00	For open foundations, the total permissible settlement shall be governed by IS: 1904 / IS: 13063 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:															
	Isolated & Raft (Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil			25 mm												
	Isolated & Strip (other than Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil			40 mm												
	Raft (other than Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil			75 mm												
	Foundations in Weathered rock / rock			12 mm												
	PILE FOUNDATIONS – In case piles are adopted, following shall be adhered to:															
	i) The pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Self erecting Crawler mounted Rotary Hydraulic Rigs. However, conventional tripod rig may be allowed in inaccessible areas subject to site specific conditions. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer. The piling work in river/water body shall be carried out with temporary or permanent MS liner and approved construction methodology. If piles are extending, above bed level of river/water body, in water, permanent MS liner of minimum 8mm thickness shall be provided. In submergence area at Samal Barrage, under water piling shall be adopted. Further, Cl. No. 7.08.00, shall be referred for special requirement for piling work for river side/ submergence facilities.															
	ii) The minimum diameter of pile shall be 600 mm and in case of piles in water body/river, minimum diameter of piles for bridge/approach bridge shall be 1200mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be least of the three values i.e. as per approved geotechnical report, as per the values furnished in following table and pile capacity achieved in pile load tests:															
	<table><tr><td>Pile</td><td>Dia. (mm)</td><td>Vertical compression capacity (T)</td></tr><tr><td rowspan="4">Bored cast-in-situ pile</td><td>600</td><td>140</td></tr><tr><td>760</td><td>250</td></tr><tr><td>1000</td><td>350</td></tr><tr><td>1200</td><td>450</td></tr></table>			Pile	Dia. (mm)	Vertical compression capacity (T)	Bored cast-in-situ pile	600	140	760	250	1000	350	1200	450	
	Pile	Dia. (mm)	Vertical compression capacity (T)													
Bored cast-in-situ pile	600	140														
	760	250														
	1000	350														
	1200	450														
Pile shall be socketed into weathered rock. A socketing length of Five meter into rock shall be ensured . The uplift and lateral load capacity shall be respectively restricted to 35% and 5% of the allowable load capacity in vertical compression. However, the pile capacities to be adopted shall be the least of the estimated design values and that obtained from the initial pile load tests.																
iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m.																
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	iv) The contractor shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, pile load test arrangement, locations of initial test piles etc.) for Engineer's approval. v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval. vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under. Vertical Lateral Minimum of 2 Nos. in each mode. Uplift vii) The initial pile load test shall be conducted with test load three times the estimated pile capacity. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part). viii) Load test shall be conducted at pile cut of level (COL). If the water table is above the COL the test pit shall be kept dry through out the test period by suitable de-watering methods. Alternatively, the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter. ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under: i) Vertical : 0.5% of the total number of piles provided. ii) Lateral : 0.5% of the total number of piles provided. x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer. xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required. xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm. xiii) The test load on initial test piles shall be applied by means of reaction from anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge with concrete blocks.			
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	xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM. xv) High Strain Dynamic Load Test may be carried out for routine vertical load test of working piles. However, at least three numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.03.00 (ix) shall be total of static routine vertical load test and high strain dynamic load tests. The procedure to carry out the test shall be submitted to the Engineer. The test and equipment shall conform to ASTM D4945-00. The test shall be conducted by an experienced independent test agency approved by the owner. Field data shall be submitted to the site engineer and shall include force velocity curves, pile capacity, simulated static load test curve, net and total pile displacement, pile integrity. A (Case pile wave analysis) CAPWAP or equivalent software analysis shall be conducted on the field data for correct capacity estimation and to evaluate end bearing and skin friction components of the pile. xvi) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions. xvii) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles. xviii) Reinforcement for job piles shall be designed as following: (a) Compression + bending piles: For these piles, the allowable safe pile capacities in compression and bending shall be considered. (b) Tension + bending piles: For these piles, the actual pile forces to be considered. However, maximum 3 types of combinations for varying percentage of tension capacity + bending case may be designed & adopted by contractor for the entire scope of work under this package. 7.04.00 Special Requirements 7.04.01 Details of treatment for foundations / underground structures required to counteract soil / water chemical environment shall be as per detailed geotechnical investigation to be carried out by contractor. Contractor shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided accordingly. 7.05.00 Excavation, Filling and Dewatering
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7.05.01	For excavation works, comprehensive dewatering with well point or deep wells arrangement, if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth.			
7.05.02	Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or any loose pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.			
7.05.03	<u>Backfilling in Power House & Boiler Area</u> Backfilling around foundations, trenches, sumps, pits, plinths, etc. shall be carried out with sand in layers not exceeding 300 mm compacted thickness and each layer shall be compacted to minimum 80% of relative density. <u>Backfilling in other area</u> Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each layer shall be compacted to 90% of standard proctor density for cohesive soils and to 80% of relative density for non cohesive soils. Rock pieces having size less than 150 mm and interstices filled with soil may be used for backfilling around foundation, plinths etc. and shall be compacted to minimum of 85% of original stack of material after filling the interstices.			
7.05.04	Founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.			
7.05.05	CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.			
7.05.06	The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding of material or article from any bank or side of such excavation which is more than one and a half meter above the footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.			
7.06.00	EXCAVATION IN ROCK Excavation in rock shall be carried out by mechanical means and if blasting is required for founding of some of the structures under this package, control blasting only shall be carried out.			
7.06.01	Controlled blasting shall be done by a specialised agency duly approved by Engineer. All controlled blasting shall be done by using time delay detonators (i.e. excel type).			
7.06.02	a) Contractor shall engage an agency expert in blasting such as, NIRM (National Institute of Rock Mechanics), CMPDIL, Central Institute of Mining and Fuel Research Dhanbad, Dept. of Mining of Govt. Institutions etc. to design detailed blasting scheme and get the same approved from Engineer before carrying out the blasting operation. All blasting shall be done as per the approved blasting scheme & initial blasting operations shall be done under the supervision & guidance of the representative of the blasting expert. b) All the statutory laws, (Explosives Act etc.) rules, regulations, Indian Standards, etc. pertaining to the acquisition, transport, storage, handling and use of explosives, etc. shall be strictly followed.			
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	c) The Contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per explosives act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive Materials. d) The Contractor shall be responsible and liable for any accident and injury / damage which may occur to any person or property of the project or public on account of any operations connected with the storage, transportation, handling or use of explosive and blasting operations.			
7.07.00	Sheeting & Shoring The contractor shall ascertain for himself the nature of materials to be excavated and difficulties, if any, likely to be encountered in excavation while executing the work. Sheet piling, sheeting and shoring, bracing and maintaining suitable slopes, drainage, etc. shall be provided and installed by the Contractor, to the satisfaction of the Engineer.			
7.08.00	SPECIAL REQUIREMENTS FOR RIVER SIDE/SUBMERGENCE FACILITIES Bidder may provide suitable foundations as per IRC. The design of river/water body side foundations shall account for local scour around foundations, which shall be assessed by Contractor. Scour depth calculation shall be as per IRC. During design the Allowable Bearing Pressure/pile capacity shall be adopted after approval of geotechnical investigation report. A) Bridges/ Approach bridge piles (Incase pile foundations are to be adopted) i) The design of river/water body side piles shall account for local scour around pile, which shall be assessed by Contractor. Scour depth calculation shall be as per IRC. ii) Contribution of frictional resistance from bed level upto maximum scour depth shall not be considered for computation of frictional resistance of river/water body side piles. iii) All piles shall be located using Total Station Laser Operated Instrument. iv) Initial pile load test under vertical (compression) & lateral loads shall be conducted on initial test piles installed river/water body side as per relevant IRC/IS code. If it is not feasible, initial load tests in simulated conditions (removal of skin friction from pile cut of level to the river bed level) may be conducted on river/water body bank with the approval of the Engineer. v) All the river/water body work safety norms shall be adhered to. vi) Diameter of piles for bridge/ approach bridges shall be 1200mm. The vertical capacity, uplift & lateral load carrying capacity shall be as per the geotechnical investigation report duly approved by the Owner.			
7.09.00	Geotechnical Investigation The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.			
7.09.01.00	Scheme of geotechnical Investigation			
7.09.02.01	Field test shall include but not be limited to the following: Boreholes, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT),Cyclic Plate Load Test(CPLT), Electrical Resistivity Test (ERT), Cross Hole			
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7.09.02.02	Test, Pressure Meter Test (PMT), In situ field permeability tests, collection of water samples, etc.			
7.09.02.03	The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. The diameter of UDS sampler shall be 100 mm minimum. Core drilling in rock shall be done by using hydraulically feed rotary drill & double tube core barrel with diamond bit.			
7.09.02.04	The minimum tests are indicated in relevant clause. Adequate number of tests shall be conducted up to sufficient depth for complete determination of subsoil conditions. The depth of boreholes shall be as specified in relevant clause. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. SPT 'N' of 100 and above shall be referred as refusal. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50.			
7.09.02.05	Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers.			
7.09.03.00	Laboratory Tests on Soil Samples Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free swell Index, Shrinkage Limit, Swell Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel. Laboratory Tests on Rock Samples Moisture content, porosity & density, Specific Gravity, Hardness, Soundness, Slake durability index, Unconfined compression test (Both at saturated and in-situ water content), Point load strength index and deformability test (Both at saturated and in-situ water content) shall be carried out on rock samples. Geotechnical investigation (field & laboratory) shall be carried out in accordance with the provisions of relevant Indian Standards. On completion of all field & laboratory work, geotechnical investigation report shall be submitted for Owner's review/approval. The Geotechnical investigation report shall contain geological information of the region, procedure adopted for investigation, field & laboratory observations/ data/ records, analysis of results & recommendations on type of foundation for different type of structures envisaged for all areas of work with supporting calculations. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, recommendation along with slope stability calculation for deep excavation, etc. Geotechnical investigation work may be got executed by the Contractor through the following suggested agencies 1. C.E.TESTING COMPANY Pvt. Ltd, Kolkata 2. Cengrs Geotechnica Pvt. Ltd, New Delhi 3. KCT Consultancy Services, Ahemdabad 4. M.K. Soil Testing Laboratory, Ahemdabad or any other agency having adequate experience for carrying out such works			
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7.10.00	and approved by engineering department of the owner.				
	Geotechnical Investigation Scheme				
	a) Boreholes (Minimum)				
	S.N	Structure	Spacing/Number of borehole	Depth of borehole	Remarks
	1	Main power house, Turbo-Generator (TG)	30 to 45 m along the rows of main power house columns. Minimum 2 boreholes under each TG	20 to 25m.	Depth of boreholes shall be as mentioned in column "Depth of Borehole" or 5m continuous in rock with RQD > 50% whichever is earlier.
	2	Main Plant structures (Boiler, ESP, Chimney, Mills, Fans etc)	Minimum 4 boreholes under each Boiler, Mill & Bunker, ESP structure and 4 boreholes under Chimney, Minimum 2 boreholes under each ESP Control Room, TPs, Fans and Duct Support.	20 to 25m.	
	3	Service Building	Minimum 2 no of boreholes	20 to 25 m	
	4	CPU Building	Minimum 2 no of boreholes	15 to 20m	
	5	Flue Gas Ducting and Absorber Area (FGD)	Minimum 15 boreholes	20 to 25m	
	6	Ash Handling Structures	Minimum 8 boreholes	20 to 25 m	
	7	Corridors for Ash pipe routes	1 borehole @ 500 m c/c along the identified corridor and one ERT shall be conducted near each borehole	8-12 m	
	8	Crossings along the pipeline corridor like road, river, nallah/ canal, Approach bridge	2 no. of boreholes at each crossing (one on each side) and 2 nos (min) of boreholes inside the river/ nallah of width more than 10.0m	15 to 20m	
	9	Cooling Tower Area, CW system Area	4 boreholes and one ERT in each CT. 4 boreholes and two ERT in CW system Area	15 to 20m	
10	Switchyard	Minimum 10 No of Boreholes	10 to 15 m		
11	Coal, Limestone and Gypsum Handling System	Minimum one borehole under each TP and one under each crusher and one borehole under	20 to 30 m		
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			each structure. Minimum 6 no of under each stockpile area, 12 nos in Limestone and Gypsum handling area, 8 nos in Track & Truck Hopper area and 8 Nos of ERT		
12	Transformer yard		Minimum 8 boreholes and 3 Nos ERT	10 to 15 m	
13	Water treatment plant Area		Minimum 8 boreholes and 4 Nos of ERT	15 to 20 m	
14	Raw water system Area		Minimum 4 boreholes	15 to 20 m	
15	Miscellaneous buildings		1 borehole under each buildings	15 to 20 m	
16	Reservoir		20 Nos	10 to 15m	
17	Make-up Water pump house, Control room building		Minimum 10 Nos. 4 Nos ERT	25 to 30 m	
19	Other Structure/Facility		Minimum 2 Nos. boreholes under each area / facility	10 to 15 m	
b) Other Field Tests (Minimum)					
1	Plate Load Test (PLT)		2 no in Power House, 3 Nos. in boiler area, 1 No. in CPU, 1 no each in each ESP and 3 Nos. in Ash Handling Structure area in Plant Area, 6 No in Balance of Plant area	Test Depth from 2 to 4 m	
2	Cyclic Plate Load Test (CPLT)		1 no in each TG, 1 no in each Mill, 1 no in ID fan, 1 no in each FGD	Test Depth from 2.5 to 4 m	
3	Trial Pit (TP)		About 35 Nos.	Depth 3- 4 m	
4	In Situ Permeability Test In Boreholes		In minimum 35 Nos. of boreholes	Tests shall be conducted at depths of 1.0m, 3.0m, 5.0m, 8.0m and 10.0m in other than Track & Truck hopper area. In Track & Truck hopper area test shall be	
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				conducted at depths of 1.0m, 4.0m,7.0m, 10.0m, 13.0m,16.0m and 20.0m	
	5	ERT	6 Nos. in TG/Power House area, 1 No. in CPU Building, 2 Nos. each in Boiler, Chimney, ESP Control Room, 4 Nos. in Ash Handling Structures area in Plant area, 4 Nos in FGD, 8 Nos in switchyard, 1No near each Pump House other than mentioned above		
	6	CROSS-HOLE TEST	1No. in each TG, 1No. in each Mill & bunker and 2 Nos in ID Fan, 1 no in each FGD	Depths covering from 1.0 m to 15.0 m	
	7	PMT	80 no of tests in power house area, SG area & Balance of Plant area	Depths covering from 1.0 m to 20.0 m	
	• Depth and location of Boreholes and other field tests (PLT, ERT, field permeability tests etc.) shall be approved by Owner before execution of geotechnical investigation work. • Investigation in any other building / structure / facilities / trestles which are not mentioned above shall also be carried out, if required, by the bidder for the facilities under his scope.				
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D-1-8	GENERAL SPECIFICATION			
8.01.00	GENERAL REQUIREMENTS			
8.01.01	JOINTS IN CONCRETE STRUCTURES			
	Construction Joints			
	All horizontal construction joints shall be provided with a groove (shear key) for transfer of shear force.			
	For construction joint in concrete wall, the maximum height of any lift should not exceed 2 meters. However, the time interval between the successive lifts should be as small as possible and the wall should be built to its full height in the least possible time.			
	Expansion joints for all underground structures shall be made watertight by using ribbed PVC water stops with central bulb or of kicker type. The thickness and width of PVC water stops shall be as per the requirement of design. However, the minimum thickness and width shall be 6mm and 225mm respectively.			
	Expansions Joints			
	In case of expansion joints, preformed bitumen impregnated fibre board conforming to IS 1838 shall be used as joint filler. The joints shall be sealed with bitumen sealing compound conforming to IS 1834, however in case of liquid retaining/carrying structures, two parts polysulphide sealant conforming to IS 12118 or silicon sealing compound shall be used.			
	IS 3414 shall be followed for details of joints in buildings. 3 mm thick stainless steel strip in matt or buff finish shall be provided over building expansion joints.			
8.01.02	Miscellaneous General Requirements			
8.01.02.1	All steel sections and fabricated structures, which are required to be transported on sea, shall be provided with anti-corrosive paint before shipment to take care of sea worthiness.			
8.01.02.2	Monorails, monorail girders and fixtures shall be provided, wherever required to facilitate erection / maintenance of equipment.			
8.01.02.3	Wherever possible all floor openings shall be provided with 100 mm thick 150 mm high RCC kerb all around.			
8.01.02.4	Angles 75 x 75 x 6 mm (minimum) with 8mm diameter and 150mm long MS lugs @ 150 c/c shall be provided for edge protection all around cut outs/openings in floor slabs. Angles 50 x 50 x 6mm with effective anchor lugs shall be provided for edges of concrete drains supporting grating/covers, edges of RCC cable / pipe trenches supporting covers/chequered plates/ grating, edges of manholes supporting covers, supporting edges of precast RCC covers and any other place where breakage of corners of concrete is expected.			
8.01.02.5	Floor of switchgear room shall be provided with embedded M.S. channel suitable for easy movement of breaker panels.			
8.01.02.6	Anti-termite constructional measures and chemical treatment measures shall be given to all vulnerable areas susceptible to termite including column pits, wall trenches, foundations of buildings, filling below the floors, etc., as per IS 6313 and other relevant Indian Standards.			
8.01.02.7	All cable & pipe routing shall be done as per system requirement and as stipulated elsewhere in the specification and shall run above ground on elevated trestles or other supporting structures except in some localized area (as approved by Employer) where the same can run in trenches. In case, pipes are to be routed on RCC pedestals, the height should not be less than 500mm above formation level/paving level. All trenches shall be of RCC with removable RCC covers.			
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	All cable trenches located inside buildings shall have minimum 6mm thick (o/p) chequered plate covers. Cable trenches, where allowed, located outside the buildings shall project at least 200mm above the finished formation level unless noted otherwise elsewhere in this specification so that no storm water shall enter the trench. The bottom of the trench shall be provided with a longitudinal slope of 1:500. The downstream end of trenches shall be connected through pipe drains to the nearby RCC manholes (to convey water from trenches) of storm water drainage system, but avoiding back flow of storm water. In general, the precast covers shall not be more than 300 mm in width and shall not weigh more than 65 kg. Lifting hooks shall be provided in the precast covers. All cable trenches, wherever required, shall be provided with suitable insert plates for fixing support angles of cable trays. In Main plant area wherever fire water pipe trenches are envisaged, these trenches shall be of RCC and provided with precast RCC cover flush with finished level of paving in that area. R. C. C. cable slits shall be filled with sand after erection of cables, up to top level and covered with 75mm thick PCC cover of minimum M15 grade.		
8.01.02.8	All steel platforms above grade shall be provided with 100 x 6 thick kick plates at edge of platform.		
8.01.02.9	Duct banks consisting of PVC conduits conforming to IS 4985 for cables shall be provided with proper sealing arrangement consisting of fire retardant sealing compound.		
8.01.02.10	Independent network of lines for sewerage and drainage shall be provided. Plant effluent shall not be mixed with either storm water or sewage.		
8.01.02.11	The sub-grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor density at Optimum moisture content (OMC.)		
8.01.02.12	Detailed scheme for dewatering shall be prepared, wherever required, before starting of deep excavation work. IS 9758 shall be followed as general guidance for dewatering.		
8.01.02.13	Structural steel column base plates and bolts, gussets, etc., shall not project above the floor level unless and noted otherwise. These shall be encased by concrete cover up to floor level with concrete grade M 25.		
8.01.02.14	Non-shrink flow able grout shall be used for under-pinning work below base plate of columns. Nominal thickness of grout shall be 50 mm. Non-shrink cum plasticizer admixture shall be added in the grout. Crushing strength of the grout shall generally be one grade higher than that of the base concrete. Minimum grade of grout shall be M-30. Grouting of all pockets, blockouts, sleeves and the openings around the embedment, inserts, bolts etc. and under pinning below the base / sole plate shall be with non - shrink flow able grout. Grade of grout shall be one grade higher than concrete. However minimum grade of grout shall be M - 30. However, for equipment foundations, high strength (minimum characteristic compressive strength of 60 N/sq.mm at 28 days) ready mixed non-shrink, chloride free, cement based, free flowing, non-metallic grout as recommended by equipment manufacturer shall be used.		
8.01.02.15	All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rain water harvesting scheme for the buildings, structures, facilities in Bidder's scope and obtaining approval of the scheme from Central Ground Water board is in Bidder's scope.		
8.01.02.16	As required suitable steel frames shall be provided around openings in the roof and external walls for mounting exhaust fans.		
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8.01.02.17	750mm wide x 100 mm thick plinth protection in PCC (M-15) shall be provided around all buildings, pits / sumps, clarifiers, tanks, etc.		
8.01.02.18	All masonry walls shall be provided with Damp Proof Course at plinth level.		
8.01.02.19	All monorail openings in the walls shall be provided with double plate flush steel door shutters with suitable access platform and ladder as required.		
8.01.02.20	Hand rail (of minimum 1m height), size and material to be adopted shall be as per general architectural specification.		
8.01.02.21	In all buildings, suitable arrangement for draining out water collected from equipment blow downs, leakages, floor washings, firefighting etc. shall be provided for each floor with suitable floor drains.		
8.01.02.22	Unless specified all sand filling shall be compacted to minimum 80% of the relative density and backfilled earth shall be compacted to minimum 90% of the Standard proctor density at OMC.		
8.01.02.23	All buildings shall be provided with peripheral drains by the side of plinth protection for catering to the rain water from roofs and storm water from adjacent area. Plinth protection drains shall be provided all around the building and to be connected with nearest storm water drain. Minimum size of plinth protection drain will be 300mmx300mm.		
8.01.02.24	Minimum 2.0m wide walkway with plain cement concrete (nominal mix M15 grade) paving 150 mm thick laid over 75 mm thick bed of dry aggregate shall be provided connecting all buildings and facilities. The top of walkway shall be minimum 200mm above FGL, unless specified otherwise.		
8.01.02.25	For all buildings, finished floor level (FFL) shall be minimum 500mm above finished ground level (FGL).		
8.01.02.26	40mm Diameter MS rods as earthing mat, placed at a distance of 1.0m away and at depths between 0.60m and 1.00m shall be supplied and laid all around the periphery of buildings, structures, and outdoor equipment, as per approved drawings. Riser of 40mm Dia. MS rods and connecting to the above Earthing mat shall also be supplied and laid in position by the Contractor, as per the approved drawings. Raiser shall be laid up to a height of 300 mm above the local Ground level, at each of the columns of the buildings on the outside of the buildings, and minimum 2 (two) numbers for each structures and equipment. The contractor shall also supply and lay necessary number of 3.0 m deep 40 mm diameter MS rods Earthing electrodes and connect electrodes to the Earthing mat, as per the approved drawings and supplying and laying of 40 mm Dia. MS rods for connecting the Contractor's earthing mat with the Employer's earthing mat separately.		
8.01.02.27	Hume pipes of required class shall be as per IS: 458. Hume pipe made of Geopolymer concrete may also be used. Details of ingredients for Geopolymer concrete is as per details specified elsewhere.		
8.01.02.28	Coefficient of active earth pressure shall be considered for design of free standing retaining walls and coefficient of earth pressure at rest shall be considered for design of top propped retaining walls.		
8.01.02.29	Interlocking concrete block , kerb blocks or concrete block specified for various uses shall be precast blocks made of alkali-activated concrete /Geopolymer concrete as per IS:17452-2020.		
8.01.02.30	Rail-track from transformer yard to unloading bay of Main Power House shall be provided with rigid type RCC foundation. Rail weighing 52 kg/m(minimum) shall be used.		
8.01.03	Acid/ Alkali Resistant Lining All structures receiving acid / alkali resistant lining shall be tested for water tightness and made leak proof before lining work. The acid / alkali resistant lining shall be provided broadly in the areas identified. The Bidder		
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8.02.00 8.02.01	shall give a guarantee for satisfactory functioning of the lining for a period of 36 months from the date of completion of the work or date of handing over the site to the Engineer, whichever is later. The Bidder shall replace / rectify defects is any, observed in the lining to the satisfaction of the Engineer without any extra cost during this period. The material for Acid/ Alkali Resistant Lining shall conform to the following: i) Bitumen primer shall conform to IS: 158. ii) Bitumastic compound shall conform to IS: 9510. Where the height of bitumastic layer on vertical surface is more than 2.0 m, the bitumastic layer shall be reinforced with diamond pattern expanded metal steel sheets conforming to IS: 412. iii) A.R. Bricks/ Tiles shall conform to class II of IS: 4860 & IS: 4457 respectively. iv) Mortar: Potassium silicate & resin type mortars shall conform to IS: 4832 Part-I&II respectively. CONCRETE GENERAL a) Concrete work shall be of grade as per IS 456. Mix design concrete shall be used for all areas other than lean concrete work and plain cement concrete where nominal/volume mix can be permitted. Design mix shall be carried out as per IS10262. Specific approval of the Engineer shall be obtained regarding degree of quality control to be adopted for design mix. b) Minimum grade of reinforced cement concrete for all foundations shall be M25 unless noted otherwise. Minimum grade of concrete for other structures/areas (other than machine foundations) shall be M25 for all superstructure and substructure unless noted otherwise elsewhere in this specification. c) The minimum grades of concrete for different machine foundations and some of other important structural members shall be as follows:																								
	<table><tr><th>Sl No</th><th>Description</th><th>Minimum grade of concrete</th></tr><tr><td>i)</td><td>ID, FD, PA fan & Mill foundations (block foundations)</td><td>M-30</td></tr><tr><td>ii)</td><td>TG top Deck</td><td>M50</td></tr><tr><td>iii)</td><td>TG Raft/ Substructure</td><td>M35</td></tr><tr><td>iv)</td><td>Complete wagon trippler/track hopper, Stacker and Reclaimer foundations, Crusher Deck foundation and other railway load bearing structures.</td><td>M35</td></tr><tr><td>v)</td><td>BFP foundations (in case of springs supported) / (in case of block foundation)</td><td>M35 / M30</td></tr><tr><td>vi)</td><td>Rail load Bearing Structures</td><td>M35</td></tr></table>				Sl No	Description	Minimum grade of concrete	i)	ID, FD, PA fan & Mill foundations (block foundations)	M-30	ii)	TG top Deck	M50	iii)	TG Raft/ Substructure	M35	iv)	Complete wagon trippler/track hopper, Stacker and Reclaimer foundations, Crusher Deck foundation and other railway load bearing structures.	M35	v)	BFP foundations (in case of springs supported) / (in case of block foundation)	M35 / M30	vi)	Rail load Bearing Structures	M35
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	vi)	Rail load Bearing Structures	M35																						
	Concrete design mix of M50 grade concrete for TG top deck and substructure shall be carried out as per IS 10262 satisfying following conditions /Specification:																								
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8.02.03	b. The manufacturer shall mark the coupler in such a way that all finished reinforcement couplers can be traced to the original cast from which they were made along with date of manufacture. c. Sampling and other requirements of IS 16172 shall be complied with. d. Each lot shall be supplied with manufacturer's test certificate (MTC) indicating values of tests in line with IS 16172. e. The minimum clear cover requirements are to be ensured for reinforcement couplers also. f. The couplers shall be used only at the locations where joint is required as per standard lapping purpose and couplers shall not be used for joining of several cut pieces of reinforcement in a single bar. As a general guideline, the length of the bars in which coupler is to be provided should not be less than 4m. Vendors for the reinforcement couplers shall be subject to the approval of Engineer-In-Charge			
	Special requirements for concreting of major equipment foundations shall be as given below.			
	a) Temperature Control of Concrete All the machine foundations such as Mills & Fans, top decks of TG & BFPs, the temperature of fresh concrete shall not exceed 25 deg C when placed. For maintaining the temperature of 25 deg C, crushed ice shall be used in mixing water.			
	b) Admixture Plasticizer /super plasticizer admixture shall generally be added to the concrete for promoting workability. In addition, plasticizer/super plasticizer-cum-retarder shall be added to retard the setting time for mass concreting work as required. In case of pumping, suitable pumping additive shall also be added to avoid segregation and increase flowability. The slump shall generally be in the range given below: Top decks of TG & BFP - 150 mm to 180 mm Block foundations - 100 mm to 150 mm TG Column - 100 mm to 150 mm			
	c) Form work Plywood with film face form work shall be used for the top decks of all machine foundations			
	d) Placing of Concrete Base Raft and top deck of machine foundations shall be cast in a single pour.			
	e) Scheme for Concreting Weigh Batching Plants, transit mixer, concrete pump shall be mobilized. Arrangements for standby Plant and Equipment shall also be made.			
	f) Ultrasonic Testing Ultrasonic pulse velocity test shall be carried out for TG top deck including TG Columns & BFP top decks (in case of Block type, UPV testing is not required) to ascertain the homogeneity and integrity of concrete. In general, grid spacing of 1.0m to 1.5m may be adopted for carrying out the UPV testing. In addition, additional cubes (at the rate of one cube per 150 Cum of concrete subject to a minimum of six cubes) shall be taken to carry out Ultrasonic Pulse velocity (UPV) testing on the cubes, to			
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8.02.04	serve as reference UPV values. Testing shall be done as per IS13311 (Part-1). In case of any defect, the Bidder shall rectify the defects suitably using cement/epoxy grout, etc. Wherever block type foundations are provided for machine foundations such as BFPs, UPV testing of foundation concrete is not required. Anchor Fasteners Anchor Fasteners for use in concrete shall conform to the following: a. The safe tensile load carrying capacity of the anchors shall be arrived by providing the minimum factor of safety of 2.5 on the characteristic load of the anchor. Minimum size of the anchors shall be M8. b. All anchors shall be from established and approved makes/ manufacturers. c. Anchors shall be fixed in position as recommended by the manufacturer and as approved by the engineer. d. Anchor fastener can be of mechanical type based on working principles such as keying, friction, combined friction- keying or chemical bonding type. 1) Mechanical type: The anchors shall be cold formed stud type torque controlled mechanical expansion fasteners having 3-way expansion sleeve of SS 316 grade with nut and washer and galvanized to minimum 5 microns. For coastal/ corrosive environments, the anchors shall be of Stainless Steel (min grade SS 304) or HCR (High Corrosion Resistance). The anchors shall conform to a minimum grade of 5.8 as per IS: 1367. 2) Chemical type: The anchor shall be adhesive type consisting of slow curing chemical adhesive with a proportion of resin and hardener as per manufacturer's recommendation in a soft foil pack, threaded rod of carbon steel conforming to a minimum grade of 5.8 as per IS: 1367 and minimum galvanization of 5 microns with associated nut and washer. The chemical shall be dispensed through mechanical dispenser and shall be self-curing type. e. Capacity of the anchors shall be established after considering the effect of concrete grade, embedded depth, concrete thickness, anchor spacing and edge distance from the concrete. f. The selection for particular type of the anchors shall be made after considering the concrete grade, available embedment depth, load to be transferred, space available for installing anchors.			
8.03.00	FORMWORK Formwork for building RCC Slabs/ Beams & Columns shall be of 2 different types. Type 1 Formwork: (For RCC slab of Structural Steel Framed Buildings Only) Troughed colour coated metal deck sheets shall be used as permanent shuttering having minimum thickness of 0.80mm. These profiled metal deck sheets shall be fixed to the structural			
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8.04.00	steel secondary beams/ Purlins using Headed shear anchor studs. The detailed material property requirement of metal deck sheet is specified elsewhere in this specification. The shear anchor studs for fixing metal deck sheet to floor structural beams shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 19mm diameter and 100mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet. The shear anchor studs for fixing metal deck sheet to roof structural purlins shall conform to Type-B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 16mm diameter and 65mm length manufactured from cold drawn round steel bars conforming to the requirement of ASTM A 29, of grade designation 1010 through 1020, of standard quality with either semi-killed or killed, welded by Drawn Arc Stud Welding through metal deck sheet. Type 2 Formwork: (For RCC Buildings) Plywood with film face formwork shall be used for floor & roof slabs, Columns & Beams of all RCC buildings. CULVERTS /RACKS ACROSS RAIL TRACKS Design of bridges/ culverts or any other structure crossing the Railway tracks shall be as per Railways/ RDSO guidelines/specifications for Dedicated Freight Corridor (DFC) 32.5 T loads. The Bidder shall obtain necessary approvals from Railways before start of construction work. Construction of these structures is to be done as per Railways guidelines. Any statutory and codal charges payable to Railways/ RDSO for approval & execution of the above crossings shall be borne by the Bidder. Engagement of approved Railway Consultant for the above work by the bidder would be at his own cost. The levels/clearances of the above crossings are to be finalized by the bidder as per Railway standards and shall be subject to approval of Owner/Owner's Consultant. However, for design of the above crossings above rail track, the following minimum clearance from Rail track shall be maintained: A. Horizontal clearance: A minimum clearance of 3.5m shall be maintained between centre line of the Railway track to face of the crossing structure. B. Vertical clearance: A min vertical clearance of 8.5m shall be maintained between Rail top level and bottom of structure. Bidder has to submit to the Owner two sets of railway approved drawings and two sets of (hard & soft copies) as built drawings. The construction of rail network inside the plant for transportation of coal, fly ash & POL is in the scope of Owner. The bidder should plan to complete the construction work of all roads/ drainage/ pipe line/ cable crossings etc which are crossing below the rail track well in advance to facilitate owner to undertake the construction work of siding.			
	8.05.00	FENCING AND GATE		
	8.05.01	FENCING Fencing with gate shall be provided around fuel oil area, and other areas wherever necessary due to security, safety, and statutory requirements as per following specifications. However for isolation between existing station/township and the project, the total height of fence may be reduced to 2.4m with 450mm barbed wire on top, while other details being same as given below.		
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	The fencing, with gate (unless specified otherwise) shall comprise of PVC coated G.I. welded wire mesh fencing of minimum 4 mm diameter (including PVC coating) of mesh size 75mmX75mm of height 2.4m above the toe wall with a 600mm high galvanised concertina at the top, such that total fence height of 3.0m above the toe wall is achieved. The diameter of the steel wire for chain link fence (excluding PVC coating) shall not be less than 2.5 mm. The PVC coated chain link will be stretched by the clips at 0.5m intervals to three strands of galvanised high tensile spring steel wire (HTSSW) of 2.5 mm diameter interwoven with chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security nuts and bolts. Above the chain link a 600mm high tensile serrated galvanised wire (HTSW) concertina made with wire diameter of 2.5mm will be stretched to 6m and attached to two strands of galvanised HTSSW of 2.5 mm diameter by means of clips at 1m intervals. These two HTSSW strands will be attached to the fence posts with 12 mm security fasteners. All nuts, bolts, fasteners, clamping strips, clamps, clips, etc., shall be galvanised. All fence posts shall be of 75 x 75 x 6 MS angles spaced at 2.5m c/c distance. All corner posts will have two stay posts and every tenth post will have transverse stay post. Suitable R.C.C. foundations for the post and stays shall be provided based on the prevailing soil conditions. All posts of fencing shall be painted with chlorinated rubber paint over a suitable primer. Toe walls either of brick masonry with bricks of minimum 50 kg./sq.cm. Crushing strength or of hollow concrete block masonry shall be provided between the fence posts all along the run of the fence with suitable foundation. Toe wall shall be minimum 200mm above the formation level with 50mm thick P.C.C. coping (1:2:4) and shall extend minimum 300mm below the formation level. Toe wall shall be plastered with cement sand mortar (1:6) on both sides and shall be painted with two coats of textured cement point (Sandtax Matt or equivalent) of approved colour and shade. Toe wall shall be provided with weep holes at appropriate spacing.			
8.05.02	Gate along Fencing All gates shall be of structural steel of minimum 3.75 metre width for single lane access road and 8.00 m width for double lane access roads. The height of gate shall be same as that of the fence unless noted otherwise. Each gate shall have provision for wicket gate of size 1.0 m x 2.1 m. The gate frame and post shall be fabricated from medium class MS pipe of nominal diameter not less than 75 mm. The panel plate shall be of minimum thickness 2.5 mm conforming to IS: 513. The gate shall be complete with fabricated hinges, MS aldrops with locking arrangement, tempered steel pivot, guide track of MS tee, bronze aluminium ball bearing arrangement, castor wheel, etc.			
8.06.00	GRATING All gratings shall be electroforged types. Minimum thickness of the grating shall be 40 mm for indoor installation and 32 mm for outdoor installation. The opening size shall not be more than 30mmx100mm. The minimum thickness of the main bearing bar shall be 5 mm or as per design requirement whichever is higher. All gratings shall be hot dip galvanised at the rate of 610 g. per sq.m. after surface preparation by means of shot blasting or cleaned by acid pickling.			
8.07.00	FABRICATION & ERECTION OF STEEL STRUCTURES The fabrication shall be done as per fabrication drawing which would clearly indicate various details of joints to be welded, type of weld, length and size of weld.			
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8.07.01	All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections. Coal bunkers with hoppers and chimney flue liners can either be fabricated at factory in segments, transported and welded at site before erection or fabricated at site. For coal bunkers, hoppers and chimney flue liners, to prevent coal dust/flue gas leakages, the applicable field joints shall necessarily be welded. Note: Steel structures shall mean Plant and Non-Plant building structures, boiler & ESP support structures, CHP structures (boiler area), AHP structures, chimney flue liners support platforms & stairs, pipe and cable support structures. Site welding can be permitted in special cases where final inputs are not available before release of fabrication drawings. Before dispatching the fabricated structural members to site, it shall be ensured that all parts in the assembly fit accurately together by carrying out pre-assembly of fabricated structural members having bolted field joints, in the factory. All steelwork before and after manufacturing shall be smooth, straight and free of deformations, cracks, twists and burrs. All steelwork shall be cut and fabricated to a tolerance of ± 1.5 mm in its length and location of matching bolt holes for field connections.			
	Welding a) Welding of Structural steel shall be done by an electric arc process and shall conform generally to relevant acceptable standards viz. IS:816, IS:9595, IS:814, IS:2014, IS:4354 and Indian Standard Hand Book for metal arc welding, and other standards, codes of practice internationally accepted. For welding of any particular type of joint, Bidder shall give appropriate tests as described in any of the Indian Standards - IS: 817, IS: 7307 and international standards as relevant. b) Submerged arc-welding shall be used for welding longitudinal fillet welds (connecting flange with web) and longitudinal / transverse butt joints for fabrication of columns, framing beams and crane girders and all other built-up members, unless manual arc welding is specifically approved by the Engineer. Necessary jigs and fixtures and rotation of structures shall be so arranged that vertically down-hand position of welding becomes possible. 'Open-Arc-Welding' process employing coated electrodes shall be employed for fabrication of other welded connections and field welding. c) Wherever welding is done for assembling the components of structures, the job shall so positioned that down hand welding is possible. d) Any structural joint shall be welded only by those welders who are qualified for all welding procedures and positions in such type of joint that is welded. e) All records for entire welding operations such as welders identification marks, the joints welded by the each welder, the welding procedures adopted, welding machine employed, pre and post heating done and any non-destructive test done and stress relieving /heat treatment performed on such joints shall be accessible to the Engineer for scrutiny. f) In a fabrication of plated columns/beams and built up members all shop splices in each component part shall be done before such component part is welded to other parts of the member. Wherever weld reinforcement interferes with proper fitting between components to be assembled by welding, these welds shall be ground flush prior to assembly. g) The members to be joined by fillet welding shall be brought and held as close together as possible and in no event shall be separated locally by more than 3mm. If the local			
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8.07.01.3	Upto and including 20mm	None			
	Over 20mm and upto and including 40m	20°C			
	Over 40mm and upto and including 63mm	66°C			
	Over 63mm	110°C			
	c)	Preheating may be applied by external flame which is non-carbonising like LPG, by electric resistance or electric induction process such that uniform heating of the surface extending up to a distance of four times the thickness of the plate on either side of the welding joint is obtained.			
	d)	Thermo-chalk, thermo-couple or other approved methods, shall be used for measuring the plate temperature.			
	e)	All butt welds with plates thicker than 50mm and all site butts weld of main framing beam shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done up to 600°C and rate of application shall be 200°C per hour. The post heat temperature shall be maintained for 60 minutes per 2.5cm thickness. For maintaining slow and uniform cooling, asbestos free pads shall be used for covering the heated areas.			
	Sequence of Welding				
	a)	The sequence of welding shall be carefully chosen to ensure that the components assembled by welding are free from distortion and large residual stresses are not developed. The distortion should be effectively controlled either by a counter effect or by a counter distortion. The direction of welding should be away from the point of restraint and towards the point of maximum freedom.			
	b)	Each case shall be carefully studied before finally following a particular sequence of welding.			
c)	Butt weld in flange plates and/or web plates shall be completed before the flanges and webs are welded together.				
d)	The beam and column stiffeners shall preferably be welded to the webs before the web and flanges are assembled unless the web and flanges to the beam or column are assembled by automatic welding process.				
e)	All welds shall be finished full and made with correct number of runs, the weld being kept free from slag and other inclusions, all adhering slag being removed.				
f)	Current shall be appropriate for the type of electrode used. To ensure complete fusion, the weaving procedure should go proper and rate of arc advancement should not be so rapid as to leave the edges unmelted.				
g)	Pudding shall be sufficient to enable the gases to escape from the molten metal before it solidifies.				
h)	Non-uniform heating and cooling should be avoided to ensure that excessive stresses are not locked up resulting ultimately in cracks.				
i)	The ends of butt welds shall have full throat thickness. This shall be obtained on all main butt welds by the use of run off and run on pieces adequately secured on either side of main plates. The width of these pieces shall not be less than the thickness of the thicker part joined. Additional metal remaining after the removal of extension				
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	pieces shall be removed by grinding or by other approval means and the ends and surface of the welds shall be smoothly finished. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the end be welded to provide the ends with the required reinforcement. j) The fusion faces shall be carefully aligned. Angle shrinkage shall be controlled by presetting. Correct gap and alignment shall be maintained during the welding operation. k) All main butt welds shall have complete penetration and back surface of the weld being gouged out clean before first run of the weld is given from the back. However, partial penetration butt weld shall be permitted, when specifically shown in the design drawings. l) Intermittent welds shall be permitted only when shown in the design drawings. m) The welding shrinkage shall be minimised by adopting the correct welding procedure and method. In long and slender member extra length should be provided at the time of fabrication for shrinkage.			
8.07.01.4	Testing of Welders All the welders to be employed for the job shall have to qualify the appropriate tests laid down in IS: 817 and IS: 1181 and ASME IX/AWS D1.1. All the necessary arrangements required for the testing of welders are to be provided by the Bidder.			
8.07.01.5	Inspection of Welds a) Visual Inspection 100 percent of the welds shall be inspected visually for external defects. Dimensions of welds shall be checked. The lengths and size of weld shall be as per fabrication drawings. It may be slightly oversized but should not be undersized. The profile of weld is affected by the position of the joint but it should be uniform. The welds should have regular height and width of beads. The height and spacing of ripples shall be uniform. The joints in the welds run shall as far as possible be smooth and should not show any humps or craters in the weld surface. Welds shall be free from unfilled craters on the surface, under-cuts, stages on the surface and visible cracks. Such inspection shall be done after cleaning the weld surface with steel wire brushes and chisel to remove the spatter metal, scales, slag, etc., If external defects mentioned above are noticed, there is every possibility of internal defects and further radiographic/ultrasonic examination shall be undertaken. b) Production Test Plate Test plates shall be incorporated on either side of at least one main butt welds of each flange plate and web plate of every main frame columns and crane girder. The weld shall be continuous over the test plate. The test plate extensions of the main plates and shall be fixed so that metal lies in the same direction as that of the main plate. Test plates shall be prepared and tested in accordance with the accepted Standards, in the presence of the Engineer or his authorised representative. Should any of these tests fail, further radiographic examination of the welds shall be done. These tests for test plates and radiographic examination are additional to those contemplated under inspection and testing. c) Non-destructive and special testing Radiographic / ultrasonic or other non-destructive examination shall be carried out. All tests of welds shall be carried out by the Bidder at his own cost. The cordoning of radiation zone, while Radiography testing is going on, shall be done.			
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	In case of failure of any of the tests, re-testing of the joints shall also be carried out after rectification is done. d) Rectification of defective welding work Wherever defects like improper penetration, extensive presence of blow holes, undercuts, cracking, slag inclusion, etc., are noticed by visual inspection/other tests, the welds, in such location shall be removed by gouging process. The joints shall be prepared again by cleaning the burrs and residual matters with wire brushes and grinding, if necessary, and rewelded. The gouging shall as far as possible be done using gouging electrodes.			
8.07.01.6	Inspection and Testing			
	a) Fillet Welds	Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification		
	b) Butt Welds	Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification		
	c) Dimensional Tolerance and Acceptance Criteria of Welds	Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification		
8.07.01.7	Correction of Defective Welds			
	Correction of defective welds shall be carried out without damaging the parent metal. When a crack in the weld is removed magnetic particles inspection or any other equally positive means shall be used to ensure that the whole of the crack and material up to 25mm beyond each end of the crack has been removed.			
8.07.02	Painting			
	a)	Surface treatment and painting before and after delivery to site shall be in accordance with Clause no. 6.4.0 above. All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. However, where it is not feasible to follow the design criteria given in ISO 12944 Part 3 where the steel surface are inaccessible for application of protective coating, corrosion allowance in thickness(over the design thickness) of structural steel members shall be kept.		
	b)	For parts to be bolted, the surfaces in contact shall be provided with ethyl Zinc silicate primer as specified in clause 6.4.3 (a) and shall be free of oil, dirt, loose rust, burrs and other defects, which would prevent proper seating of the parts. For design of friction type bolted joints slip factor for surfaces with ethyl zinc silicate primer as given in IS 4000 shall be considered.		
	c)	Surfaces inaccessible after shop assembly shall receive the full-specified protective treatment before assembly. However, interior surfaces of Box-sections, which are effectively sealed from all ends, need not be painted.		
8.07.03	Bolting			
	The threaded portion of each bolt shall project through the nut by at least one thread. High strength friction grip bolts, preferably the type with indicated load, shall be used where specified and shall be tightened strictly in accordance with the manufacturer's instructions and the relevant regulations.			
	When connections are made using high strength friction grip bolts the relevant standards shall be observed.			
8.07.04	Erection of Structures			
	All erection work shall be done with the help of cranes, use of derrick is not envisaged.			
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	Erection Marks a) Erection marks in accordance with fabrication drawing shall be clearly painted on the fabricated steelwork. Each piece shall be marked in at least on two places. Each piece shall also have its weight marked thereon. c) The centre lines of all columns, elevations and girder bearings shall be marked on the sections to ensure proper alignment and assembly of the pieces at site. Erection Scheme a) The Erection Scheme for the erection of all major structures shall be furnished. The erectability of the structure shall be checked by the Bidder before commencement of fabrication work to avoid future modification. The erection scheme shall indicate the approximate weight of the structural members, position of lifting hook, crane boom length, crane capacity at different boom length and at different boom inclination, etc., b) The erection scheme shall also give details of the method of handling, transport, hoisting, including false work/staging, temporary, bracing, guying, temporary strengthening, etc., It will also give the complete details of the number and capacity of the various erection equipment that will be used such as cranes, winches, etc., along with disposition at the time of erection of columns, trusses, etc. c) The erection of columns, trusses, trestles, portals, etc., shall be carried out in one single piece as far as practicable. No column shall be fabricated and erected in more than 3 pieces. Galleries shall generally be erected as box i.e. the bottom chord and bracings, top chord and bracings, side vertical posts and bracings, end portals and roof-trusses shall be completely welded prior to erection and if required temporary strengthening during erection shall be made. The inside sheeting runners and roof sheeting purlins may be erected individually. When erection joints are provided in columns, their location shall generally be just above a floor level.			
8.08.00	STEEL HELICAL SPRINGS AND VISCOUS DAMPERS UNITS			
8.08.01	General Requirement This part of the specification covers the requirement for the manufacturing, testing, supply, transport to site, pre-stressing erection, supervision of erection by the vendor, release of pre-stress, alignment, commissioning, etc. of Steel helical springs and viscous dampers units.			
8.08.02	The Steel helical springs and viscous dampers units supplied should be of proven make. Codes and Standards Some of the relevant applicable Indian standards and codes, etc, applicable to this section of the specification are listed below: DIN : 4024 Machine foundations; Flexible supporting structures for machine with rotating masses. DIN : EN 13906-1 Cylindrical helical springs made from round wire and bar: calculation & design. DIN : 2096 Helical compression springs out of round wire and rod; quality requirements for hot formed compression springs. ISO : 10816 /IS:14817 Criteria for assessing mechanical vibrations of machine. ISO : 1940/IS: 11723 Criteria for assessing the state of balance of rotating rigid bodies.			
8.08.03	Design & Supply of Material			
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8.08.04	i)	Supply Steel helical springs and viscous dampers and associated auxiliaries shall consist of: (a) Steel helical springs units (fully pre-stressable) and viscous dampers units along with viscous liquid including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads, etc. (b) Frames for pre-stressing of spring elements. (c) Suitable hydraulic jack system including electric pumps, high pressure tubes etc. required for the erection, alignment etc., of the spring units. One set of extra hydraulic jacks, and hand operated pumps shall also be provided. (d) Any other items which may be required for the pre-stressing, erection, release of pre-stress, alignment, and commissioning of the Steel helical springs and viscous dampers.		
	ii)	Design The spring units should have stiffness in both vertical and horizontal directions with the horizontal stiffness not less than 50% of vertical stiffness. However, for projects in high seismic zones, the minimum stiffness in horizontal direction shall be reviewed based on the design requirement and in no case it shall be less than 15% of vertical stiffness. The stiffness should be such that the vertical natural frequency of any spring unit at its rated load carrying capacity is between 2 Hz to 4 Hz. The damper units or spring-cum-damper units should be of viscous type offering velocity proportional damping. The damper units should be suitable for temperatures ranging from 0 to 50°C. The damping resistance of individual damper units should be such that the designed damping can be provided using reasonable number of Units. The Steel helical spring units and viscous damper units and their housings shall be designed for a minimum operating life of 30 years. Steel helical spring units shall conform to infinite life fatigue load calculations as per DIN EN 13906-1.		
	Manufacturing & Testing Complete manufacturing and testing of the Steel helical springs and viscous dampers shall be done at the manufacturing shop of the approved sub vendor / supplier. For this purpose the contractor / sub vendor shall submit the detailed quality plan for approval of engineer and take up the manufacturing / testing after approval of such quality plan. The quality plan shall include (a) Manufacturing schedule and quality check exercised during manufacturing. (b) Detail of test to be carried out at the manufacturing shop with their schedule. (c) Special requirements, if any, regarding concreting of top deck. (d) Complete step-by-step procedure covering the installation and commissioning of the spring system. (e) Manuals for erection, commissioning, testing and maintenance of the Steel helical springs and viscous dampers. (f) A checklist for confirming the readiness of the civil fronts for erection of Steel helical springs and viscous dampers. (g) Checklist for equipment required at each stage of erection. (h) Bill of materials and data sheet of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply. (i) Bill of material and data sheet for frames for pre stressing, hydraulic jack including			
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	electric pump, high pressure tubes, hand operated pump etc., with their rating and umbers. (j) Any other details which may be necessary to facilitate design and construction of the foundations / structures.			
8.08.05	The springs shall conform to codes DIN EN 13906-1 and DIN 2096. The quality assurance and inspection procedure shall be finalized on the basis of the above codes and the quality plans be drawn accordingly.			
8.08.06	Transportation Steel helical springs and viscous dampers shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.			
8.08.07	Erection and Commissioning Complete erection and commissioning of the Steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. shall be carried out by a specialist supervisor of vendor. The contractor shall guarantee the performance of the Steel helical springs and viscous dampers for 24 months from the date of commissioning of each machine which shall be termed as Guarantee Period”.			
8.08.08	Supervision The supervision of installation of Steel helical springs and viscous dampers including pre-stressing, placing, releasing and alignment of spring units shall be done by a specialist supervisor of sub vendor / supplier, trained for this purpose.			
8.08.09.1	Realignment of Spring System If any realignment of the Steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the contractor.			
8.08.09.2	Acceptance Criteria Stiffness values shall be checked. The permissible deviations shall be as per DIN 2096. Following acceptance criteria shall be followed: General workmanship is being good as recommended by the manufacturer and approved by Equipment supplier. Tolerances are within the specified limit. Manufacturer’s test certificate (MTC) shall be in compliance with the applicable codes / standards. Bought out material is from the approved manufacturer / vendor. Bought out material is matching with the approved sample.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS 			
	Information on Geopolymer Concrete- A) Ingredients: Geo-Polymer Concrete is a special type of concrete where no cement is used unlike conventional cement concrete. Major ingredients of Geo-polymer concrete are as below: - Fly Ash (to be collected from location within existing operating plant/from existing fly ash silos near plant boundary) - Ground Granulated Blast Furnace slag - Aggregates (Coarse and fine) - Sodium Silicate - Sodium Hydroxide - Chemical admixtures like super-plasticiser, retarder, shrink-reducing compound, evaporation reducer etc. Fly ash produced by coal-based power stations of NTPC, if available, will be issued free of cost for the production of Geo-polymer concrete on 'as is where is' basis. B) Batching & Mixing: Geopolymer concrete of minimum required grades of M10 and M35 shall be prepared for Dry Lean Concrete (DLC) and Pavement Quality Concrete (PQC), respectively. The solid constituents of geo-polymer concrete mix such as coarse aggregate, fine aggregate, fly ash and slag are to be mixed dry for 2-3 minutes, then Geo-activator solution, consisting of sodium silicate and sodium hydroxide pre-mixed in tanks at site, is added to the dry mix in batching plant mixer. The whole mixture is mixed until a homogeneous cohesive mix is obtained. Pumping devices shall be used for transferring activator solution from tank to the mixer. Proportion of different ingredients and mixing process are to be finalized/established during mix design finalization and trial mix at site. However, if any constraint is observed related to initial setting time of the geopolymer concrete and time required for transporting the geopolymer concrete mix from batching plant to the point of application then suitable alternative option such as mixing of geoactivator solution may have to be mixed in transit mixer instead of batching plant. Bidder shall make available concrete batching plant suitably customized for handling/feeding/dosing/weighing etc of ingredients and capable of production of Geo-Polymer Concrete of suitable grade. C) Geo-activator: This solution shall be prepared using Sodium Hydroxide & Sodium silicate with water in a certain ratio. The ratio of Sodium Silicate and Sodium Hydroxide in activator solution shall be decided during finalization of Design mix. Separate tanks having adequate capacity are to be constructed close to batching plant with fencing and a lockable gate for preparation of Sodium Hydroxide and Sodium Silicate solution. These tanks shall be provided with acid-alkali resistant lining and covered with GI sheet. Each tank shall be fitted with a chemical resistant pump of suitable capacity and dual valve in the discharge line for recirculation (to enable mixing) and also for transferring the Geo-Activator solution to mixer. This connection pipe from Pump discharge to batching plant mixer shall be HDPE of suitable Diameter.			
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	Preparation of Geo-activator solution is a critical process and extra care needs to be taken during the preparation in respect of safety of personnel handling the chemicals. Worker handling the chemicals shall be provided with proper PPE's. A dedicated shower with water tank shall be available close to chemical handling area/tank on permanent basis for washing of affected person, in case of emergency. Bottles filled with distilled water in cupboard / Boxes near work place shall also be kept for emergency eye wash by worker exposed to such hazardous chemicals. D) Placing: Laying /placing of Geopolymer concrete DLC and PQC manually with hand-guided means or by semi-mechanized methods may be permitted provided acceptance criteria as per MORT&H specification is achieved.		
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D-1-9	Architectural Concepts and Design			
9.01.00	For Architectural Concepts and Design refer to 5.01.00 in this specification.			
9.02.00	General Architectural Specifications			
9.02.01	General			
	a) Minimum 1000 mm high (from floor/ roof level) hand railing shall be provided around all floor/roof openings, projections/balconies, walkways, platforms, steel stairs, etc. wherever the height of the building is more than 12m, railing height shall be 1.2m. All handrails and ladder pipes (except at operating floors) shall be 32 mm nominal bore MS pipes (medium class) conforming to IS: 1161 and shall be galvanised as per IS: 4736 and finished with suitable paint. All rungs and ladders shall also be galvanised. Minimum weight of galvanising shall be 610 g/sqm. The spacing of vertical posts shall be maximum 1500mm. Two number of horizontal rails shall be provided including the top member. In addition, toe guard/ kick plate of min size 100x6th shall be provided above the floor level. For handrailing at operating floors of Main Power House including RCC stairs (for one flight above and below operating floor level), passages, around all floor openings shall be Stainless Steel (SS) pipes shall be used. All floors of Service Building, Administration Building, Gate Complex, Canteen shall also be provided with SS handrailing. Height of the handrail shall be 1000 mm /1200mm in accordance with the preceding para. For SS handrail 32NB/50NB/60NB (polished) stainless steel pipe shall be provided. The spacing of vertical posts shall not be more than 1500mm. Two number of horizontal rails shall be provided including the top member. SS Toe guard and kick plate shall be provided above the floor level. b) All stairs shall have a maximum riser height of 180mm and a minimum tread width of 275 mm. Minimum clear width of stair shall be 1200 mm unless specified otherwise. c) All buildings having metal cladding shall be provided with 1M high brick wall at ground floor level. All buildings having metal cladding shall be provided with a 150 mm high RCC toe kerb (on upper floor) at the edge of the floor along the metal cladding. 1000 mm high hand railing shall be provided on this RCC kerb, wherever required from the safety point of view. d) In all buildings, structures, suitable arrangement for draining out water collected from equipment blowdowns, leakages, floor washings, fire fighting, etc., shall be provided for each floor. All the drains shall be suitably covered with grating or precast RCC panels. e) RCC staircase shall be provided for main entrance of all RCC construction buildings. f) Parapet, Chajjas 450mm over window and 600mm door heads, 900mm over rolling shutters, architectural facia, projections, etc., shall be provided with drip course in cement sand mortar 1:3. g) All fire exits shall be painted with fire resistant paint P.O red/signal red colour shade which shall not be used anywhere except to indicate emergency or safety measure. Fire safety norms shall be followed as per National Building Codes and fire safety requirements for providing fire exits, escape stairs and fire fighting equipment. In detailing of all buildings, fire safety requirements conforming to IS: 1641 and IS:1642 shall be followed. h) Ramps & Lifts for physically challenged persons shall be provided for barrier free access to the Service buildings.			
9.03.00	Water Supply and Sanitation			
9.03.01	Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage			
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9.03.02	tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc. Service water tank shall be of RCC construction. Galvanised MS pipe of medium class conforming to IS:1239 shall be used for internal piping works for service water and potable water supply. The pipes shall be concealed, and painted with anti-corrosive bituminous paint (as per IS: 158) wherever required. UPVC (conforming to IS:13592) shall be used for sanitary works above ground level. All Buildings shall be designed with Toilets as per NBC norms. All buildings shall have minimum one toilet block each. The facilities provided in the toilet block shall depend on the number of users. However, minimum facilities to be provided shall be as stipulated in subsequent clause. IS:1172 shall be followed for working out the basic requirements for water supply, drainage and sanitation. In addition, IS:2064 and IS:2065 shall also be followed. Each Toilet block shall have the following minimum facilities. Unless specified all the fittings shall be of Chromium plated brass (fancy type). a) One number wall mounted coloured glazed vitreous China European water closet and flushing valve system, water faucet, toilet paper holder as per IS:2556 b) One number colour glazed ceramic oval shaped wash basin 450x 550 mm (approx.) mounted over 18mm thick granite beveled edge counter fitted with photo-voltaic control system for water controls, bottle trap as per IS:2556. For common toilets, number of washbasins shall be as per requirement. However, for Pump Houses the same shall be provided without photo voltaic control system for water control. c) For Male Toilets Urinal as per requirements, with all fittings with photovoltaic control flushing system as per IS: 2556. d) One number looking mirror 600 x 900 x 6 mm, edge mounted with teak beading and minimum 12 mm thick plywood backing, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser e) One toilet with required facilities shall be provided for physically challenged persons as per National Building Code requirements f) Janitor Space & space for drinking water cooler. g) Electric operated hand dryer with photo voltaic control. h) The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length with trap, hot and cold water mixer, one number geyser of 25 liters capacity, with inlet and outlet connections, one number over head water storage tank, as per IS : 12701 and of 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, GI concealed water supply pipe of minimum 12 mm diameter of medium class, cast iron sanitary pipe (with lead joints) of minimum 75 mm diameter, floor trap with Stainless Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless noted otherwise) One number of pantry shall be provided on each floor of ESP control room building and One number of pantry shall be provided in Buildings having Control Room and at each floor of Service Building. i) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS: 2556 (Part-5).			
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9.04.00	j)	In addition, adequate number of portable toilet units with adequate plumbing and sanitary arrangement, shall be provided during construction stage for workers.			
	k)	Adequate number of toilet units with adequate plumbing and sanitary arrangement, shall be provided for workers (O&M workers).			
	Flooring				
	Floor finishes of approved shade and colour (non - premium colours), over under bed of cement mortar / concrete, at all levels and for all kind of works, elevations, on horizontal and vertical surfaces for all types of work (like flooring, skirting, dado, wall lining & facing, tread and risers etc.), including topping, spreading white cement slurry at an average rate of 2.5 kg/Sq. M., (unless noted otherwise), jointing and joint filling with white cement (unless noted otherwise) slurry mixed with colour pigment, to match the shade of the finishing material, laying to plumb and water level in desired pattern, line and flush butt square jointing, curing, rubbing, grinding, polishing, edge moulding, finishing and cleaning, testing, providing opening of required size and shape, casting in panels wherever specified.				
	9.04.01	The nominal total thickness of floor finish shall be 50 mm i.e. underbed and topping. The floor shall be laid on an already laid and matured concrete base. The underbed for floors and similar horizontal surfaces shall consist of cement concrete M20 grade. Stone chips shall be 12.5 mm down well graded & proper filling shall be done with brick bats/cinders. Flooring like Tiles/ Stones shall be laid with 1:4 cement sand mortar and Tile/ Stone Cladding on wall shall be laid with 1:3 cement sand mortar.			
	9.04.02	All toilets shall have sunken slab to accommodate sanitary pipes and the finish level of floor shall match with general floor finish level. Sunken slabs shall be made watertight by suitable water proofing treatment.			
	9.04.03	Metallic hardener topping -with ordinary grey cement shall be- 12 mm thick (insitu) or finishing the concrete / mortar surfaces topping shall be furnished with neat cement slurry (with ordinary grey cement)			
	9.04.04	Heavy duty cement concrete tiles 300 mm x 300 mm shall be in using white cement with pigment, with hard and abrasion resistant carborundum / quartz chips for wearing course as per IS:1237. Laying of tiles shall be as per IS: 1443.			
9.04.05	Digitally glazed ceramic tiles shall be as per IS: 15622. Designer digitally glazed ceramic floor and wall tiles				
9.04.06	a)	300x300mm in white colour of Kajaria/ Nitco/ Somany/ Orient/ Johnson or equivalent			
	b)	300x450mm in DIGITAL series of Kajaria/ Nitco/ Somany/ Orient/ Johnson or equivalent			
	c)	300x600mm in DIGITAL series of Kajaria/ Nitco/ Somany/ Orient/ Johnson or equivalent			
9.04.07	12mm/20mm / 38mm / 75 mm/ 115mm thick acid resistant tile on horizontal and vertical surfaces, at all levels for all type of works shall include one coat of bitumen primer followed by 12 mm thick bituminastic layer, 20mm / 38mm/ 75 mm / 115mm thick A.R. tiles, 6 mm thick under-bed by potassium silicate mortar conforming to IS:4832 (Part-I), pointing of joints of tiles with acid/alkali resistant epoxy/furane mortar conforming to IS:4832 (Part-I), up to a depth of 20 mm and bituminastic end sealing.				
9.04.07	Battery Room in all buildings shall be provided with acid/ alkali resistant tiles on flooring & dado 1200mm high.				
	(i)	Mirror polished Digitally glazed vitrified & Matt Finish Digitally glazed Vitrified ceramic tiles (minimum 9.0mm thick) with 3mm groove joints as per approved pattern pointed neatly with 3x4mm stainless epoxy grout mix of 0.70kg of organic coated filter of desired shade (0.10kg of hardener and 0.20kg of resin per kg) with sizes of the tiles shall be as under:			
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	a) Size of tile 600x600/605x605 of Premium Series Kajaria/ Royale Series Somany/ OMA00025 Series Johnson or equivalent b) Size of tile 800x800 of Polished and Lapatto Series Kajaria/Diamond Series Somany/ Polished and Lapatto Series Johnson or equivalent ii) Anti-Skid Full Body Vitrified Tiles Antiskid, full body Vitrified Tiles of size 600X600X20 mm thick as specified below of approved make, shade, colour and pattern, over under bed of cement mortar / PCC shall be provided in TG Hall flooring at operating level. Full body Vitrified Tiles shall be laid on properly laid leveled floor, with joints 3 to5 mm wide & 8 to10 mm deep & shall be filled with approved Epoxy Grout mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardner and 0.20 kg of resin per kg). Full body Vitrified Tiles shall have water absorption less than 0.5%, Modulus of Rupture more than 38N/mm2, Breaking strength more than 7500 N, Mohs scale more than 6, Abrasion resistance less than 144 mm3 and coefficient of friction more than 0.4. Vitrified Tiles shall generally conform to IS: 15622			
9.04.08	For pathway, chequered and designed concrete tiles minimum 22 mm thick, 200x200 mm size conforming to IS: 13801 of approved shade and colour shall be used. 1000 wide pathways shall be provided for maintenance on rooftops of all buildings.			
9.04.09	Epoxy Flooring Epoxy Flooring shall be provided with surface preparation of concrete substrate with Captive Shot Blasting Machine OR Light Grinding to form the required anchor profile on the floor substrate followed by application of epoxy resin based moisture barrier underlay of 2 mm thickness including filling of saw cut joints with epoxy cementitious resin based moisture barrier underlay as per manufacturer specification. Application of self smoothing epoxy floor topping of epoxy based resin of 2 mm thickness over epoxy resin based moisture barrier underlay including application of solvent free epoxy resin based two component primer. It shall include application of PU Sealant at Expansion and Isolation Joint respectively including surface preparation of the joint, fixing of backup strip and application of sealant.			
9.04.10	Wherever required, carpet flooring shall be provided over cement concrete floor. The carpet shall be of tile/roll form, machine/handmade tupled un-cut loop pile and lay with under lay of 10mm thick and shall be laid as per manufacturer's recommendations, in matching grains. It shall be treated with anti fungus and anti-termite before laying.			
9.04.11	Mirror polished (6 layers of polish) Granite stone (slab) - 18 mm thick (minimum) / Flame finish/ (making top surface rough by burning)/ honed finish granite stone (slab) - 18 mm thick (minimum) shall be provided.			
9.04.12	Decorative/designer prepolished, plain and pigmented, high wearing resistance concrete tiles of 20mm thickness (minimum) in various non-standard interlocking patterns.			
9.04.13	Skirting in general shall be 150 mm high. Dado in toilets & pantries, shall be upto false ceiling level from finished floor level. Skirting and Dado shall match with the floor finish.			
9.04.14	Interlocking concrete blocks shall be of various sizes and thickness having M35 grade of concrete and pigmented to specified colours, in different pattern (in different textures chequered or other patterns in indentation for guiding band/s for visually impaired persons) including the preparation of sub base with 20mm thick sand and filling of joints with sand.			
9.04.15	Matt finish (with grooves) Porcelain tiles (for guiding band/s for visually impaired persons in service building) shall be with 3mm groove joints as per approved pattern pointed neatly with			
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9.04.16	3x4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile.			
	24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern.			
9.05.00	Laminated wooden flooring (11mm thick) shall be provided in VIP area, conference rooms.			
	Rubber Flooring			
9.06.00	Rubber flooring shall conform to IS 809. The minimum thickness shall be 4 mm with sheet size of 602mm x 602mm. Rubber flooring shall consist of 100% virgin elastomer reinforcing agents, resins, curing agents, anti-oxidants and pigments. It shall have excellent abrasion resistance and shall have class-I fire rating. It shall be acid & alkali resistant and shall be of anti static grade. In general, BS code shall apply for their technical characteristics.			
	Epoxy Resin Floor Finish			
9.06.01	Self-smoothing, seamless epoxy resin floor finish shall be provided on horizontal and vertical surfaces including preparation of surface, application of epoxy based primer coat, of approved colour, quality and make to give minimum thickness of 300 micron (in two coats)			
	Roof			
9.06.02	Except for the roofs subjected to heavy loads, roof of all buildings having structural steel frame work shall consist of permanently colour coated (on exposed face) troughed metal sheet decking of approved profile as specified in clause 9.08.00. Silicon modified polyester paint having DFT of minimum 20 microns shall be used for permanent coating. The sheeting shall be fixed by means of concealed fixing system or any other compatible method approved by the Engineer. RCC slab of minimum 40 mm clear thickness in excess of trough depth shall be provided over the metal decking. Water proofing cum plasticiser compound shall be added to concrete over the metal decking. Bidder shall demonstrate that the roof is leak proof by carrying out the water-retaining test by maintaining the minimum water depth of 50mm over the roof surface for a period of 48 hours. Water Proofing Treatment as given below for RCC roof slabs shall be provided to ensure that the roof is watertight.			
	DELETED			
9.06.03	For efficient disposal of rainwater, the run off gradient for the roof shall not be less than 1:100 and the roof shall be provided with RCC water gutter, wherever required. Gutter shall be made water tight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete 1:2:4 (using 12.5 mm coarse aggregate) and/or cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.			
	Medium class galvanised mild steel pipes conforming to IS 1239/IS 3589 with welded joints shall be provided to drain off rain water from the roof. These shall be suitably concealed with masonry work, cement concrete / or sheeting work to match with the exterior finish. The number and size of down comers shall be governed by IS 1742 and IS 2527. Roof drain level of all RCC framed buildings having cast-in-situ RCC roof shall be provided with Rain water gutter and/or 45 x 45 cm size Khurras having minimum thickness of 30 mm with 1:2:4 concrete over PVC sheet of 1 m x 1 m x 400 micron and finished with 12 mm thick cement sand plaster 1:3. All the pipes shall be provided with suitable fittings and fixtures.			
9.06.05	Roof Water Proofing			
	Roof water proofing treatment shall be as follows:			
	a) For roofs having structural slope:			
	Top surface of sloped R.C.C. slab shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid. The elastomeric shall comprise of high solid content liquid applied urethane laid over reinforcing layer of polyscrim cloth or non woven geo-textile. The top of the elastomeric membrane			
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	shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also. b) For roofs having no structural slope: Screed concrete mix (1:2:4) grading having minimum 25mm thickness at the lowest point of the slope shall be laid over R.C.C. slab and shall be laid as per the slope specified elsewhere in the specification. Top surface of grading underbed shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid and top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also			
9.06.06	Roof of all buildings shall be provided with access/approach through staircase or ladder. Roof where equipment are mounted shall be provided with access through staircase.			
9.06.07	RCC parapet wall of minimum 1000 mm height (above top of slab) for all accessible roofs and 600 mm height for all non-accessible roofs shall be provided. Alternatively, parapet wall comprising structural steel post, runner and sheeting may be provided for buildings with metal sheet cladding.			
9.06.08	Fillets at junction of roof and vertical walls shall be provided with cast-in-situ cement concrete (1:1.5:3) nominal mix followed by 12mm thick 1:4 cement sand plaster.			
9.06.09	Pathways for handling of materials and movement of personals shall be provided with 22mm thick chequered cement concrete tiles as per IS:13801 for a width of 1000mm.			
9.07.00	Walls			
9.07.01	All walls shall be non-load bearing infill panel walls.			
9.07.02	For initial height up to 1 metre in buildings one brick thick masonry wall shall be provided wherever metal cladding is specified.			
9.07.03	All internal walls shall be with one brick thick in cement mortar (1:6). However, internal partition walls for toilets shall be with half brick masonry thick with cement mortar (1:4).			
9.07.04	For ESP Control Room Building, wall shall be of Autoclaved Aerated Concrete Block. Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of 625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part-III).The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in IS 6041 – 1985, IS - 1905.			
9.07.05	Toilet Block in ESP Control Room Building shall be of Brick Masonry			
9.07.06	50 mm thick DPC in Cement concrete (1:1.5:3) with water proofing compound followed by two layers of bitumen coating 85/25 grade as per IS: 702 @ 1.7 kg./sq.m. shall be provided at plinth level before starting the masonry work.			
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9.07.07	Enclosure of the elevator shall have 2hours fire rating and it shall be sealed from outside to ensure dust free environment.			
9.08.00	COLOUR COATED AND OTHER SHEETING WORK			
9.08.01	Material			
	a) Wall Cladding & Roofing Material			
	Troughed permanently colour coated sheet of approved shade and colour shall be			
	i) either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150			
	ii) or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150.			
	iii) or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS: 1254.			
	Bidder to ensure that same profile is to be used throughout the package for all facilities to maintain uniformity.			
	b) Metal Deck Roof Material			
	Troughed permanently colour coated metal decking sheets shall be			
	i) either of steel with minimum 0.8mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275.			
	ii) or of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275.			
	iii) or of steel of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275.			
	Alternatively aluminium feed material of minimum bare metal thickness of 0.9 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254 can also be used for metal decking.			
	Thickness tolerance of (+/-) 0.04mm is permissible. However, all design calculations shall be carried out on the basis of lowest value of sheet thickness provided.			
	Bidder to ensure that same profile is to be used throughout the package for all facilities to maintain uniformity. In addition, the depth of the profile shall be restricted to 60 mm (maximum) to reduce the overall thickness of floor slab and thus minimizing the dead load of the floor slab. If the bidder proposes to use two different metal deck sheets			
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9.08.02	(same profile but different grades or thicknesses), the unexposed (concrete) side of the metal deck sheets shall be painted with clearly distinct colours to facilitate identification. Bidder to ensure that both cladding sheet and decking sheet supplied at site to be provided with transparent organic film of thickness of 40 microns on each face. Also they should be stored in a covered place on wooden sleepers till erection.					
	Colour Coating Steel shall be colour coated with total coating thickness of at least 40 microns (nominal) comprising of silicon modified polyester (SMP with silicon content of 30% to 50%) paint or Super Polyester paint, of minimum 20 microns (nominal) dry film thickness (DFT) on external face over primer coat of minimum 5 microns (nominal) and minimum 10 microns (nominal) SMP or super polyester paint over primer coat of minimum 5 microns (nominal) on internal face. SMP and Super polyester paint systems shall be of industrial finish of product type 4 of AS/NZ2728.					
	9.08.03	Design Criteria For wall cladding insulated / uninsulated and conveyor gallery sides and roof, permanently colour coated sheet of troughed profile shall be used. However alternative profile meeting the strength, deflection and other functional requirements such as section modulus and moment of inertia shall be provided. Sheet shall be of profile, sectional properties, colour and shade as per specifications. For profiled metal decking sheets (to be used for RCC floor slab or roof slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self-weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sq.m for two span condition. The section modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. For metal deck sheets used for roofing (with or without RCC) and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.				
		9.08.04	Fasteners Side cladding/roofing/decking sheets shall be fixed to the runner/purlins using self-drilling special coated fasteners confirming to corrosion resistant class 3 of AS3566 and tested for 1000 hours salt spray test. Spacing of Self-drilling fasteners in transverse direction (along runners/purlin) shall be equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location. Shear anchor studs shall also be provided through metal deck, which are to be used as permanent shuttering, at regular interval on all top flange / flange plate of structural beams as specified in Clause no. 8.03.00. Alternatively, J/U type hooks shall be used in roofing which shall be provided in transverse direction (along runners/purlin) at a spacing equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location.			
			9.08.05	Miscellaneous Details To minimize the number of joints, the length of the sheet shall preferably be not less than 4.5m, cut pieces shall not be used, unless specifically approved by the Engineer. However, the actual length shall be such so as to suit the purlin / runner spacing.		
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9.08.06	Lap between the sheets shall be at least 150mm in the longitudinal direction and at least one crest wide in the transverse direction which shall be properly anchored / fixed with fasteners. Z spacers if required shall be made of at least 2 mm thick galvanised steel sheet of grade 350 as per IS 277 Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non stainless material and be flexible enough not to interface with fit of the sheets Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The filler blocks shall be manufactured from black synthetic rubber or any other material approved by the Engineer. For insulation of cladding and other areas, mineral wool conforming to IS 8183 shall be used. The density shall be 32 or 48 kg. /cu.m for glass or rock wool respectively. The nominal thickness of insulation shall be 50mm. All flashings, trim closures, caps etc. required for the metal cladding system shall be made out of plain sheets having same material and any weather/moisture sealants with appropriate material and coating specification as mentioned above for the outer face of the metal cladding. Overlap shall be min. 150 mm or as specified by manufacturer. The contractor shall prepare working drawings of sheeting system including end and side laps, flashing, fixing details etc. before starting sheeting work at site.			
	Pre-Fabricated Insulated Metal Sandwich Panels For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets. Each sheet shall be			
	i) either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii) or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 iii) or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150.			
	Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254. Metal sheets (steel or aluminium) shall be colour coated with total coating thickness of at least 40 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester (SMP with silicon content of 30% to 50%) paint or Polyester paint, of minimum 20 microns (nominal) SMP or polyester paint on one side (exposed face), over minimum 5 micron (nominal) primer coat and minimum 10 micron (nominal) SMP or Polyester paint over minimum 5 micron (nominal) primer coat on other side. SMP and Super Polyester paint shall conform to product type 4 of AS/NZS 2728. Troughed sheet shall be of approved profile, sectional properties, (suitable for the specified loading / deflection and purlins / runners spacing), colour and shade. Special coated fastener conforming to corrosion resistant Class 3 of AS3566 and tested for 1000 hours salt spray test shall be used for fixing Pre-Fabricated Insulated Metal Sandwich Panels with the structural members below.			
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9.08.07	The contractor shall prepare working drawings of sheeting system including end and side laps, fixing details etc. before starting sheeting work at site. Polycarbonate Sheets The polycarbonate sheet to be used for cladding and glazing purpose in conveyor galleries, Transfer points & pump houses shall have toughed profile to match with the metal cladding profile. Minimum 3.0mm thick fire retardant and UV resistant polycarbonate clean sheet of approved make shall be used. The polycarbonate sheet shall be installed along with the metal cladding so as to have a watertight lapping arrangement. Suitable detailing shall be made to cater for the thermal expansion. IS 14434 to be referred for other details.			
9.09.00	Plastering			
9.09.01	Outer face (i.e. rough side) of all brick walls shall have 18 mm thick and inner face (i.e. smooth side) of all walls shall have 12 mm thick cement sand plaster 1:6.			
9.09.02	Acrylic wall putty in two coats shall be applied over cement plastered surfaces in interior of building. The finish surface shall be smooth and shall be of 2 mm nominal thickness.			
9.09.03	All R.C.C. walls shall have minimum 12mm thick cement sand plaster 1:6.			
9.09.04	All RCC ceilings (except areas provided with false ceiling, cable vault ceiling and metal decking) shall be provided with 6mm thick cement sand plaster 1:4.			
9.09.05	Groove of uniform size 12 x 12 mm up to 20 x 15 mm in plastered surface as per approved pattern, shall be provided as per approved drawing.			
9.09.06	All plastering work shall conform to IS: 1661.			
9.10.00	Painting, Aluminium Composite Panel, Glass Reinforced Concrete Tile and GRC Customized Screens and Dome			
9.10.01	All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush then same shall be finished off with roller.			
9.10.02	All paints shall be of approved make including chemical resistant paint.			
9.10.03	Minimum 2 finishing coats of paint shall be applied over a coat of primer. Stone work for wall lining etc. (Veneer work) over 20 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry @3.3kg/sq.m, including rubbing and polishing in complete. (Black polished granite stone slab, 18 mm thick / polished Sadarhally grey granite slab 18 mm thick). The final, finished coating shall be fungus resistant, UV resistant, water repellent, alkali resistant, and extremely durable with colour fastness.			
9.10.04	Acrylic emulsion paint shall be as per IS: 15489. Acrylic distemper shall be as per IS: 428. Cement paint shall conform to IS: 5410, white wash/colour wash shall conform to IS: 627.			
9.10.05	All fire exits shall be painted in post office red/signal red colour shade, which shall not be used anywhere else except to indicate emergency or safety measure.			
9.10.06	For painting on concrete, masonry and plastered surface IS: 2395 shall be followed. For painting on wood work IS: 2338 shall be followed.			
9.10.07	For painting on steel work and ferrous metals, BS: 5493 and IS: 1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.			
9.10.08	Bitumen primer used in acid/alkali resistant treatment shall conform to IS: 158.			
9.10.09	All internal paints shall be of low VOC (Less than 50 g /L) content conforming to GRIHA rating for reduction of VOC content.			
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9.10.10	Aluminium Composite Panel Aluminum Composite Panel cladding with open grooves shall be designed, fabricated, tested installed and fixed for linear as well as curvilinear portions of the building for all heights and levels including: - Structural analysis & design and preparation of shop drawings for pressure equalization or rain screen principle as required, proper drainage of water to make it watertight including checking of all the structural and functional design. - Aluminium Composite Panel cladding in pan shape in metallic/ solid colour of approved shades made out of 4mm thick aluminium composite panel. ACP consisting of 3mm thick Fire Retardant mineral filled Core comprising of around 70% Inorganic compound which is 100% non-combustible mineral and balance 30% is food grade virgin polymer sandwiched between two Aluminium sheets (each 0.5mm thick). The aluminium composite panel top and bottom skin should confirm to Aluminium Alloy 5005 (AlMg 1) marine grade series and H 22/24 temper. The ACP sheet shall be coil coated with Kynar 500 based (70:30 ratio) PVDF / Lumiflon based fluoropolymer resin coating of approved colour and shade on face # 1 and polymer (Service) coating on face # 2 as specified using stainless steel screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc. - The fastening brackets of Aluminium alloy 6005 T5 / MS with Hot Dip Galvanised with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bi-metallic contacts all complete required to perform as per specification and drawing.			
9.10.11	GRC Wall Cladding Tiles GRC Wall Cladding Tiles shall be of Unistone or equivalent company. Glass Reinforced Concrete (G.R.C) Wall Cladding Tiles shall be of approved design, size, texture, thickness, patten and color. The thickness of the tiles shall range between 12 to 18mm (depending on the texture of the tile), allowing variance of 2 mm in accordance with IS: 1237-1980. The composition of tiles shall be '43' Grade Portland cement, reinforced with Alkali Resistant Glass Fiber and homogeny pigmentation shall be done with exterior grade synthetic inorganic iron oxide pigments manufactured by 'BAYFERROX / Lanxess (Germany)' or equivalent. The pigmentation shall be homogeneous and in accordance with British Standards BS EN 12878:1999. The other additives shall be fine washed graded quartz, super plasticizers and integrated water proofing agents and others. The tiles shall be produced with high vibration technology and concrete mix design compressive strength equivalent to M40 Grade@28 days. The top surface of the tiles shall be sealed with acrylic lacquer resulting in surface water absorption of tiles, less than 1% and water absorption by 24 hrs immersion method, less than 8%. The tiles shall be applied on a rough plaster of 1:3 cement mortar 1:3 (1cement: 3 coarse sand) and the fixing of tiles shall be done by 'Unistone' tile adhesive or equivalent as per manufacturer's laying instruction.			
9.10.11	GRC Customized Screens and Dome in shapes as Specified GRC Customized Screens shall be of 'Unistone', make or equivalent. Glass Reinforced Concrete (G.R.C) Screens shall casted with 'Spray Mix' concrete design in approved size, pattern, thickness of 50mm on the outer Border & 25-30mm for Internal			
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9.10.13	member and shade. The Screens should be made from '53 grade' White Portland Cement manufactured by 'JK Cement' or 'Birla white', White Quartz fine graded sieved Silica Sand, Alkali Resistant Glass Fibre manufactured by 'NEG Japan, Owen Corning 'Saint Gobain' or equivalent, Super Plasticizers manufactured by 'Karochem' or equivalent, Polymers manufactured by 'Nova Polychem' or equivalent and U.V resistant Synthetic inorganic pigments shall be used for pigmentation manufactured by 'Phenochem industries or equivalent. The Screens casting shall take place with layering methodology using- Direct Power Spray machines. The GRC Screens flexural strength average L.O.P shall be above or equivalent to 6 N/mm² & M.O.R shall be above or equivalent to 12 N/mm² for tests done on 28 days cured samples. The fixing of Screens shall be done using 'Dry fixing' method onto structural support members i.e. R.C.C, Brick work, MS Framework. SS / MS Galvanized CLAMPS & PINS also if required fasteners to be used of Wurth, Hilti & Fischer or equivalent. ALL CAST IN SOCKET TO BE EPOXY PRIMER COATED. ELECTRODES to be used of ADVANI, MANGALAM, ESAB or Victor brand or equivalent. Exterior Painting on Wall (Premium Acrylic Smooth Exterior Paint with Silicone Additives) The paint shall be (premium acrylic smooth exterior paint with silicone additives) of approved brand and manufacture. This paint shall be brought to the site of work by the contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge. Preparation of Surface For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall have received the approval of the Engineer in charge after inspection before painting is commenced. Application of Base Coat Base coat shall be of water proofing cement paint. Preparation of Mix for Base Coat Cement Paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement Paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement Paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement Paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously. The lids of cement Paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement Paint rapidly becomes air set due to its hygroscopic qualities. In case of cement Paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.			
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	Application of Base Coat The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement Paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work. The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted. For new work, the surface shall be treated with three or more coats of water proof cement Paint as found necessary to get a uniform shade. Precaution Water proof cement Paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, Paints etc. It shall not be applied on gypsums, wood and metal surfaces. If water proofing cement is required to be applied on existing surface, previously treated with white wash, colour wash etc., the surface shall be thoroughly cleaned by scrapping off all the white wash, colour wash etc. completely. Thereafter, a coat of cement primer shall be applied followed by two or more coat of water proof cement. Application of exterior paint Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Engineer-in-charge shall be followed meticulously. The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust. Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. 9.11.00 Doors & Windows 9.11.01 Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings (where ever provided), and all windows and ventilators of all buildings (unless otherwise mentioned) shall have aluminium framework with glazing. The aluminium section shall have minimum 2 mm thickness. The aluminium frame shall be electro colour dyed (anodised with 15 micron coating thickness) when used on outer side of the building and it shall be powder coated(50 microns coating thickness) when used in interior of the building. All doors of toilet areas shall be of steel framed solid core flush shutter. For Mill Bunker Building, transfer points, crusher house, conveyor gallery, steel louvered windows shall be provided. 9.11.02 Control Rooms of all buildings shall be provided with Aluminium Glazed door. 9.11.03 Single glazed panels with aluminium framework shall be provided as partition between two air-conditioned areas wherever clear view is necessary. 9.11.04 - The doors frames shall be fabricated from 1.6 mm thick MS sheets and shall meet the general requirements of IS: 4351. - All steel doors shall consist of double plate flush door shutters. The door shutter shall be 35 mm (min.) thick with two outer sheets of 1.2 mm rigidly connected with			
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	continuous vertical 1.0 mm stiffeners at the rate of 150 mm centre to centre. Side, top and bottom edges of shutters shall be reinforced by continuous pressed steel channel with minimum 1.2 mm. The door shall be sound deadened by filling the inside void with mineral wool. Doors shall be complete with all hardware and fixtures like door closer, tower bolts, handles, stoppers, aldrops, locks etc.			
9.11.05	Steel windows and ventilators shall be as per IS: 1361 and IS: 1038.			
9.11.06	Wherever functionally required Rolling shutter (fully closed/partly grilled) with suitable operating arrangement (manual/Electric) shall be provided to facilitate smooth operations. Rolling shutters shall conform to IS: 6248. M.S sliding doors with suitable mechanical and electrical operations fixtures as per requirement for bigger openings shall be used.			
9.11.07	All windows and ventilators on ground floor of all buildings shall be provided with suitable Aluminium grill.			
9.11.08	Fire-Proof doors with panic devices shall be provided at all fire exit points as per requirements. These doors shall generally be as per IS 3614 (Part 2). Fire rating of the doors shall be of minimum 2 hours. These doors shall be double cover plated type with mineral wool insulation.			
9.11.09	Hollow extruded section of minimum 2 mm wall thickness as per IS: 1285 (Grade of Aluminum shall be Alloy 63400) shall be used for all aluminium doors, windows and ventilators.			
9.11.10	Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However for toilets minimum width shall be 0.75 m and office areas minimum width shall be 1.20m.			
9.11.11	Electrically operated, self operable/closing, aluminium framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building.			
9.11.12	Minimum area of windows in building on each floor level shall be 10% of floor area.			
9.12.00	Glazing			
9.12.01	All windows and ventilators (not specified elsewhere) shall be provided with minimum 6 mm thick toughened glass conforming to IS: 5437.			
9.12.02	For single glazed aluminium partitions and doors, 8mm thick clear toughened glass shall be used.			
9.12.03	Toughened tinted glass of 6 mm thickness shall be used for all windows and ventilators in toilets.			
9.12.04	All glazing work shall conform to IS: 1083 and IS: 3548.			
9.12.05	For glazings of Air Conditioned Buildings Composite double glazing shall be 24mm thick consisting of 6mm thick clear float glass on inner side and 6mm thick reflective toughened glass on outer side. The two glasses shall be separated by 12mm air-gap and hermetically sealed by beading of anodized aluminium with outer edge sealed with silicon sealant. Outer glass of 6mm thickness shall have following technical characteristics: Solar factor 25% or less, Maximum U-value 3.3 W/ SQMK, VLT min 30%: Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28)			
	The glass to be used should be from the manufacturers of glass like Saint Gobain (India) or Asahi (India) or equivalent. The glass should be free from distortion and thermal stress			
9.12.06	For internal glazed partition, 8mm thick clear toughened glass shall be provided.			
9.13.00	False ceiling			
9.13.01	False ceiling of 12.5 mm thick tapered/square edge glass fibre reinforced gypsum board conforming to IS : 2095 having fine texture finish, including providing and fixing of frame work at all levels, for all kind of work, consisting of light weight galvanised steel member (minimum			
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	0.8 mm thick and galvanised as per IS: 277) having maximum grid size of 1200 mm x 600 mm for supporting panels of specified size, suspended from RCC structural steel or catwalkway grid above, with 4 mm (minimum) galvanised wires (rods), with special height adjustment clips, providing angle section of minimum 25 mm width along the perimeter of ceiling, supporting grid system (minimum 0.8 mm thick and galvanised as per IS: 277), expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (concealed grid and finished flat seamless and curve shape (dome etc.), finished smooth(seamless) along with the galvanised light gauge steel supporting system laid in profile to suit the profile of dome).			
9.13.03	False ceiling of 12 mm thk calcium silicate board of 'HILUX' or equivalent with suspension system as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (With concealed grid and finished flat seamless).			
9.13.05	ALUMINIUM FALSE CEILING : Aluminium false ceiling shall be in 600 mm x 600 mm tile or plank type of 0.6 mm thickness (minimum) with perforation of 2.5 mm dia in combination with built in nonwoven tissue for providing good acoustic properties. False ceiling shall have coil coating of thickness 25micron (minimum)and it shall be installed with T-Grid (of profile 24 mm) in same or contrasting colours or with 6 mm recess joints. The whole system shall be level adjusting arrangement and shall be suspended as per manufacturer guidelines.			
9.13.08	Additional hangers and height adjustment clips shall be provided for return air grills, light fixtures, A.C. ducts etc.			
9.13.09	Suitable M.S. channel (Minimum MC75 with maximum spacing of 1.2 m C/C both ways) grid shall be provided above the false ceiling level for movement of personnel and to facilitate maintenance of lighting fixtures, AC ducts etc.			
9.13.10	Underdeck insulation shall be provided on the ceiling (underside of roof slab) and underside of floor slab of air-conditioned area depending upon the functional requirements. This underdeck insulation shall consist of 50mm thick mineral wool insulation with 0.05 mm thick aluminium foil & 0.6 mm x 25mm mesh wire netting and shall be fixed to the ceiling with 2 mm wire ties.			
9.13.11	Suitable cut-outs shall be provided in false ceiling to facilitate fixing of lighting fixtures, AC grills, smoke detectors, etc.			
9.14.00	Elevator Machine Room Elevator machine room shall be as per NBC requirements in either way. a) Floor of the elevator machine room shall be of RCC and wall shall be of one brick thick masonry wall. It shall be provided with fire door and other requirements as per NBC and elevator norms. b) Floor of Machine Room shall be provided with profiled metal decking sheet. Trough shall be filled with Insulating Material (glass wool or rock wool) and thereafter finished with Minimum 50 mm thick wooden flooring, consisting of 37 mm thick hardwood planks, finished with 11mm thick laminated wooden flooring (of 'pergo' or equivalent) with plank size 193x1195mm (material class shall be 34 as per EN13329), over 2 mm expanded polystyrene foam and polythene sheet under laying. Roof and Side enclosure of Machine Room shall be provided with Prefabricated Insulated Metal Sandwich panels. Composition of Insulated Metal Sandwich Panels shall be as described in Clause 9.08.00 of Part-B (Civil) of Technical Specification. Doors of Machine Room shall be Double Plate Steel flush doors of thickness 45 mm with steel sheets of 18 gauge with necessary stiffeners. Space between two sheets shall be filled with mineral wool insulation. Frame of doors shall be pressed steel sheets of 16 gauge. All necessary fittings for the doors shall be provided by the Bidder. Rubber sealing, for making the Doors airtight shall also be provided.			
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9.15.00	Windows/ventilators shall be of standard extruded anodised Aluminium Sections of minimum 2 mm thickness with 24 mm hermitically sealed double glazing consisting of two 6 mm thick toughened glass separated by 12 mm. gap. Technical requirements of prefabricated insulated metal sandwich panels/decking sheets shall be same as given elsewhere in this specification. Interior Design A comprehensive interior design scheme shall be conceived with the intention of projecting a definite theme and aesthetic appearance to inside working environment. It shall take into account the multidisciplinary engineering activities involving power plant technology, and architectural & civil engineering for a smooth control hierarchy and man machine interface. All the design aspects such as flooring, false ceiling, furniture, colour scheme equipment design & layout, illumination, fire fighting, acoustics and ergonomics requirements shall be detailed out so as to present an overall unified aesthetic spatial appearance. The areas to be undertaken for this interior design process shall be control room complex including common control room, computer room, conference rooms and office areas in the buildings and the following aspects shall be reviewed and evaluated for design. Furniture to be supplied by Bidder for the control room complex and other control rooms shall be as specified under C&I specification. a) Layout, keeping in view the man-machine interface and suitable ergonomic practices. b) Integration of civil engineering with architecture and interior design. c) Illumination levels, noise levels, electromagnetic interference levels, taking into account the equipment and furniture. d) Comfort and safety requirements such as air conditioning, fire fighting, fire escapes, etc. e) Microprocessors based control system to control the functional requirements. The above design philosophy put into practice shall be detailed out through presentation drawings, perspective views, scale models, detail drawings, etc.			
9.16.00	Stainless Steel Hand railing Providing and fixing knockdown railing system comprising of SS 304 Grade Stainless Railing of 50mm diameter handrail fixed on 50 mm SS round baluster placed at maximum 1000 c/c along with five numbers 19 mm diameter midrail connected at side of baluster by special brackets, both the end of mid rail should be bush inserted for jointing and to give extra strength (joints should not be welded and invisible). The balustrade should be fixed onto floor with casted plate of minimum 6mm thickness. Base plate shall be concealed with suitable SS 304 cover cap so that the mounting height fasteners are not visible after installation. Only high strength anchor fasteners would be used for fixing of baluster, as giving extra strength, rust proof and more durable. Onsite welding is strictly not allowed. Wherever welding is required, it should be Tig welding process with same grade 304/316 at factory only so that floor stone and other things would not be damaged and for safety purpose also. Baluster and handrail connector should be screwed tightened and not to be welded on site. Wall thickness of all pipes shall be taken as 2 mm. Along with all visible components developed in high grade SS and whenever required, joints to be filled with bushings for extra strength. Railing Height to be taken @ 1000/ 1200 mm from floor level.			
9.17.00	Finishing Schedule Interior and Exterior Finishes shall be as given in Tables-A & B respectively attached at the end of these specification.			
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
1.	Main power house Building.				
	a) Unloading Bay	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)	
	b) Cable vault	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)	
	c) Balance area including passage	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)	
	d) SWAS Room	Matt Finished Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns upto false ceiling level	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	e) Equipment Area, ESP SWGR/ ACP Room/ UAF Room	Cement concrete with Metallic hardener topping	Acrylic distemper.	Acrylic distemper (except metal deck area)	
	f) UPS Battery charger room	Matt finished Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns upto false ceiling level	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	g)Deaerator floor	Cement concrete with Metallic hardener topping.		-	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	h) Operating Floor	20 mm thick heavy duty anti skid full body vitrified tile in TG Hall. Rubber flooring at TG deck.	Colour coated Metal cladding on A-Row& Gable end, up to crane girder level.	Metal deck roofing (bottom of sheeting with RAL 9002 finish)	
	i) General circulation and movement areas	20 mm thick heavy duty anti skid full body vitrified tile		Acrylic distemper (except metal deck area).	
	j) Switchgear room	Heavy duty tiles (Cement Concrete tiles 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)	
	k)MCC Room	Heavy duty tiles (Cement Concrete tiles 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)	
	l) Control room area including control room	Matt Finish Vitrified ceramic tiles flooring of size 1000 x1000 mm	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
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TABLE –A INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	m) control equipment room,	Matt finish Vitrified ceramic tiles.	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	n)Conference room, senior executive room., Computer Room	Matt finish Vitrified ceramic tiles	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	o)Record room	ceramic tiles	Acrylic distemper.	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	p)Locker room	Ceramic Tiles	Acrylic Emulsion Paint	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	q)Toilet area	ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Alluminium False ceiling in size 600x 600	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	r) Office Room, Staff Room	Matt Finished Vitrified ceramic tiles.	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	s)Laboratory area	Vitrified Ceramic / Acid/alkali resistant tiles.	Designer ceramic wall tiles up to False Ceiling Height/ Aluminium composite panel cladding for columns and walls in case of A.C Panel	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	t) RCC Stair case	18mm thick Granite (Polished and honed Finished) stone	Polished Granite Stone up to 1.2m. ht. & Acrylic Distemper Paint over wall putty finish for balance height.	Acrylic Distemper	
	u) Lift and Staircase Lobby	18mm thick polished granite stone as pattern.	18mm thick polished granite & glass mosaic tile cladding up to False Ceiling Height	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	v) Passages and general circulation areas.	Deleted	Deleted	Deleted	
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	w) Battery Room	Acid and alkali resistant tile.	Acid and alkali resistant tile up to 1.2m height and chemical resistant paint for balance height	Chemical Resistant paint except in locations where Metal deck has been provided	
	x) Oil canal, oil room, oil purification Tank and other areas where oil spillage is likely to occur.	Oil resistant paint (epoxy based) 150 micron over primer.	As above except oil canal Oil resistant Paint	As above except oil canal.	
	y)Pathways including roof area.	22mm thick concrete chequered tiles.	-	-	
2.	Service Building/Administration Building				
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	a) Entrance Lobbies and Lift areas/Foyer/Exhibition space.	18mm thick polished granite stone as/ pattern.	Combination of 18mm thick polished granite cladding, lacquered glass cladding and Fiber Reinforced Plastic murals based on local art in lift lobby & foyer	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	b) Conference room, senior executive room.	11 mm thk. Laminated wooden flooring	Glazed partition with Aluminium frame/ Acrylic emulsion paint.	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design.	
	c) Office Room, Staff Room	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint./ Designer Glass mosaic tile mural in combination with textured paint in Canteen	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	d) Passage	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint.	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	e) RCC Stair case	18mm thick Granite (Polished and Honed Finished) stone	Glass Mosaic Tile cladding in murals and pattern based on local art upto ceiling level	Acrylic Distemper.	
	f) Toilet/ Pantry/ Kitchen	ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Acrylic distemper in kitchen / Calcium Silicate false ceiling in toilet and pantry	
	g) AHU/ A.C. Plant room/MCC Room/Store	Cement concrete with Metallic hardener topping.	Acrylic distemper / Wall insulation in AHU as per HVAC Requirement	Acrylic distemper / Underdeck insulation in AHU as per HVAC Requirement	
	h) Stilt parking area	Cement concrete with Non-Metallic hardener topping.	-	-	
	i) Pathways including roof area.	22mm thick concrete chequered tiles.			
3	ESP control building/Air compressor house				
	a) Operating/Maintenance areas	Cement concrete with Metallic hardener topping	Pre color coated metal panel cladding.	Acrylic distemper (except metal deck area)	
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	b) Office Room, Staff Room	Digitally glazed Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns	Mineral fiber Board False Ceiling	
	c) Control Room	Digitally glazed Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns in ESP Control Room Building	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design	
	d) MCC Room	Heavy duty tiles (Cement Concrete 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)	
	e) RCC Stair case	18mm thick Granite (Polished and Honed Finished) stone	Polished Granite stone up to 1.2m.ht. & Acrylic Distemper	Acrylic Distemper (except metal deck area)	
	f) Battery Room	Acid, Alkali resistant tile	Acid, Alkali resistant tile 1.2m height / chemical resistant paint above dado	Chemical resistant paint (except metal deck area)	
	g) AHU/ AC Plant room/ Cable vault	Cement concrete with Metallic hardener topping	Acrylic Distemper	Acrylic Distemper (except metal deck area)	
	h) Toilets	ceramic tiles.	Designer ceramic wall tiles dado up to false ceiling level.	Calcium silicate false ceiling.	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2		SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN	
				PAGE 24 OF 31	

CLAUSE NO.	TECHNICAL REQUIREMENTS				
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
4.	Mill & Bunker building/ T.P.s / Conveyor Galleries	Cement concrete with Metallic hardener topping	Acrylic distemper on masonry walls/ color coated Metal panel cladding	color coated Metal panel cladding	
5.	Fire water pump house	Not Used	Not Used	Not Used	
6.	Fire water booster water pump house.				
	a) Maintenance /Pump floor/PLC	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)	
	b) Control room /PLC.	Matt Finished Vitrified Ceramic Tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling.	
	Toilet area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to false ceiling level.	Acrylic distemper	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2		SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN	
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
7.	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Ash Water recirculation Pump House/ Transport air compressor house/ HCSD pump house/Fuel Oil Unloading Pump House with switchgear building& control room /H2 generation Building/ Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Pump house, Switchgear room, control room/Any other Building..				
	a) Operating/Mainte nance areas/ MCC room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)	
8.	DELETED		.		
9.	O&M store building/Dozer Shed				
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	a) Stores/dozer shed	Cement concrete with Metallic hardener topping.	Acrylic distemper/ color coated Metal panel cladding	Acrylic distemper (except metal deck area)	
	b)Office Room, Staff Room/ Electronic Store	Matt Finished Vitrified ceramic tiles.	Acrylic emulsion paint.	Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area	
	c)Passages	Matt Finished Vitrified Ceramic Tiles	Acrylic distemper	Acrylic distemper	
	d)RCC Stair case	18mm thick polished Marble stone finish.	Marble stone up to 1.2m.ht. & Acrylic Distemper above.	Acrylic Distemper	
	e) Toilets	ceramic tiles.	Designer ceramic wall tiles dado up to 2.1 m Height from FFL.	Acrylic distemper	
10	Rest Room for O&M Workers				
	Rest room	Cement concrete with Metallic hardener topping.	Acrylic distemper	Metal roof	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2		SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN	PAGE 27 OF 31

CLAUSE NO.		TECHNICAL REQUIREMENTS			
TABLE –A					
INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	Toilets	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above	Metal roof	
10	Occupational Health Centre with Crèche Facilities				
	a)Waiting Lobby cum Reception/ Doctor's Chamber /First Aid Room/ Patient Room	Matt finish vitrified tiles	Acrylic Emulsion paint	Acrylic Emulsion paint	
	b)Driver's Room	Digitally Glazed vitrified tiles	Acrylic Distemper Paint	Acrylic Distemper Paint	
	c)Toilet area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to false ceiling level.	Calcium Silicate False Ceiling	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2		SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN	
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
TABLE –A INTERIOR FINISHING SCHEDULE					
S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH	
	Creche	5 mm thick vinyl flooring	Glass mosaic tiles in murals & patterns and Acrylic Emulsion Paint	Acrylic Emulsion paint	
Note : 1. All wall and roof areas above false ceiling shall be plastered. 2. The colour and pattern of finish shall be as per approved details. 3. All materials shall be of reputed and established brand approved by Engineer-in-charge. 4. Wherever alternative materials are specified, the final selection rests with Engineer-in-charge. 5. This finishing schedule shall also be applicable to similar functional areas for all other buildings and facilities. 6. All the finishing materials shall be applied/provided as per manufacturer specification and guidelines under the supervision & guidelines of manufacturer. 7. Requirement given above are suggestive and minimum. Bidder is welcome to suggest alternative scheme conforming to design functional requirement subject to approval of the Engineer-in-charge.					
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2		SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN	
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TABLE –B
EXTERIOR FINISHES SCHEDULE

Sl.No.	DESCRIPTION OF AREA	WALL AND PROJECTIONS	SOFFIT OF PROJECTIONS
1.	Auxiliary building in steel framed structure.	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface/ Aluminium Composite Panel Approved colour/ colour combination of colour coated metal cladding	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface Approved colour/ colour combination of colour coated metal cladding
2.	Building with concrete frame work, etc.	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface
3.	Steel Structure, trestles, etc.	High performance Paint of approved specification and shade.	
4.	Administration Building, Gate Complex and CISF building	GRC Tiles, GRC Customized Screens, Domes, design developed based on Tender Drawing	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
5	Service Building	GRC Tiles, GRC Customized Screens and Aluminium Composite Panel	Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface
NOTE : 1. The colour and pattern of finish shall be as finalized by Engineer. 2. All materials shall be of reputed and established brand approved by Engineer.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN
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CLAUSE NO.	TECHNICAL REQUIREMENTS	
D-1-10 10.01.00	MATERIAL SPECIFICATION Cement Fly ash based portland pozzolana cement conforming to IS: 1489 (Part-1) shall be used for all areas other than for the critical structures identified below. Other properties shall be as per IS code. Ordinary Portland Cement (OPC) shall necessarily be used for the following structures. - Ordinary Portland Cement (OPC) shall necessarily be used for RCC for Chimney shell. - TG foundation top deck/ Substructure - Spring supported decks of all machine foundations such as TDBFP/MDBFP The grade of cement shall be Grade 43 for OPC conforming to IS: 269. In place of fly ash based portland pozzolana cement, OPC mixed with Fly Ash can be used. Batching plant shall have facility for mixing fly ash. Fly ash shall conform to IS: 3812(Part I). Percentage of fly ash to be mixed in concrete shall be based on trial mix. Mix design shall be done with varying percentage of fly ash mix with cement	
10.02.00	Aggregates Coarse Aggregate Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383. However, use of aggregate manufactured from other than natural sources (Listed in Annexure-A of IS 383) and Bottom Ash from Thermal Power Plants shall be permitted only in Lean Concrete of Grade M7.5 and M10 (for % of utilization refer Table-1 of IS 383). Fine Aggregate Fine aggregate shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Fine aggregate in concrete shall conform to IS: 383. Bidder can use either natural sand or crushed sand, confirming to IS:383, based on availability. For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116. However, use of aggregate manufactured from other than natural sources (as Listed in Annexure-A of IS 383) and Bottom Ash from Thermal Power Plants conforming to IS:383 shall be permitted only in Lean Concrete of Grade M7.5 and M10 (for % of utilization refer Table-1 of IS 383). Petrographic examination of aggregate shall be carried out by the contractor at National Council for Cement and Building Materials (NCB), Ballabgarh, or any other approved laboratory to ascertain the structure and rock type including presence of strained quartz and other reactive minerals for machine foundations, etc. In case, the coarse aggregate sample is of composite nature, the proportions (by weight) of different rock types in the composite sample and petrographic evaluation of each rock should also be ascertained. While determining the rock type, special emphasis should be given on identification of known reactive rocks like chalcedony, opal etc. The procedure laid down in IS 2430 for sampling of aggregates may be followed. The laboratory shall determine potential reactivity of the aggregate, which may lead to reaction of silica in aggregate with the alkalis of cement and / or potential of some aggregates like limestone to cause residual expansion due to repeated temperature cycle. If the same is established, the contractor shall further carry out alkali aggregates	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-4540-001A-2
		SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION
		PAGE 1 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
10.03.00	reactivity test as per IS 2386 (Pt.VII) and / or repeated temperature cycle test to establish the suitability of the aggregates for the concrete work. The test results, with the final recommendations of the laboratory, as to a suitability of the aggregate, for use in the concrete work for various structures and suggested measures, in case of results are not satisfactory, shall be submitted to the Engineer for his review, in a report form. In case in the report, it is established, that the aggregates contain reactive silica, which would react with alkalis of the cement, the contractor shall change the source of supply of the aggregate or use low alkali cement as per recommendation or take measures as recommended in the report as instructed by Engineer. In case aggregates indicate residual expansion, under repeated temperature cycle test (from 10o Celsius to 65o Celsius and for 60 temperature cycles) the material shall not be used for concreting of TGs', BFPs' and other equipment foundations which are likely to be subjected to repeated temperature cycle. The contractor shall use aggregates free from residual expansion under repeated temperatures cycle test.			
	Reinforcement Steel Reinforcement steel shall be of high strength deformed TMT steel bars of grade Fe-415/Fe-500/Fe 500D and shall conform to IS 1786 and IS 13920. However, minimum elongation shall be 14.5%. Relevant clause of IS 13920 are quoted below for clarity: Quote 5.3.1 Steel reinforcement shall comply with all of the following: a) Elongation shall be at least 14.5 percent, b) Ratio of ultimate stress to 0.2 percent proof stress shall not exceed 1.25, c) Ratio of ultimate stress to 0.2 percent proof stress shall be at least 1.15, and d) Steel shall be only of strength grades with minimum 0.2 percent proof stress of 415 MPa, 500 MPa or 550 MPa, in addition to other requirements of IS 1786.' 5.3.2 The actual 0.2 percent proof stress of steel bars based on tensile test must not exceed their characteristic 0.2 percent proof stress by more than 20 percent Unquote Mild steel and medium tensile steel bars shall conform to Grade A of IS:432-Part 1 and hard drawn steel wire shall confirm to IS:432-Part II. Welded wire fabric shall conform to IS 1566.			
	Structural Steel Structural Steel (including embedded Steel) shall be straight, sound, free from twists, cracks, flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below.			
	Mild Steel a) Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of Grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall be tested for impact resistance at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2. b) Pipes shall conform to IS: 1161. c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240 and minimum thickness shall be 4 mm..			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-4540-001A-2	SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION	PAGE 2 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
10.04.02	d) Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection. Steel for chequered plate shall conform to grade E250A semi killed of IS: 2062 or equivalent grade conforming to ASTM & BS standards only.			
10.05.00	Medium and High Tensile Steel Rolled Sections and plates shall be of grade designation E350 or higher, Quality B0 (Fully killed), conforming to IS: 2062. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.			
10.06.00	Bricks Only fly ash bricks shall be used in all construction, except for elevator shafts, which can be either of burnt clay bricks or RCC construction as per functional / codal provisions. Bricks shall be table moulded/ machine made of uniform size, shape and sharp edges and shall have minimum compressive strength of 75kg/cm ² . Burnt clay fly ash bricks and fly ash lime bricks shall conform to IS: 13757 and IS: 12894 respectively. Minimum fly ash content in fly ash based bricks shall be 25%.			
10.07.00	Foundation Bolts Material and details of foundation bolts shall conform to IS: 5624. Mild steel bars used for the fabrication of bolt assembly shall conform to grade 1 of IS: 432 and/ or grade A of IS: 2062. Hexagonal nuts and lock nuts shall conform to IS: 1363 & IS: 1364 upto M36 diameter and IS: 5624 for M42 to M150 diameter.			
10.08.00	Stainless steel The material specification for stainless steel plates are mentioned in the design concept area of Mill Bunker building.			
10.09.00	Water Water used for cement concrete, mortar, plaster, grout, curing, washing of coarse aggregate, soaking of bricks, etc. shall be clean and free from oil, acids, alkalis, organic matters or other harmful substances in such amounts that may impair the strength or durability of the structure. Potable water shall generally be considered satisfactory for all masonry and concrete works, including curing. When water from the proposed source is used for making the concrete, the maximum permissible impurities, development of strength and initial setting time of concrete shall meet the requirements of IS: 456. All materials brought for incorporation in works shall be of best quality as per IS unless specified otherwise.			
10.10.00	PTFE (Poly Tetra Fluoroethylene) Bearing The bearing shall be of reputed make and manufacturer as approved by the Engineer, for required vertical load and end displacement/rotation. PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/sq.cm. In order to prevent cold flow in PTFE surface it shall be rigidly bonded by a special high temperature resistance adhesive to the stainless steel substrata. The stainless steel surface that slides against the PTFE is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of stainless steel plate shall be between 1.0 mm to 1.5 mm.			
	Statutory Requirements Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules at Tariff Advisory Committee. Water Act for pollution control, Explosives Act, etc. Provisions of safety, health and welfare according to Factories Act shall be complied with.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	These shall include provision of continuous walkways along the crane - girder level on both sides of building, comfortable approach to EOT crane cabin, railing, fire escape, locker room for workmen, pantry, toilets, rest room etc. Provisions for fire proof doors, number of staircases, fire separation wall, lath plastering/encasing the structural members (in fire prone areas), type of glazing etc. shall be made according to the recommendations of Tarrif Advisory Committee. Statutory clearances and norms of State Pollution Control Board shall be followed. Bidder shall obtain approval of Civil/Architectural drawings from concerned authorities before taking up the construction work.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-4540-001A-2	SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION	PAGE 4 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
D-1-11	Inspection, Testing and Quality Control			
11.01.00	Sampling and testing of major items of civil works viz. earthwork, concreting, structural steel work (including welding, sheeting, etc. shall be carried out in accordance with the requirements of this specification. Wherever nothing is specified relevant Indian Standards shall be followed. In absence of Indian Standard equivalent International Standards may be used. The Bidder shall submit and finalise a detailed field Quality Assurance Programme before starting of the construction work according to the requirement of this specification. This shall include frequency of sampling and testing, nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer. The Bidder shall furnish the test certificate from the manufacturer's of various materials to be used in the construction.			
11.02.00	Workmanship and dimensional tolerances shall be checked as stipulated else where in the specification			
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
D-1-12(C)	Annexure (C) GEOTECHNICAL DATA			
TALCHER TPP STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B DOC NO. CS-4540-	SUB-SECTION-D-1-12 (C) CIVIL WORKS BORE HOLE DATA	PAGE 1 OF 263	

CLAUSE NO.	TECHNICAL REQUIREMENTS										
D-1-12(D)	Annexure- (D)										
	CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – I for site specific information. Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard. Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method. Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz. Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards. It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects. Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for: <table><tr><td>a) Welded steel structures</td><td>: 1.0%</td></tr><tr><td>b) Bolted steel structures/ RCC structures</td><td>: 2.0%</td></tr><tr><td>c) Prestressed concrete structures</td><td>: 1.6%</td></tr><tr><td>d) Steel stacks</td><td>: As per IS: 6533 & CICIND Model Code whichever is more critical.</td></tr></table>				a) Welded steel structures	: 1.0%	b) Bolted steel structures/ RCC structures	: 2.0%	c) Prestressed concrete structures	: 1.6%	d) Steel stacks
a) Welded steel structures	: 1.0%										
b) Bolted steel structures/ RCC structures	: 2.0%										
c) Prestressed concrete structures	: 1.6%										
d) Steel stacks	: As per IS: 6533 & CICIND Model Code whichever is more critical.										
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CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<u>ANNEXURE-I</u> <u>SITE SPECIFIC DESIGN PARAMETERS</u> The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows: a) The basic wind speed “V_b” at ten metres above the mean ground level : 50 metres/second b) The risk coefficient “K_1” : 1.08 c) Category of terrain : Category-2	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
D-1-12(E)	Annexure-(E)			
	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT			
	All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments.			
	A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I.			
	Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.			
	The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4).			
	Damping in Structures			
	The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:			
	a)	Steel structures	:	2%
	b)	Reinforced Concrete structures	:	5%
	c)	Reinforced Concrete Stacks	:	3%
	d)	Steel stacks	:	2%
	Method of Analysis			
	Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893. The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve. For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B. Design/Detailing for Ductility for Structures The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 2 OF 6	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	APPENDIX-I <u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u> The various site specific seismic parameters for the project site shall be as follows: 1) Peak ground horizontal acceleration (MCE) : 0.16 g 2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra a) for special moment resisting steel frames designed and detailed as per IS:800 : 0.04 b) for special concentrically braced steel frames designed and detailed as per IS:800 : 0.03 c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.024 d) for RCC chimney, RCC Natural Draft Cooling Tower : 0.08 e) for liquid retaining tanks : 0.048 f) for Steel chimney, Absorber tower, Vessels : 0.06 g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below, in general (excluding special structure/configuration/ materials) : 0.04 3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.08 Note: g = acceleration due to gravity The horizontal seismic acceleration spectral coefficients are furnished as Annexure – S in subsequent pages.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 3 OF 6	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																																																																																																																																												
	ANNEXURE - S <u>HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS for</u> <u>Talcher TPP</u> <u>(In units of 'g')</u> <table><tr><th rowspan="2">Time Period (Sec)</th><th colspan="3">Damping Factor (as a percentage of critical damping)</th></tr><tr><th>2%</th><th>3%</th><th>5%</th></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>0.03</td><td>1</td><td>1</td><td>1</td></tr><tr><td>0.04</td><td>1.388</td><td>1.338</td><td>1.261</td></tr><tr><td>0.05</td><td>1.790</td><td>1.676</td><td>1.509</td></tr><tr><td>0.06</td><td>2.204</td><td>2.015</td><td>1.748</td></tr><tr><td>0.07</td><td>2.627</td><td>2.355</td><td>1.980</td></tr><tr><td>0.08</td><td>3.059</td><td>2.696</td><td>2.205</td></tr><tr><td>0.09</td><td>3.499</td><td>3.036</td><td>2.424</td></tr><tr><td>0.097</td><td>3.810</td><td>3.275</td><td>2.575</td></tr><tr><td>0.098</td><td>3.810</td><td>3.310</td><td>2.596</td></tr><tr><td>0.1</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.11</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.108</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.11</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.115</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.12</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.125</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.13</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.135</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.14</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.145</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.15</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.2</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.25</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.3</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.35</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.37</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.38</td><td>3.810</td><td>3.310</td><td>2.640</td></tr><tr><td>0.39</td><td>3.713</td><td>3.310</td><td>2.640</td></tr><tr><td>0.4</td><td>3.620</td><td>3.310</td><td>2.640</td></tr><tr><td>0.43</td><td>3.367</td><td>3.079</td><td>2.456</td></tr><tr><td>0.45</td><td>3.218</td><td>2.942</td><td>2.347</td></tr><tr><td>0.52</td><td>2.785</td><td>2.546</td><td>2.031</td></tr></table>	Time Period (Sec)	Damping Factor (as a percentage of critical damping)			2%	3%	5%	0	1	1	1	0.03	1	1	1	0.04	1.388	1.338	1.261	0.05	1.790	1.676	1.509	0.06	2.204	2.015	1.748	0.07	2.627	2.355	1.980	0.08	3.059	2.696	2.205	0.09	3.499	3.036	2.424	0.097	3.810	3.275	2.575	0.098	3.810	3.310	2.596	0.1	3.810	3.310	2.640	0.11	3.810	3.310	2.640	0.108	3.810	3.310	2.640	0.11	3.810	3.310	2.640	0.115	3.810	3.310	2.640	0.12	3.810	3.310	2.640	0.125	3.810	3.310	2.640	0.13	3.810	3.310	2.640	0.135	3.810	3.310	2.640	0.14	3.810	3.310	2.640	0.145	3.810	3.310	2.640	0.15	3.810	3.310	2.640	0.2	3.810	3.310	2.640	0.25	3.810	3.310	2.640	0.3	3.810	3.310	2.640	0.35	3.810	3.310	2.640	0.37	3.810	3.310	2.640	0.38	3.810	3.310	2.640	0.39	3.713	3.310	2.640	0.4	3.620	3.310	2.640	0.43	3.367	3.079	2.456	0.45	3.218	2.942	2.347	0.52	2.785	2.546	2.031		
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 4 OF 6																																																																																																																																											

CLAUSE NO.	TECHNICAL REQUIREMENTS				
	Time Period (Sec)	Damping Factor (as a percentage of critical damping)			
		2%	3%	5%	
	0.555	2.609	2.386	1.903	
	0.56	2.586	2.364	1.886	
	0.565	2.563	2.343	1.869	
	0.57	2.540	2.323	1.853	
	0.575	2.518	2.303	1.837	
	0.58	2.497	2.283	1.821	
	0.585	2.475	2.263	1.805	
	0.59	2.454	2.244	1.790	
	0.595	2.434	2.225	1.775	
	0.6	2.413	2.207	1.760	
	0.65	2.228	2.037	1.625	
	0.7	2.069	1.891	1.509	
	0.75	1.931	1.765	1.408	
	0.8	1.810	1.655	1.320	
	0.85	1.704	1.558	1.242	
	0.9	1.609	1.471	1.173	
	0.95	1.524	1.394	1.112	
	1	1.448	1.324	1.056	
	1.05	1.379	1.261	1.006	
	1.1	1.316	1.204	0.960	
	1.15	1.259	1.151	0.918	
	1.2	1.207	1.103	0.880	
	1.25	1.158	1.059	0.845	
	1.3	1.114	1.018	0.812	
	1.35	1.073	0.981	0.782	
	1.4	1.034	0.946	0.754	
	1.45	0.999	0.913	0.728	
	1.5	0.965	0.883	0.704	
	1.55	0.934	0.854	0.681	
	1.6	0.905	0.828	0.660	
	1.65	0.878	0.802	0.640	
	1.7	0.852	0.779	0.621	
1.75	0.827	0.757	0.603		
1.8	0.804	0.736	0.587		
1.85	0.783	0.716	0.571		
1.9	0.762	0.697	0.556		
1.95	0.743	0.679	0.542		
2	0.724	0.662	0.528		
2.05	0.706	0.646	0.515		
2.1	0.690	0.630	0.503		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 5 OF 6	

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC																																																																																																																						
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
D-1-12(F)	Annexure-(F) QA REQUIREMENT All Civil, Structural and Architectural construction work at the project shall be executed strictly in accordance with the Quality Assurance guidelines specified in separate part of the Specification.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-12(F) CIVIL WORKS QA REQUIREMENT	PAGE 1 OF 1

Clause No.	TECHNICAL REQUIREMENTS	
D-1-12(I) 1.0.0 1.02.0	ANNEXURE-(I) DEVELOPMENT OF LAYDOWN AREA IN ABANDONED ASH DYKE This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area 'A', 'B' & 'C' has been identified for this purpose. Construction, Maintenance, and upkeep of the approach road shall be the responsibility of the bidder. DESCRIPTION OF SITE, LOCATION AND APPROACH AND ITS PRELIMINARY ASSESSMENT The abandoned ash dyke area is in vicinity of Talcher TPP-III. The capacity of the dyke has exhausted, and the maximum depth of deposited ash is approximately 15m. For using abandoned ash dyke for creation of laydown area for Talcher-III, following measures needs to be taken by the EPC contractor: a. Any work should be minimum 50 m away from the Heel of dyke embankment to ensure the dyke stability and safety. b. Suitable measures to avoid fugitive dust emission shall be adopted within the preassembly area and adjoining area. c. Regular inspection of the abandoned dyke to be carried out and remedial measures be taken when any abnormal behavior is noticed in the dyke. Contingency arrangements in form of stacking of sandbags, soil etc. should be in place in order to address the problem of any imminent failure in the dyke. Any adverse effect on the dyke due to creation of laydown area needs to be immediately attended d. The contractor shall plan the laydown area in accordance with the prevailing site condition/ strata and geotechnical parameters so as to ensure that there is no adverse impact on the dyke e. Toe drain in the toe of the dyke shall be examined and it shall be ensured that the seepage water/ rain water is flowing in the drain unhindered. f. Soil cover of minimum 500 mm, turfing along with surface drainage arrangement has to be maintained in areas which are not hard crusted. g. The drain in the downstream slopes shall be properly maintained so that rainwater properly flows through it.	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEVELOPMENT OF LAYDOWN AREA Page 1 of 4

Clause No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
1.3.0	h. Roads over the toe drain if any shall be provided with suitable cross drainage arrangement to avoid blockage of toe drain i. At locations where heavy equipments are to be placed and are to be used as fabrication yards, heavy duty paving/ hard crusting shall be carried out. j. It should be ensured that there is no vehicular movement in any part of dyke embankment except on the new roads that shall be constructed connecting laydown area in the dyke lagoon. No vehicular movement should be there along dyke embankment top.			
	CONTRACTOR’S OBLIGATIONS The EPC vendor shall be deemed to have full knowledge of the site and site limitations, whether he visits site or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed. EPC Contractor is advised to visit site and its surroundings to assess and satisfy themselves about the local conditions such as access roads to the site, water and power supply, application / details of taxes, duties, royalties and levies, nature of ground and subsoil conditions, general topography of the site, availability of construction materials, environmental and safety laws, acts and regulations and any other relevant information, as required by them. The EPC Contractor may obtain all necessary information as to risk, contingencies and other circumstances, which may influence or affect their tender. EPC Contractor shall be deemed to have considered local conditions and information and to have satisfied himself in all respects. before quoting terms and no claim whatsoever in this regard shall be entertained by the Owner at a later date.			
	SOIL DATA Not Available. Vendor to carry out the same.			
	ACCESS TO WORK SITE The Contractor shall make his own arrangement for access to the work site and for movement of men, machinery, other equipments, etc. required for carrying out the work included under this contract.			
	Roads over the toe drain if any shall be provided with suitable cross drainage arrangement to avoid blockage of toe drain.			
	Rainfall run-off As part of the work may have to be carried out in wet season. The Contractor shall supply, install and operate his own temporary pumping installation along with DG set that may be required for dewatering. Proper drainage arrangement in the area shall be developed.			
	CONSTRUCTION POWER AND CONSTRUCTION WATER In order to meet Construction Power requirement for this area and construction water, the EPC Contractor shall make its own arrangement.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA	Page 2 of 4

Clause No.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
1.8.0	GENERAL ENVIRONMENTAL REQUIREMENTS			
1.8.1	The contractor shall be solely responsible and liable for all damage caused by any pollution that may take place during the execution of the works, and he shall make arrangements, as the Engineer may approve, for preventing pollution but, notwithstanding such approval, the entire responsibility for any pollution shall rest with the contractor.			
1.8.2	Measures for sprinkling of water to suppress the fugitive dust emission in the area like construction, haulage roads during transportation, filling areas etc. shall be done by the contractor.			
1.9.0	BORROW PITS/ QUARRY AREA			
1.9.1	For carrying filling work in the abandoned dyke area borrow pits/quarry area shall be identified in consultation with Engineer-in-charge. The Contractor shall formulate a detailed proposal for working in borrow pits identified outside ash lagoon areas as per the requirements. The proposal shall be submitted to the Engineer for his approval. Obtaining Engineer's prior approval is mandatory to start any work in borrow areas/Quarry areas.			
1.9.2	Borrow area/quarry material is to be arranged by the contractor at his cost. The contractor shall conduct test to check the suitability of the fill material. The Contractor shall not incorporate in the works, material which has not been passed as satisfactory by the Engineer in charge.			
1.9.3	Contractor's Borrow areas shall not be within the land boundary of ash dyke area and shall also be outside the NTPC property line. For materials to be borrowed & supplied by the contractor from pits / quarries, it shall be the Contractor's responsibility for identification and arranging of such quarry areas, obtaining approval for their use from concerned authorities, the Contractor shall pay any levies, royalties, etc., that may have to be paid for utilisation of borrow areas as per the provisions of SCC & GCC.			
2.0.0	GENERAL TECHNICAL REQUIREMENT			
	Specification of various works covered in the scope of work has been mentioned in the section. The content mentioned herein shall be read in conjugation with other relevant portions of the technical specification. For details not mentioned in this section relevant clauses in Part A and Part B of Technical specification may be referred.			
2.1.0	AREA FILLING, BACKFILLING, PAVING & HARD CRUSTING			
	Any existing area which falls in the working area shall be made suitable for the purpose of being used as a laydown area by carrying out filling using suitable material. Hard crusting of Laydown area, fabrication, and pre-assembly yard area has to be carried out as per specifications mentioned below. At locations where hard crusting is not present, Soil cover of minimum 500 mm shall be maintained on top of the abandoned dyke. Soil of approved type shall be obtained from identified borrow area.			
	Specification for area filling & compaction shall be in accordance with Stipulations under relevant clause of Site Levelling and Slope Protection Works, Subsection D-01 Part B of Technical specification, Section VI.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2		SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA
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Clause No.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
2.2.0	Specification for backfilling shall be in accordance with Stipulations under relevant clause of Area Paving, Subsection D-01 Part B of Technical specification, Section VI.		
	Hard crusting shall be of minimum 200mm thickness comprising of compacted filling using 63 mm and down aggregate having interstices filled with well graded selected moorum/ non-expansive soil on compacted and dressed sub - grade.		
	ROAD WORKS		
	Construction of flexible pavement (WBM roads with bituminous top) wherever constructed shall be in accordance with the IRC, MORTH and IS specifications. The road shall have 300mm thk subbase course 225mm thk base course, 75 thk bituminous macadam surface and 25 mm thk premix bituminous carpet. The roads shall be double lane.		
	Drains shall be designed as per local conditions. However, drains shall be of minimum 1m width x 1.5m depth.		
2.3.0	TURFING		
2.3.1	Scope		
	This section of the specification covers turfing on selected locations of the laydown area which are not hard crusted.		
2.3.2	General Requirements		
	The Contractor shall furnish all labour, equipment and materials required for the complete performance of the work in accordance with the drawings, Schedule of Quantities and as described here in.		
2.3.3	Material		
	50 mm thick grass turf sods of locally available variety shall be used in this work. Direct planting of grass on the dyke slope shall not be permitted.		
2.3.4	Placing		
	Selected locations of the laydown area, which are not hard crusted, shall be turf sodded. Area to be turf sodded shall be slightly roughened and covered with a layer of turf sod consisting of blocks of dense lining grass growth of locally available species. The sod shall include a mat of roots and earth at least 5 cm. thick. Sod containing an excessive amount of obnoxious weed growth shall be excluded. Sod shall be carefully handled in transportation and placing so that a minimum amount of earth will be lost from the root mass. The blocks of sod shall be laid in close contact and then tamped firmly in place so as to fill and close the joints between blocks. Immediately after placing, the sodded area shall be thoroughly wetted and then kept moist for 3 months or till such time the grass establishes itself uniformly on the surface whichever is later. The watering shall be done so as to avoid erosion and prevent damage to sodded areas by water tanker, etc. The growth of weeds on the turfing shall be prevented by removing them and disposing off.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-4540-001A-2	SUBSECTION D-1-12(I) CIVIL WORKS DEPEVELOPMENT OF LAYDOWN AREA
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CLAUSE NO.	TECHNICAL REQUIREMENT				एनटीपीसी NTPC													
D-1-12(M)	ANNEXURE – M																	
	Specification For High Performance Moisture Compatible Corrosion Resistant Coating System																	
	a) Providing & applying High Performance Moisture Compatible Corrosion Resistant Coating System manufactured as per technical specifications of Central Electrochemical Research Institute, Karaikudi, (C.S.I.R. affiliate Institute), Tamil Nadu, Pin - 630 006.																	
	b) The coating system shall be water compatible, compatible for applying in wet conditions also and shall be tolerant to under-prepared surfaces and existing residual tar / paint. The system shall also be quick curing so as to be suitable for application during shut downs. The coating material shall be stored in the manner as per recommendations of the manufacturer until ready for use. The coating material shall be used within the manufacturer's written recommended shelf life.																	
	c) The coating system shall conform to the following : PROPERTIES OF PAINT <table><tr><td>Base</td><td>High Performance Moisture Compatible Corrosion Resistant Coating System CECRI know-how system</td></tr><tr><td>Volume Solids</td><td>70%</td></tr><tr><td>Specific Gravity (ASTM-D-1475)</td><td>1.25 ± 0.1</td></tr><tr><td>Dry Film Thickness (ASTM-D-1186)</td><td>160 ± 10 µm per coat</td></tr><tr><td>Coverage</td><td>4 - 4.5 sq.m/ ltr</td></tr><tr><td>Touch Dry</td><td>2 Hours</td></tr><tr><td>Recoating</td><td>24 Hours</td></tr></table>					Base	High Performance Moisture Compatible Corrosion Resistant Coating System CECRI know-how system	Volume Solids	70%	Specific Gravity (ASTM-D-1475)	1.25 ± 0.1	Dry Film Thickness (ASTM-D-1186)	160 ± 10 µm per coat	Coverage	4 - 4.5 sq.m/ ltr	Touch Dry	2 Hours	Recoating
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		BID DOC. NO.: CS-4540-001-2	TECHNICAL SPECIFICATIONS SECTION-VI, PART B	SUB SECTION D-1-12(M) High Performance Moisture Compatible Corrosion Resistant Coating System	Page 1 of 2													

CLAUSE NO.	TECHNICAL REQUIREMENT				एनटीपीसी NTPC
	PROPERTIES OF COATING				
	Salt Spray (ASTM-B 117)	2000 Hours			
	Resistance to sea water (Carried out upto 6 months)	Passes			
	Coating Resistance (Carried out upto 6 months)	10 ⁹ Ω. cm ²			
	Adhesion (ASTM-D 4541)	4.5 N/mm Sq			
	Flexibility (ASTM-D-522)	1/8" passes			
	Elongation	33%			
	Impact (ASTM G 14–04)	45 cm passes			
	d)	Paint material & its application method shall be obtained from any manufacturer who has been granted License by CECRI, Karaikudi for technical know how for High Performance Moisture Compatible Corrosion Resistant Coating System . The application method of coating shall be got duly approved from CECRI, Karaikudi.			
	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		BID DOC. NO.: CS-4540-001-2	TECHNICAL SPECIFICATIONS SECTION-VI, PART B	SUB SECTION D-1-12(M) High Performance Moisture Compatible Corrosion Resistant Coating System

Details of facilities to be dismantled

Sl. No.	Name of facility	Total No. of Units	Plinth Area per Unit {Sq.m.}	Total Plinth Area {Sq.m.}	Type of Super-structure	Type of Sub-structure	Storey Configuration	Scope of Dismantling	Facilities envisaged under TTPS Stage-III	Type & Present Location of facility
1	E-type & F-type Qrts in BHEL sector	39	150	5850	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	PT Plant	Residential facilities in Township area
2	4R3/4 - Temp Sector	1	620	620	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
3	3R21/22 - Sector 2	1	350	350	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
4	2R 121 -136 - Sector 2	4	150	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard CR & Canteen	
5	2R 49-68 - Sector 2	5	190	950	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Bay	
6	2R 69-108 - Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - transformer Yard & FO Handling area	
7	2RA 109-139- Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
8	F type - Sector 1	7	170	1190	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
9	1R type - Sector 2	16	220	3520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	FO handling area, Aux. Boiler, CT & Switchyard	
10	2RB type - Setor 3	4	140	560	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Admin Building area	
11	C 3/4 - Sector 1	1	220	220	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
12	C9-12 - Sector 3	2	220	440	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Admin Building area	
13	D type 9-13/21-32 - Sector 3	5	300	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Switchyard	
14	2R 7 2RA - Sector 4	15	200	3000	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Construction Office & Workshop	
15	3R 1-16 Sector 2	8	350	2800	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Hall & FO handling area	
16	3R 17-21/ 62-65	4	350	1400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
17	NC 1-4 Temp sector	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
18	ND 1-8 Temp sector	8	200	1600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
19	E 139-186 Temp sector	8	150	1200	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Track Hopper + Ash Silo	
20	F 1-56 Sector 4	7	300	2100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	BOP Batching Plant area	
21	Club Auditorium	1	698	698	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	Non-residential facilities in Township area
22	Club dining hall	1	556	556	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - ESP	
23	Stadium gallery	1	1170	1170	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Main Plant area - Boiler	
24	POLICE OUTPOST	1	128	128	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
25	Outpost front shop	1	49	49	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
26	Medicine store	1	32	32	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
27	ATM (SBI)	1	15	15	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
28	Cable tv room	1	46	46	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
29	Mangla mandir	1	75	75	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
30	Kalayani Mandap	1	82	82	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
31	shopping centre	1	600	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
32	Sai mandir	1	90	90	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Ash Silo	
33	Durga Mandap	1	575	575	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
34	CISF Barrack - quarter guard	1	520	520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
35	CISF Barrack Morcha	1	16	16	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
36	Primery school	1	2348	2348	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	FGD area	
37	DAV TT HIGH SCHOOL	1	1410	1410	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
38	BHEL Market	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	PT Plant	
39	LITTLE ANGEL SCHOOL	1	250	250	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
40	DAV TT HIGH SCHOOL	1	1053	1053	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
41	BANK BUILDING	1	742	742	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	AWRS & Ash classification	
42	T/S Civil Office	1	100	100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	CWPH	
43	T/S Civil Office Store	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	CWPH	
44	BADMINTON HALL	1	406	406	Structurel Steel with sheet cladding	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - Boiler	
45	OAT Stage	1	298	298	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
46	OLD EWA Building	1	221	221	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
47	OLD UPL Building	1	106	106	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Chmney	
48	WATER TANK & PUMP HOUSE	1	200	200	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Triple storey	Sub-structure	Chimney	
49	T/S ELECTRICAL OFFICE	1	664	664	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
50	CISF BARRACK	1	3328	3328	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
51	GAS GOWDOWN	1	122	122	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
52	SAI MANDIR SHED	1	133	133	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Ash Silo	
53	RC	1	2880	2880	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
54	Security barrack	1	1084	1084	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
55	DAV TT H.SCHOOL C.STAND	1	365	365	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area -ID Fan	
56	GRIDCO OFFICE	1	347	347	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
57	Ash Brick manufacturing Plant	2	750	1500	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
58	Vehicle Parking Sheds	1	400	400	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area	
59	Store Sheds	28	640	17920	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Ash handling, TAC,CAC & ESP	
60	Under ground Diesel tank	1	100	100		Under ground RCC sump		Sub-structure	Main Plant - ID fan area	
61	Watch Towers	7	20	140	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Main Plant & CHP area	
62	Admin Building	1	2998	2998	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -CPU area	
63	C&M office Building	1	378	378	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -TAC	
64	Old Admin BUILDING	1	1622	1622	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
65	Safety building	1	103	103	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
66	Weigh Bridge Room	1	40	40	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -TAC	
67	DG room	1	53	53	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
68	plant tea stall	1	86	86	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - Boiler	
69	Stage-I Raw water reservoir	1	21000	21000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - CH, coal stock pile & Gypsum area	
70	Heavy Machinery shed	1	320	320	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area - CH	
71	Waste water sump & Pumphouse	1	100	100	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	TP-1 & Inplant Railway siding	

72	Waste storage shed	1	180	180	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area	Facilities in Plant area
73	Stage-II Raw water reservoir	1	20000	20000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - coal stock pile, truck tippler, TP-9 & Dozer shed	
74	Stage-II Raw Water Pumphouse	1	200	200	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	TP-8	
75	Stage-II PT Plant clarifiers	2	1100	2200	RCC Over-ground 30m dia	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
76	Stage-II PT Sludge sump & Pumphouse	1	80	80	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
77	Stage-II PT Plant Building including clarified/Filtered water Pumphouse, sump, Chemical House etc..	1	700	700	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	Pipe conveyor	
78	AAQMS Room	1	20	20	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Super-structure & Sub-structure	CSSP	
79	Cylinder Shed	1	70	70	Structurel Steel	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CSSP	
80	Coal Slurry Settling pit	1	1200	1200		brick masonry under-ground pit		Super-structure & Sub-structure	Coal stock Pile	
81	Dozer shed	1	500	500	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	
82	Coal yard shed	1	1000	1000	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	BOP Laydown area	
83	TP-14	1	180	180	Structurel Steel shed with side cladding	RCC foundation with PCC mudmat	Triple storey	Super-structure & Sub-structure	Coal stock Pile	
84	Ground Conveyor 16A/B - 2m wide 600m long	1	1200	1200	Ground conveyor along with stacker-Reclaimer support rails			Super-structure & Sub-structure	Coal stock Pile	
85	Conveyor 17 - overground - 5m wide 275m long	1	1375	1375	Overhead structural steel conveyor gallery	RCC foundation with PCC mudmat		Super-structure & Sub-structure	BOP Laydown area	
86	Conveyor 17 - underground - 5m wide 80m long	1	400	400		Under-ground RCC tunnel		Super-structure & Sub-structure	BOP Laydown area	
87	Site Store sheds	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
A-MH-1	Section-VI, Part E		47 & 48 of 73		4540-001-POM-A-039 (option-01), Rev-A 4540-001-POM-A-040 (option-01), Rev-A 4540-001-POM-A-040 (option-02), Rev-A 4540-001-POM-A-041	4540-001-POM-A-039 (option-01), Rev-B 4540-001-POM-A-040 (option-01), Rev-B 4540-001-POM-A-040 (option-02), Rev-B Withdrawn drw. 4540-001-POM-A-041
A-MH-2	Section-VI, Part-A	SUB-SECTION-IIA-15	1 of 7	1.00.01 (iii)	Conveyor 1A/1B shall feed coal to Crusher House via Pent house (PH-1). Suspended magnets (SM-1 and SM-2) shall be provided on Conveyor 1A/1B at pent house for removal of tramp Iron pieces. Metal detectors MD-1 and MD-2 shall be provided on Conveyors 1A/1B to detect non-magnetic metallic materials present in the “as received” coal. Further Conveyor 1A/1B shall have facility for manual stone picking, at a suitable location. Two (2) numbers Belt Scale (BS-1 & BS-2) shall also be provided, one each on Conveyor 1A and 1B for measurement of coal flow rate. Two (2) nos. In line magnetic separators (ILMS-1 & ILMS-2) shall be provided at discharge end of Conveyor 1A/1B for removal of metallic ferrous tramp from “as received” coal.	Conveyor 1A/1B shall feed coal to Conveyor 2A/2B via Pent house (PH-1). Suspended magnets (SM-1 and SM-2) shall be provided on Conveyor 1A/1B at pent house for removal of tramp Iron pieces. Metal detectors MD-1 and MD-2 shall be provided on Conveyors 2A/2B to detect non-magnetic metallic materials present in the “as received” coal. Further Conveyor 1A/1B & 2A/2B shall have facility for manual stone picking, at a suitable location. Two (2) numbers Belt Scale (BS-1 & BS-2) shall also be provided, one each on Conveyor 1A and 1B for measurement of coal flow rate. Two (2) nos. In line magnetic separators (ILMS-1 & ILMS-2) shall be provided at discharge end of Conveyor 2A/2B for removal of metallic ferrous tramp from “as received” coal. Conveyor 2A/2B shall feed Coal to Crusher House.

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A-MH-3	Section-VI, Part-A	SUB-SECTION-IIA-15	1 of 7	1.00.01 (iv)	Conveyor 1A/1B evacuating coal from Track Hopper shall feed coal to crusher house. Coal sampling unit (CSU-1) shall be provided to sample the coal of (-) 250 mm size. Further, a passenger cum goods elevator (EL-1) as specified elsewhere shall also be provided in Crusher House (CH). In Crusher house (CH), coal from incoming Conveyor 1A will pass through two (2) numbers (dedicated) Vibrating Feeder (VF-1 & VF-2) and two (2) number (dedicated) Crushers (CR-1 & CR-2) respectively. Similarly, coal from incoming Conveyor-1B will pass through two (2) numbers (dedicated) Vibrating Feeders (VF-3 & VF-4) and two (2) numbers (dedicated) Crushers (CR-3 & CR-4) respectively. Each dedicated stream shall have a set of Rod gate and Rack & Pinion Gate before VF. The dedicated coal flow stream shall permit maintenance of equipment, hoppers and chutes in one stream without affecting the operation of other stream.	Conveyor 1A/1B evacuating coal from Track Hopper shall feed coal to crusher house via Conveyor 2A/2B . Coal sampling unit (CSU-1) shall be provided to sample the coal of (-) 250 mm size. Further, a passenger cum goods elevator (EL-1) as specified elsewhere shall also be provided in Crusher House (CH). In Crusher house (CH), coal from incoming Conveyor- 2A will pass through two (2) numbers (dedicated) Vibrating Feeder (VF-1 & VF-2) and two (2) number (dedicated) Crushers (CR-1 & CR-2) respectively. Similarly, coal from incoming Conveyor- 2B will pass through two (2) numbers (dedicated) Vibrating Feeders (VF-3 & VF-4) and two (2) numbers (dedicated) Crushers (CR-3 & CR-4) respectively. Each dedicated stream shall have a set of Rod gate and Rack & Pinion Gate before VF. The dedicated coal flow stream shall permit maintenance of equipment, hoppers and chutes in one stream without affecting the operation of other stream.
A-MH-04	Section-VI, Part-A	SUB-SECTION-IIA-15	7 of 7	Addional clause 1.46.00		Compressed air system (pipes, valves, fitting etc) with suitable flow & pressure for opening doors of eight numbers of BOBR Wagon Doors at one time, with tapping along the length of Track Hopper at three locations, shall be provided.

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A-MH-5	Section-VI, Part-A	SUB-SECTION-IIA-15	2 of 7	1.00.01 (viii)	At Transfer Point TP-3, Conveyor 4A/4B shall drop coal on to either Conveyor 5A or 5B. Inline magnetic separators (ILMS-3 & ILMS-4) shall be mounted at the discharge end of Conveyor 4A/4B to remove tramp iron pieces. Coal TP-3.	At Transfer Point TP-3, Conveyor 4A/4B shall drop coal on to either Conveyor 5A or 5B. Provisions shall be kept for future conveyors from discharge of Conveyor 4A/B. Inline magnetic separators (ILMS-3 & ILMS-4) shall be mounted at the discharge end of Conveyor 4A/4B to remove tramp iron pieces. Coal TP-3.
A-MH-6	SECTION-VI, PART-B	SUB SECTION-A-20	8 of 101	4.4.1	The Contractor shall supply..... under extreme moisture. Coal Chutes shall be fabricated from wear resistant steel plates, Hardox 400, 400 HBN or higher quality. However, Limestone/Gypsum chute may be fabricated from Tiscral or equivalent. The material selection shall assist the free flow of coal. The thickness of the chutes shall be 20 mm for the three sides where material slides/impacts the chute and 10 mm for the chute wall that is not subject to abrasion. The chutes shall include..... shall be provided for all chutes. Chutes shall be provided with 12 mm thick abrasion resistant wear plates at impact points and bolted with countersunk screws. Chutes, which feed..... to include a blocked chute.	The Contractor shall supply..... under extreme moisture. Coal Chutes shall be fabricated from Tiscral or equivalent. The material selection shall assist the free flow of coal. The thickness of the chutes shall be 20 mm for the three sides where material slides/impacts the chute and 10 mm for the chute wall that is not subject to abrasion. The chutes shall include..... shall be provided for all chutes. Chutes, which feed..... to include a blocked chute.
A-MH-7	SECTION-VI, PART-B	SUB SECTION-A-20	49 of 101	2.1.2	(b) Sliding zones & adjacent sides: 20 mm thk. Hardox 400, 400 HBN or higher quality for Coal 20 mm thk. Tiscral or equivalent for Limestone/Gypsum	(b) Sliding/impact zones & adjacent sides: 20 mm Tiscral or equivalent.

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A-MH-8	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	9 of 101	4.4.3	Skirt board belt Conveyor. ‘Skirt Material’ shall be of low friction, high tear resistance & abrasion resistant polyester-based polyurethane/Rubber with Durometer Shore A Hardness of ‘65 (+/-) 5 and min thickness should be 15 mm. Chamfering to be done at one edge of the skirt. Skirt Plate of each side shall be in single piece.	Skirt board belt Conveyor. Skirt sealing Material shall be of low friction, high tear resistance & abrasion resistant polyester-based polyurethane /Rubber with Durometer Shore A Hardness of ‘65 (+/-) 5 and min thickness should be 15 mm. Chamfering to be done at one edge of the skirt. Skirt sealing material of each side shall be in single piece.
A-MH-9	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	20 of 101	4.11.7	 Coal Stockyard Dust Suppression System Spray heads shall comprise of swiveling type spray units spaced at an interval of approximately 40 meters around each coal pile as shown in tender drawings . Solenoid	 Coal Stockyard Dust Suppression System Spray heads shall comprise of swiveling type spray units spaced at an interval of approximately 40 meters around each coal pile. Solenoid
A-MH-10	SECTI ON-VI, PART- B	SUB SECTI ON-A- 01	97 of 101	4.02.19	Minimum clear cross section of chute: 1800 mm X 1200 mm (inside both ways) for Coal Handling plant	Minimum clear cross section of chute: 1400 mm X 1000 mm (inside both ways) for Coal Handling plant
A-MH-11	SECTI ON-VI, PART- B	SUB SECTI ON-A- 01	94 of 101	4.02.08 (b)	Minimum 2 no. sprinkler nozzles shall be considered per each stacker reclaimers for sizing of the pumps. For this purpose both stacker cum reclaimers shall be considered as working.	Minimum 2 no. sprinkler nozzles shall be considered for sizing of the pumps.
A-MH-12	SECTI ON-VI, PART- B	SUB SECTI ON-A- 01	95 of 101	4.02.12	No. of days of crushed coal storage based on BMCR Design coal consumption at 100% PL: Bidder to maximize the coal stockyard storage capacity by utilizing the available space. However, stockyard capacity in any case shall not be less than 8 days	Bidder to maximize the coal stockyard storage capacity by utilizing the available space. However, stockyard capacity in any case shall not be less than 1,50,000 million tonne in the stockpile considering 800 T/cum bulk density for coal.

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A-MH-13	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	21 of 101	4.11.19	The dust suppression system for the track hopper shall consist of fifteen (15) zone headers, each of 15 meters length , routed along the entire length of track hopper on each side. Each nozzle header shall be provided with adequate number of spray nozzles spaced at 500 mm interval. Further, at the track hopper the water spray shall be of fogging type with a minimum pressure of 2.5 kg/sq.cm(g) at spray nozzle inlet. It should be possible to operate maximum four (4) number of zones simultaneously on both sides of track hopper.	The dust suppression system for the track hopper shall consist of maximum fifteen (15) zone headers, each of 20 meters length , routed along the entire length of track hopper on each side. Each nozzle header shall be provided with adequate number of spray nozzles of suitable range spaced at max. 500 mm interval. Further, at the track hopper the water spray shall be of fogging type with a minimum pressure of 4.5 kg/sq.cm(g) at spray nozzle inlet. It should be possible to operate minimum four (4) number of zones simultaneously on both sides of track hopper.
A-MH-14	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	2 Of 101	3.01.0. (b)	 “As received” limestone shall be fed on the double stream conveyors from where the same shall be conveyed upto the crushers. The crushed limestone shall be conveyed by double stream conveyors/ Bucket elevators up to the limestone storage shed/Silo. From the limestone storage shed/Silo paddle feeders will extract/ reclaim crushed limestone and feed the same onto double stream conveying system up to the limestone day silos.	 “As received” limestone shall be fed on the double stream conveyors from where the same shall be conveyed upto the crushers. The crushed limestone shall be conveyed by conveyors/ Bucket elevators up to the limestone storage shed/Silo. From the limestone storage shed/Silo paddle feeders/ vibro-feeders will extract/ reclaim crushed limestone and feed the same onto conveying system up to the limestone day silos.

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A-MH-15	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	79-80 of 101	2.01.02 (d)	(1) Capacity of each nozzle: 2.0 lpm at 4.5 kg/cm ² (2) Nozzle spacing.: 500 mm (3) No. of dust suppression nozzles that can be operated simultaneously on both side of Hopper: min. one zone or four (4) such zones (one zone means 20 mtr. Length of header on both sides)	(1) Capacity of each nozzle: Min. 2.0 lpm at 4.5 kg/cm ² (2) Nozzle spacing.: Max. 500 mm (3) No. of dust suppression nozzles that can be operated simultaneously on both side of Hopper: Min. four (4) such zones (one zone means min. 20 mtr. Length of header on both sides)
A-MH-16	SECTI ON-VI, PART- B	SUB SECTI ON-A- 20	79 of 101	2.01.02 (b)(1)	Maximum number of nozzles operating simultaneously for each stacker cum reclaimer:- Two numbers	Maximum number of nozzles operating simultaneously: - Two numbers
A-MH-17	SECTI ON-VI, PART- A	SUB- SECTI ON-VI	1 to 23	Chapter- 04	COAL HANDLING PLANT	COAL, LIMESTONE & GYPSUM HANDLING PLANT
A-MH-18	SECTI ON-VI, PART- A	SUB- SECTI ON-VI Chapter -03, AHP	12 of 13	10.03.00	ASH POND FUGITIVE DUST SUPPRESSION SYSTEM	Deleted
A-MH-19	SECTI ON-VI, PART- A	SUB- SECTI ON-VI Chapter -04, CHP	2 of 23 9 of 23 12 of 23 13 of 23 15 of 23	8. Q) (ix) U) 1 to 9 W) 1 – 27 X) 1 - 16	Cable reel drive Festoon Roller assembly for flexible cable SIDE ARM CHARGER Wagon Tippler and Accessories APRON FEEDERS	Deleted

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A-MH-20	SECTION-VI, PART-A	SUB-SECTION-VI Chapter -03, AHP	5 of 13 7 of 13 12 of 13	4.04.00 4.04.01 - 4.04. 11 4.06.00 4.06.01 to 4.06.06 11.02.03 11.02.04	Instrument Air Compressor Air Drying Plant for IA System Motor/IAC Compressor Air Blower for drying plant	Deleted.
A-MH-21	SECTION-VI, PART-A	SUB-SECTION-VI Chapter -03, AHP	9 of 13	6.00.00	FLY ASH STORAGE SILO (Quantities as specified shall be applicable for fly ash Storage silo and HCSD silo separately)	FLY ASH STORAGE SILO
A-MH-22	SECTION-VI, PART-A	Sub Section -IIA-16	4 of 18	1.01.05, (C), iii)	Two (2) numbers (1 working + 1 standby) economizer ash water pumps along with valves, pipes & fittings for both the units. These pumps shall be located in the ash water pump house.	Three (3) numbers (2 working + 1 standby) economizer ash water pumps along with valves, pipes & fittings for both the units. These pumps shall be located in the ash water pump house.
A-MH-23	SECTION-VI, PART-A	Sub Section -IIA-16	13 of 18	1.02.01. 02 (e)	The water requirement for disposal of fly ash in slurry form shall be met by one (1) number working and one (1) number standby fly ash water pumps.	The water requirement for disposal of fly ash in slurry form shall be met by two (2) number working and one (1) number standby fly ash water pumps.
A-MH-24	SECTION-VI, PART-A	Sub Section -IIA-16	6 of 18	1.01.06 (A) (a) (iv)	Six (6) nos. fly ash surge-cum-collection buffer hoppers (3 working + 3 Standby) complete with structural steel structures, platforms, stairs, aeration system, primary collector and secondary collector (if applicable) along with bag filter, target box etc for each unit	Twelve (12) nos. fly ash surge-cum-collection buffer hoppers (6 working + 6 Standby) complete with structural steel structures, platforms, stairs, aeration system, primary collector and secondary collector (if applicable) along with bag filter, target box etc for each unit.

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A-MH-25	SECTI ON-VI, PART- A	Sub Section -IIA-16	11 of 18	1.02.00 c)	Seal water pumps (one working + one standby) for meeting the seal water requirement of Combined slurry disposal pumps and drain water pump of Combined slurry pump house, etc. These pumps shall be located in the Combined ash slurry disposal pump house.	HP & LP , Seal water pumps (one working + one standby, each) for meeting the seal water requirement of Combined slurry disposal pumps and drain water pump of Combined slurry pump house, etc. These pumps shall be located in the Combined ash slurry disposal pump house.
A-MH-26	SECTI ON-VI, PART- A	Sub Section -IIA-16	15 of 18	1.04.06	Eight (8) nos. Pump tanks/Air lock tank for each coarse ash sil o and four (4) nos. of pump tanks/air locks tank for fine ash hopper for transportation of coarse fly ash and fine fly ash respectively, to silos provided for dry fly ash storage silos meant for Road and Rail loading.	Eight (8) nos. Pump tanks/Air lock tank for each coarse ash hopper and four (4) nos. of pump tanks/air locks tank for fine ash hopper for transportation of coarse fly ash and fine fly ash respectively, to silos provided for dry fly ash storage silos meant for Road and Rail loading.
A-MH-27	SECTI ON-VI, PART- B	SUB SECTI ON-A- 21	3 of 40	1.03.00, b)	Jet Pumps: Rated Capacity (M3/hr): Three (3) nos. pumps shall evacuate 4 hr. collection of bottom ash in 65 minutes . incl. 5 minutes time for start/stop/changeover /flushing etc.	Jet Pumps: Rated Capacity (M3/hr): Three (3) nos. pumps shall evacuate 4 hr. collection of bottom ash in 75 minutes . incl. 5 minutes time for start/stop/changeover /flushing etc.

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A-MH-28	SECTION-VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	34 of 73	1.03.09 (A) (i)	 Total time for evacuating four (4) hours of ash collection from all the hoppers of (APH +SCR +Duct Hoppers) of a unit corresponding to collection rates specified shall not exceed 45 mins (including change over time. The total time for evacuating four (4) hour collection of bottom ash from a unit corresponding to collection rates specified shall not exceed 75 minutes including five (5) minutes time required for starting, stopping, sequential change over from one unit to second unit.....	 Total time for evacuating four (4) hours of ash collection from all the hoppers of (APH +SCR +Duct Hoppers) of a unit corresponding to collection rates specified shall not exceed 40 mins (including change over time. The total time for evacuating four (4) hour collection of bottom ash from a unit corresponding to collection rates specified shall not exceed 75 minutes including five (5) minutes time required for starting, stopping, sequential change over from one unit to second unit.....
A-MH-29	Section -VI, Part E		92- 99 of 268		4540-001-POM-A-025, Rev-A 4540-001-POM-A-027, Rev-A 4540-001-POM-A-028, Rev-A 4540-001-POM-A-029, Rev-A	4540-001-POM-A-025, Rev-B 4540-001-POM-A-027, Rev-B 4540-001-POM-A-028, Rev-B 4540-001-POM-A-028A, Rev-A 4540-001-POM-A-029, Rev-B
A-MH-30	SECTION-VI, PART-A	Sub Section -IIA-13	1 of 2	1.04.00	The LDO shall be pumped to two (2) nos. storage tanks each of capacity 1700 cu. meter. One (1) number day oil tank of capacity 100 cu. meter for auxiliary boiler shall be provided. The day oil tank shall be fed from a separate set of transfer pumps and pipe line.	The LDO shall be pumped to two (2) nos. storage tanks each of capacity 1700 cu. Meter.

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A-MH-31	Section-VI, Part-A	SUB-SECTION-IIA-15	7 of 7	Additional clause 1.47.00		One (1) no. pendent controlled electrically operated overhead travelling crane for CHP workshop building of minimum 5 T capacity complete with runway rails, necessary rail clamps, bolts, splice bars and stops for each of the runway.
A-MH-32	SECTION-VI, PART-A	SUB-SECTION-VI Chapter -04, CHP	21 of 23	(O)	PLC (STACKER / RECLAIMER & WAGON TIPPLER)	PLC (STACKER / RECLAIMER)

NTPC Ltd
TALCHER SUPER THERMAL POWER STATION
KANIHA
CHEMISTRY LABORATORY

Name of sample: Quarry-4 of Jagannath mine void area water sample

Sample Date – 01/04/22

Collected by: EMG Dept., TTPS

Sample name:	pH	TSS (ppm)	Turbidity (NTU)
Drinking water stg-1	7.56	11.2	20


ज्योति प्रकाश पंडा
JYOTI PRAKASHA PANDA
उप प्रबंधक (रसायन विज्ञान विभाग)
Dy. Manager (Chemistry Dept.)
एनटीपीसी लिमिटेड / तालचेर कनिहा
NTPC Limited / Talcher Kaniha

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Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A-PU-1	VI/B	A-01	70 of 101	3.12.02, iv)	All the landings of boiler staircases, turbine building, crusher house, transfer points/junction house of internal & external CHP , bunker floors, service building, administrative building, etc. and other multi-storied structures of the entire plant shall be provided with hydrant landing valves.	All the landings of boiler staircases, turbine building, crusher house, transfer points/junction house of CHP , bunker floors, service building, administrative building, etc. and other multi-storied structures of the entire plant shall be provided with hydrant landing valves.
A-PU-2	VI/B	A-01	72 of 101	3.12.05, i.	The PLC based panel at fire water pump house and ce ntral monitoring station and DDCMIS. Control & operation of fire water pumps and borewell pumps of external CHP (at plant end & mine end) shall be possible from OWS at respective DDCMIS of external CHP control system.	The PLC based panel at fire water pump house and cent ral monitoring station and DDCMIS.
A-PU-3	VI/B	A-01	72 of 101	3.12.05, iii.	The panel at with fire alarm panel at CHP control room for alarm purpose. The panel at respective external CHP control room shall exhibit alarms from detection and protection from external CHP and all other auxiliary buildings/areas.	The panel at with fire alarm panel at CHP control room for alarm purpose.
A-PU-4	VI/B	A-01	72 of 101	3.12.05, iv.	The central monitoring station to be located at Central Control Room shall cover the fire detection and protection system of the complete plant including external CHP . This shall give audio-visual annunciations for fire in each of the risk area / equipment / status of the fire protection system as well as system operator open / short circuit status of detector or control cabling, etc. Further, this shall activate a hooter/sounder in each of the area provided with fire/smoke detection system.	The central monitoring station to be located at Central Control Room shall cover the fire detection and protection system of the complete plant. This shall give audio-visual annunciations for fire in each of the risk area / equipment / status of the fire protection system as well as system operator open / short circuit status of detector or control cabling, etc. Further, this shall activate a hooter/sounder in each of the area provided with fire/smoke detection system.

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Specification Reference					Existing	Read As
Sl. No	Sec/Part	Sub Sec	Page No.	Clause No.		
A-PU-5	VI/B	G-04	218 of 224	PG Test Procedure for Compressed Air System	For eventual noise, from the discharge line, accessories and /or ancillary equipment which are not included, a correction factor of Maximum 4 dB (A) shall be allowed for background & ambient noise.	For eventual noise, from the discharge line, accessories and /or ancillary equipment which are not included, a correction factor of Maximum 8 dB (A) shall be allowed for background & ambient noise.
A-PU-6	VI/B	A-17	1 of 30	3.01.00, d)	Administrative Building: i) Screw type water chilling units: 2X50% ii) Primary Chilled water pumps: 2X50% iii) Secondary chilled water pumps (with VVVF): 2X50% iv) Condenser water pumps: 2X50% v) Cooling Towers (with VVVF Fan): 2X50%	Administrative Building: i) Screw type water chilling units: 2X50% ii) Primary Chilled water pumps: 2X50% iii) Secondary chilled water pumps (with VVVF): 2X50% iv) Condenser water pumps: 2X50% v) Cooling Towers (with VVVF Fan): 2X50% vi) AHUs (with VVVF Fan): All working & no standby.
A-PU-7	VI/B	A-17	2 of 30	4.02.00	Type: Water-cooled type. (Chillers for main plant shall be with multiple compressors)	Type: Water-cooled type. (Chillers for main plant shall preferably be with multiple compressors)

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A-SG-01	SECTION-VI, PART-A	SUB-SECTION-VI-Chapter 01	PAGE 23 OF 38	1.24.00	1.24.00 SCR System (Mandatory Spares) 1.24.01 - Soot Blower/ Sonic Horn Assy, ... 1.24.13 - Coating Material (if any)	1.24.00 Not Applicable
A-SG-02	SECTION-VI, PART-A	SUB-SECTION-I-A PROVEN-NESS	PAGE 118&19 OF 36	Notes below 4.23 & 4.24	Notes:- A) to D)	Add E) Notes for 4.23.2, 4.23.3 & Notes-A-4 DJU and Bank guarantee will not be applicable in case of order of SCR ready/Hybrid ready plant system.
A-SG-03	Sec VI/ Part-B	A-06	3 of 4	1.13.00	Aux Boiler Canopy: To offer protection to the Boiler against rainfall, a rain canopy shall be provided.	Aux Boiler area Canopy provisions: To offer protection to the Boiler against rainfall, a rain canopy shall be provided. Bidder to ensure that all equipments & Instrumentations needs to be protected against rain-fall. Suitable local canopy shall be provided where such equipment/instruments (fan, pump, drum floor, burner floor etc.) are placed.
A-SG-04	Sec VI/ Part-B	A-06	3 of 4	1.17.00	Equipment Handling Arrangement Where it is necessary to handle any item in excess of 55 kg. weight on the boiler for pur-pose of erection or maintenance, a suitable lifting beam arrangement is to be provided. For loads one ton and above on lifts exceeding three me-ters electric hoists shall be provided.	Equipment Handling Arrangement Where it is necessary to handle any item in excess of 200 kg. weight on the boiler for purpose of erection or maintenance, a suitable lifting beam arrangement is to be provided. For loads one ton and above on lifts exceeding three meters electric hoists shall be provided.
A-SG-05	Sec VI/ Part-B	A-06	4 of 4	1.21.00	Valves For valves of Fuel Oil system for auxiliary boil-er, the Contractor shall comply with requirements stipulated for Fuel oil system for main boiler in relevant clauses of Sub-Section-A-03, Part-B, Section-VI.	A-06, Part-B, Cl.1.21.00: Valves For valves of Fuel Oil system for auxiliary boiler, the Contractor shall comply with requirements stipulated for Fuel oil system for main boiler in relevant clauses of Sub-Section-A-02, Part-B, Section-VI. Alternatively, gate and globe valves can also be used for isolation and regulating purpose respectively while complying to the leakage & fire prrof requirements as specified at above clause.

A-SG-06	VI/A	IIA-02A, Annexure-SG-04	3 of 3	2, b).	Duct up to SCR Inlet Gate including SCR Inlet Gate	~~Duct up to SCR Inlet Gate including SCR Inlet Gate.~~ (Following para shall be added at the last of cl. 2) Scope shall be as per "Typical SCR Sketch" at Annexure-1. Further, Bidder to ensure that there should be proper arrangement (Flange & Bolt) of connecting ducts for SCR wherever Blanking plate is being provided at Terminal Points. Bidder to also ensure that the future erection of the SCR system and its integration with Terminal Points can be done without any trouble and optimized resources. Related procedure for the erection of the same shall be provided to the employer.
A-SG-07	VI/A	IIA-02A, Annexure-SG-04	3 of 3	2, o).	Structures and foundations in Boiler/APH/ Other areas considering the loading of complete SCR/Hybrid system as per Subsection-IIA-02/IIA-02A. However, structures for SCR reactors above the APH shall not be supplied and constructed.	Structures and foundations in Boiler/APH/Other areas considering the loading of complete SCR/Hybrid system as per Subsection-IIA-02/IIA-02A. However, structures for SCR reactors above the APH shall not be supplied and constructed. Structures and foundations in other areas like Ammonia/Urea unloading, storage, handling & injection area are not included for De-NOX ready system however, only space requirement and location will be identified.
A-SG-08	VI-B	SS-A-01	4 of 101	1.05.01-v	Heat Input per burner(*) - 600×10^5 kCal/Hr (Maximum) (*) Minimum number of coal pulverisers to be provided for each steam generator shall not be less than Seven (7).	Heat Input per burner(*) - 650×10^5 kCal/Hr (Maximum) (*) Minimum number of coal pulverisers to be provided for each steam generator shall not be less than Seven (7).

A-SG-09	VI-B	SS-A-02	17 of 65	9.01.03	S.N.# 1 to 5	<u>Add S.N.-6</u> <u>APH Guarantee Condition</u> 1.Air Leakage (at 100% TMCR i.e. 660 MW unit load for design coal) – 10% (Max.) 2.Design Ambient Temperature & Relative Humidity: 25 deg.C & 60% RH 3.Excess Air – 20% 4.The maximum air-in-leakage to flue gas after 3000 hours continuous operation of the Steam Generator with coal shall be guaranteed. 5.Contractor shall demonstrate that the air-heater air-in-leakage do not exceed the guaranteed or specified value (whichever is lower) as per description at Sub section-A-01 & A-02, Part-B (Mechanical), of Technical specifications.
A-SG-10	SECTION – VI, PART-B	SUB SECTION-A-02 - SG AND AUXILIARIES	19 of 65	10.02.01 b)	Bunker Shut Off Gates shall be motor operated & RC Feeder outlet gates shall be pneumatic operated	Bunker Shut Off Gates shall be motor operated & RC Feeder outlet gates shall be motor / pneumatic operated
A-SG-11	SECTION- VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	28 of 28	7.00.00	1. Boiler enclosure shall be covered with colour coated metal sheeting. The metal sheet shall display a visually appealing painting (which will be informed later) on outside. The height covered for sheeting will be from boiler roof to Penthouse and 15 m below from penthouse. During Overhauling or repair, the covering should not restrict material movement from Top and Sides of the boiler. Accordingly, removable type sheet shall be provided for such location. Necessary approach and lugs shall be provided for this purpose. 2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof with access through staircase / lift.	1. Boiler enclosure shall be covered with colour coated metal sheeting. The metal sheet shall display a visually appealing painting (which will be informed later) on outside. The height covered for sheeting will be from boiler roof to Penthouse and 15 m below from penthouse bottom. During Overhauling or repair, the covering should not restrict material movement from Top and Sides of the boiler. Accordingly, removable type sheet shall be provided for such location. Necessary approach and lugs shall be provided for this purpose. 2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have sloped (Up to 10deg) roof with access through staircase / lift.
A-SG-12	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	39 OF 65	13.01.06	Material of construction : (iii) Pipe struts, trusses, bracing : ASTM A 53 or equivalent seamless steel pipe.	Material of construction : (iii) Pipe struts, trusses, bracing : ASTM A 53 or equivalent seamless steel pipe. Material conforming to equivalent Indian standard shall also be acceptable.
A-SG-13	SECTION – VI, PART-B ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	4 OF 22	4.02.01	The reactor casing shall be fabricated from all welded reinforced, 6 mm minimum thickness, carbon steel plates conforming to ASTM A36. 	The reactor casing shall be fabricated from all welded reinforced, 6 mm minimum thickness, carbon steel plates conforming to ASTM A36. Material conforming to equivalent Indian standard shall also be acceptable.

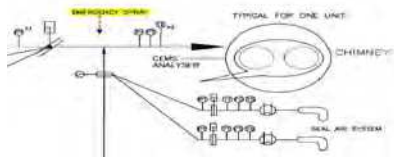
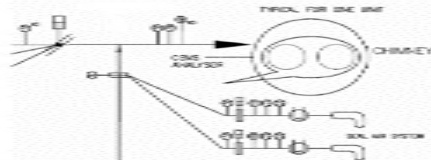
A-SG-14	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	3 of 101	1.04.00 (a)	Step load change: Minimum ± 10% per minute	Step load change : Minimum ± 10% per minute																		
A-SG-15	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	10 of 101	1.05.06.01-2 (iv)	a) Load Range - 60% BMCR with design / best / worst coal and max moisture b) Load Range - 100% BMCR with Design/Best/worst coal and maximum moisture.....	a) Load Range - 60% TMCR with design / best / worst coal and max moisture b) Load Range - 100% TMCR with Design/Best/worst coal and maximum moisture.....																		
			11 of 101	1.05.06.02-2 (iv)	a) Load Range -a) 60% BMCR with worst coal and maximum moisture with one set of RAPH in service b) 100% BMCR with worst coal and maximum moisture with both sets of RAPH in service	a) Load Range -a) 60% TMCR with worst coal and maximum moisture with one set of RAPH in service b) 100% TMCR with worst coal and maximum moisture with both sets of RAPH in service																		
A-SG-16	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	12 of 101	1.05.07.02	Design SCAPH and connected air ducts to handle flows corresponding to 60% BMCR loads with one of the two streams working	Design SCAPH and connected air ducts to handle flows corresponding to 60% TMCR loadswith one of the two streams working																		
A-SG-17	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	18 of 101	1.05.13.03	The fans shall also fulfill following sizing criteria in addition to those mentioned at Clause 1.05.13.02 above Each fan to be sized for 50% TMCR flow calculated taking into following conditions occurring together. <table><tr><td></td><td>FD</td><td>ID</td></tr><tr><td>(i) Margin over 100% BMCR flow:</td><td>20%</td><td>20%</td></tr><tr><td>(ii) Margin over 100% BMCR pressure requirement:</td><td>44%</td><td>44%</td></tr></table>		FD	ID	(i) Margin over 100% BMCR flow:	20%	20%	(ii) Margin over 100% BMCR pressure requirement:	44%	44%	The fans shall also fulfill following sizing criteria in addition to those mentioned at Clause 1.05.13.02 above Each fan to be sized for 50% TMCR flow calculated taking into following conditions occurring together. <table><tr><td></td><td>FD</td><td>ID</td></tr><tr><td>(i) Margin over 100% TMCR flow:</td><td>20%</td><td>20%</td></tr><tr><td>(ii) Margin over 100% TMCR pressure requirement:</td><td>44%</td><td>44%</td></tr></table>		FD	ID	(i) Margin over 100% TMCR flow:	20%	20%	(ii) Margin over 100% TMCR pressure requirement:	44%	44%
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(i) Margin over 100% TMCR flow:	20%	20%																						
(ii) Margin over 100% TMCR pressure requirement:	44%	44%																						
A-SG-18	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	25 of 101	1.05.19.03	Height of catalyst module (maximum)(mm): 1300	Height of catalyst module (maximum)(mm): 1400																		
A-SG-19	SECTION – VI, PART-A	SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	4 of 7	5.03.00	This system shall be comprising of 2x100% gypsum dewatering system with each stream sized to dewater 110% of the maximum gypsum produced by all the two units operating simultaneously at 100% BMCR , with any coal from the specified range of coals (whichever gives the maximum gypsum flow)...	This system shall be comprising of 2x100% gypsum dewatering system with each stream sized to dewater 110% of the maximum gypsum produced by all the two units operating simultaneously at FGD DESIGN POINT , with any coal from the specified range of coals (whichever gives the maximum gypsum flow)....																		

A-SG-20	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	15 of 28	6.07.03	The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the limestone at part load operation. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 10mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends.	The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the limestone at part load operation. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends.
A-SG-21	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	17 of 28	7.04.09	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor. The elevation of discharge point of vacuum belt filter shall be atleast 10.0 m above GL .	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor. ~~The elevation of discharge point of vacuum belt filter shall be atleast 10.0 m above GL.~~ The elevation of vacuum belt filter shall be suitable to discharge the gypsum cake effectively.
A-SG-22	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	4 of 28	3.01.00	6. Recirculation Slurry pH: Not less than 5.5 under all operating conditions	6. Recirculation Slurry pH: Not less than 5.5 under all operating conditions For JBR (Jet Bubbling Reactor) technology, pH range - between 4 and 6 (Justification of the selected pH shall be provided with proven references).
A-SG-23	VI/B	A-05	5 of 28	3.03.04	The blade and other components in the gas path, of the bypass damper and gate in the bypass duct and gate at Absorber outlet shall be made of Carbon steel with C276 cladding of sheet of minimum thickness 1.6 mm or better material.	~~The blade and other components in the gas path, of the bypass damper and gate in the bypass duct and gate at Absorber outlet shall be made of Carbon steel with C276 cladding of sheet of minimum thickness 1.6 mm or better material.~~
A-SG-24	VI/B	A 13	1 of 8	1.00.0 (b) (i)	(a) Shot content: 5% by weight (maxm.), size of any shot not to exceed 5 mm in diameter.	(a) Shot content: 5% by weight (maxm.), size of any shot not to exceed 5 mm in diameter (size details, as applicable, shall be as per above referred standard).
A-SG-25	VI/B	A-05	10 of 28	5.06.11	The complete absorber vessel (absorber oxidation tank, absorber tower & absorber outlet duct) shall be made of clad sheet of C276 / Alloy 59 (minimum 2 mm thick-ness) having minimum 7 mm thick carbon steel as base material..	The complete absorber vessel (absorber oxidation tank, absorber tower & absorber outlet duct) shall be made of clad sheet of Titanium/ C276 / Alloy 59 (minimum 2 mm thick-ness) having minimum 7 mm thick carbon steel as base material..
A-SG-26	VI/B	A-05	5 of 28	3.02.04	The duct from Absorber outlet to bypass duct & duct after by pass damper/gate to chimney inlet shall be made of clad sheet of minimum 2 mm thickness of either Titanium (Grade 2 as per ASME SB265) or C-276 over 8 mm thick (minimum) mild steel base metal....	The duct from Absorber outlet to bypass duct & duct after by pass damper/gate to chimney inlet shall be made of clad sheet of minimum 2 mm thickness of either Titanium (Grade 2 as per ASME SB265) or C-276 over & 7 mm thick (minimum) mild steel base metal....
A-SG-27	VI/B	A-05	11 of 28	5.06.17	The spray headers (if provided) and air supply headers shall be made of FRP or Carbon Steel with Chlorobutyl / Bromobutyl rubber lining (minimum 10 mm natural rubber lining), corrosions and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry).	The spray headers (if provided) and air supply headers (exposed to slurry in any form) shall be made of FRP or Carbon Steel with Chlorobutyl / Bromobutyl rubber lining (minimum 10 mm natural rubber lining), corrosions and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry).
A-SG-28	VI/B	A-01	23 of 101	1.05.19.01, 2	Each Reactor shall be sized - ii) 25% excess air	Each Reactor shall be sized - ii) ~~25%~~ 20 % excess air

A-SG-29	VI/B	G-06	5 of 14	3.02.05	SCR SYSTEM Complete pre-commissioning work including tests of facilities such as pressure drop test of SCR system and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.	SCR SYSTEM The bidder shall only provide the procedure (as per De-NOx system ready scope) for the complete pre-commissioning work including tests of facilities such as pressure drop test of SCR system and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.
A-SG-30	VI/A	II A-01	13 of 28	2.15.05	Seal Air Fans ...electrically operated Inlet Guide Vanes,...	Seal Air Fans ...electrically operated Inlet Guide Vanes (Alternatively Electrically operated 'Inlet dampers' shall also be acceptable based on bidder's proven practice),...
	VI/B	A-02	22 of 65	10.05.01, D)	Seal Air System (a)2x100% centrifugal seal air fans with electrically operated Inlet Guide Vanes common for all the pulverizers of one Steam Generator unit shall be provided....	Seal Air System (a)2x100% centrifugal seal air fans with electrically operated Inlet Guide Vanes (Alternatively Electrically operated 'Inlet dampers' shall also be acceptable based on bidder's proven practice) common for all the pulverizers of one Steam Generator unit shall be provided....
A-SG-31	VI/A	II A-01	27 of 28		Architectural Features for Steam Generator Enclosure ...2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof with access through staircase / lift.	Architectural Features for Steam Generator Enclosure ...2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof (alternatively pitched roof can also be provided with min. 10 deg. slope with basis during detail engineering stage) with access through staircase / lift.
A-SG-32	VI/B	A-02	12 of 65	7.01.01, (3)	Construction of Superheaters & Reheaters Maximum depth of tube banks/ sections in the direction of gas flow: 2 metres or maximum soot blowing radius, whichever is lower	Construction of Superheaters & Reheaters Maximum depth of tube banks/ sections in the direction of gas flow: 2 metres or maximum soot blowing radius, whichever is lower. Bidder can also provide the higher depth limited to 2.5 m also, only if it's a bidder's proven practice. References shall be provided in support of the same. However it will be limited to maximum soot blower radius.
A-SG-33	SECTION-VI, PART-B	SUB SECTION-A-02	24 of 65	10.05.22	(a) Mill reject system shall automatically discharge the tramp iron and other non grindable material through an outlet connection at a suitable height (to be approved by Employer) to a dense phase pneumatic conveying system.	(a) Mill reject system shall automatically discharge the tramp iron and other non grindable material through an outlet connection at a suitable height (to be approved by Employer). ~~to a dense phase pneumatic conveying system.~~ The conveying system shall be as defined elsewhere in the specifications.
A-SG-34	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	24 of 101	1.05.19.02	Max flue gas pressure drop across SCR system (mmwc): 150	Max flue gas pressure drop across SCR system (mmwc): 100 or as per bidder's adopted SCR system design or actual, whichever is higher
A-SG-35	NOT USED					

A-SG-36	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-4540-001A-2	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	1 OF 28	1.03.03	Supply of all consumables (except coal oil and limestone) like chemicals for chemical cleaning, passivation, inhibition etc., Catalysts, fuel oil & coal for firing beyond declared quantity (during bid stage as per SS-I, part-A), oil for line flushing, nitrogen for blanketing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities. And the total required limestone shall be issued free of charge by the employer for such purposes.	Supply of all consumables (except coal oil and limestone) like chemicals for chemical cleaning, passivation, inhibition etc., Catalysts, fuel oil & coal for firing beyond declared quantity (during bid stage as per SS-I, part-A), oil for line flushing, nitrogen for blanketing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities. And the total required limestone shall be issued free of charge by the employer for such purposes. Further, the 'Supply of Anhydrous Ammonia' and 'Catalyst' as envisaged for the operation of SCR system & Ammonia Storage & Handling System will be excluded from bidder's scope.
A-SG-37	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B, SUB-SECTION-A-05 (FGD)	SUB-SECTION-A-05 (FGD)	3.01.00	4 of 28	The entire flue gas system, flue gas ducts inlet to absorber and bypass duct etc. shall be designed to meet the following conditions: 2. Design Inlet Gas Temperature (deg.C) 150 or as per Design Point conditions, whichever is higher	The entire flue gas system, flue gas ducts inlet to absorber and bypass duct etc. shall be designed to meet the following conditions: 2. Design Inlet Gas Temperature (deg.C) ~~150~~ 145 or as per Design Point conditions, whichever is higher
A-SG-38	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	10 of 28	5.06.06	The ME system shall be equipped with washing and drain provisions, where drains are directed into the absorber. Washing provisions shall include external and internal piping systems with replaceable nozzles, water pressure booster pumps complete with all piping, valves, instrumentation and controls. The mist eliminator wash piping shall be constructed of Chlorobutyl/Bromobutyl rubber lined carbon steel or glass fiber reinforced plastics. The mist eliminator spray headers shall be made of FRP or rubber lined Carbon Steel, corrosions and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry).	"The ME system shall be equipped with washing and drain provisions, where drains are directed into the absorber. Washing provisions shall include external and internal piping systems with replaceable nozzles, water pressure booster pumps (if required) complete with all piping, valves, instrumentation and controls. The mist eliminator wash piping/header shall be constructed of Chlorobutyl / Bromobutyl rubber lined carbon steel or glass fiber reinforced plastics. Polypropylene or PVC is also acceptable for mist eliminator wash headers provided Contractor or its Collaborator has proven experience for the same. " Carbon steel pipe can be selected outside pipe up to the nozzles at Mist Eliminator casing only for the portion which is not exposed to slurry. Ease of replace ability and placement of the mist eliminator on maintenance platforms is an important requirement. The ME shall be designed to allow for efficient cleaning in process.

A-SG-39	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	11 of 28	5.06.17	The spray headers (if provided) and air supply headers shall life of 20,000 hrs. The design of the spray nozzles shall be such that rapid wear, encrustation and plugging are avoided. Nozzle pipes and slurry spray nozzles shall be with bolted flanged connections. Nozzle pipes shall be installed easily to be removed partially through absorber modules.	The spray headers (if provided) and air supply headers shall life of 20,000 hrs. The design of the spray nozzles shall be such that rapid wear, encrustation and plugging are avoided. Nozzle pipes and slurry spray nozzles shall be with bolted flanged connections. Nozzle pipes shall be installed easily to be removed partially through absorber modules. In case of JBR technology, following shall apply: 1. Slurry spray headers shall be made of Nickel based alloy in gas cooling section. 2. Air supply header inside JBR shall be made of FRP. 3. Slurry spray nozzles in gas cooling section shall be made of SiC. Other slurry spray nozzles are made of SiC or High Alumina or equivalent having a minimum guaranteed life of 20,000 hrs. All wash and water nozzles and pipes shall be made of FRP. SiC coating shall be provided inside FRP slurry pipes."
A-SG-40	SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA		18 of 101	1.05.13.03	Margin over 100% BMCR pressure requirement : 44%	Margin over 100% TMCR pressure requirement : 44% Further for booster fan sizing, bidder to consider the margin over pressure requirement as 44% over the calculated head value excluding the static head. Margin on Static head shall be taken as 10%. For bubbling type Absorber, Bidder shall consider choking/blockage of 10% sparger tubes while calculating the head requirements of fan.
A-SG-41	SECTION – VI, PART-A	SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	4 of 7	5.03.00	One (1) number passenger cum goods elevator of minimum capacity of 1000kgs for each Absorber (to be provided in case height of absorber is higher than 20m) and One (1) number passenger cum goods elevator of minimum capacity of 1000kgs in Limestone Grinding System Building shall be provided for easy access & movement of man/materials.	One (1) number passenger cum goods elevator of minimum capacity of 1000kgs for each Absorber (to be provided in case height of absorber is higher than 15 m), One (1) number passenger cum goods elevator of minimum capacity of 1000kgs in Limestone Grinding System Building, One (1) number passenger cum goods elevator of minimum 1000 kgs for gypsum dewatering building and One (1) no. 680 Kg elevator for control room building shall be provided for easy access & movement of man/materials.
A-SG-42	VI/A	IV	16 of 73	1.01.05.01	The performance test on electrostatic precipitator will commence after a minimum period of three thousand (3000) hours of cumulative operation after completion of initial operation.	The performance test on electrostatic precipitator will ~~commence after a minimum period of three thousand (3000) hours of cumulative operation after completion of initial operation.~~ be conducted soon after completion of trial operation or along with Boiler PG test whichever is earlier.

A-SG-43	VI/B	A-05	7 of 28	5.02.00	Sufficient number of agitators, as per the prov-en practice of the contractor, shall be provided for thorough mixing of the re-circulating slurry. In case the Contractor's Absorber includes side entry agitators, the contractor shall offer and demonstrate mixing arrangement such that n-1 number of agitators are sufficient to avoid the slurry settlement in the absorber tank in case of one agitator under breakdown (n-total no. of working agitators). In case vertical absorber agitators are offered, one complete mechanical assembly of agitator shall be supplied as warehouse spare for each Absorber.	Sufficient number of agitators, as per the prov-en practice of the contractor, shall be provided for thorough mixing of the re-circulating slurry. In case the Contractor's Absorber includes side entry agitators, the contractor shall offer and demonstrate mixing arrangement such that n-1 number of agitators are sufficient to avoid the slurry settlement in the absorber tank in case of one agitator under breakdown (n-total no. of working agitators). In case vertical absorber agitators are offered, one complete mechanical assembly of agitator shall be supplied as warehouse spare for each Absorber. In alternate cases of absorber design also, the bidder to provide no.of agitators as per its proven practice (minimum two (02) nos.) and additional one agitator shall be provide as ware house spare.
A-SG-44	SCHEME OF FGD ABSORBER SYSTEM		4540-001-POM-A-022			
A-SG-45	VI / Part-A	SECTION-VI, PART-A, SUB SECTION-IIA-03	1 of 1	1.00.01	The scope shall include the unloading, storage, transportation & feeding to coal bunkers along with all the associated systems. The storage area shall be provided with suitable firefighting system like fire hydrants and water monitors. The entire feeding system shall be provided with firefighting system including conveyors, storage silo, bunkers etc.	The scope shall include the unloading, storage, transportation & feeding to coal bunkers along with all the associated systems. The storage area shall be provided with suitable firefighting system like fire hydrants and water monitors. The entire feeding system shall be provided with firefighting system including conveyors, storage silo, bunkers etc. The scope shall include from the bunker top inlet. The bunker area fire fighting system shall be suitably reinforced to tackle biomass fire hazard also.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A-TG-1	VI/A	FGLD/IV	Page 1 of 73	1.00.01/(b)	The guaranteed performance parameters indicated in furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.	The guaranteed performance parameters indicated / furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
A-TG-2	VI/B	A-07	10 of 25	5.02.00/(a)	Horizontal/Vertical, Spray-cum-tray with integral direct contact vent condenser Bidders to provide cladding on internal surfaces of storage tank and/or Stainless Steel vessel to meet HEI requirements.	Horizontal/Vertical, Spray-cum-tray with integral direct contact vent condenser Bidders to provide Stainless Steel cladding on internal surfaces of storage tank above Low low level to meet HEI requirements and/or ~~Stainless Steel vessel.~~
A-TG-3	VI/B	A-07	11 of 25	5.02.00/(d)	All pressure parts like shell, heads and nozzles shall be of carbon steel as per ASTM A-516 Gr. 70. Shell plate min. thickness 15.8mm of welded construction.	All pressure parts like shell and heads shall be of carbon steel as per ASTM A-516 Gr. 70. Shell plate min. thickness 15.8mm of welded construction. Nozzles shall of carbon steel as per ASTM A-105.
A-TG-4	VI/A	IIA-06	6 of 10	7.01.00	One thirty percent capacity (1x30% One (1) number portable centrifuge of adequate capacity shall also be provided.	One thirty percent capacity (1x30%) One (1) number portable centrifuge of adequate capacity per station shall also be provided.
A-TG-5	VI/B	A-01	54 of 101	2.08.00/(a)	Ensure HP bypass aggregate capacity not less than 65% of the main steam flow com bined boiler turbine start up curve. (to be intimated during detail engineering)	Ensure HP bypass aggregate capacity not less than 65% of the main steam flow combined boiler turbine start up curve. ~~(to be intimated during detail engineering)~~
A-TG-6	VI/B	A-07	1 of 25	1.03.01/(a)	Adequate drainage facility and temp. sensing devices in casings, strainers housings, stop and control valves, extraction lines etc and in drain lines at downstream of the isolating valve to detect any choking and passing of high energy drains.	Adequate drainage facility and temp. sensing devices in casings, strainers housings, stop and control valves, extraction lines etc and in drain lines at ~~downstream~~ upstream of the isolating valve to detect any choking and passing of high energy drains. The power operated high energy drain isolating valves seat tightness shall be conforming to MSS SP61.
A-TG-7	VI/B	A-01	47 of 101	2.02.03/(11)	Additional 10% margin on cumulative Hydraulic pressure drop across LP & HP condenser shall be considered for CW (Cooling water) pump head selection. This will be exclusive of margin considered for frictional losses in CW pump sizing.	Clause deleted

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

A-TG-8	VI/C		27 of 114	13.02.00	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. However, the lube oil for Main Turbine, Drive Turbine, TDBFP and MDBFP shall be kept same in view of ease of operation and maintenance.
A-TG-9	VI/B	A-07	4 of 25	1.16.00 (a)	Seat tightness of the HP bypass valves shall be equivalent to block valve tightness conforming to MSS SP61.	Seat tightness of the HP bypass valves shall be equivalent to ~~block valve~~ tightness conforming to MSS SP61.
A-TG-10	VI/B	A-07	5 of 25	1.16.00 (j)	HP Bypass should have the provision of removable valve seat arrangement for ease of maintenance.	HP Bypass should have the provision of removable valve seat/ any other arrangement for ease of maintenance.
A-TG-11	VI/A	II-A-24	2 of 17	Annexure-I S. No. (1)	Vertical Turret Lathe- Main motor spec. 42 Kw, 40 HP, 415 V, 3 Phase. AC.	Vertical Turret Lathe- Main motor spec. 42 Kw, ~~40 HP~~ , 415 V, 3 Phase. AC.
A-TG-12	VI/A	VI	11 of 31	XXV	Valve seat for HPSV,HPCV,IPSV HPBYPASS VALVE, HPBYPASS SPRAY VALVES 1 No. of each kind of valve	Valve seat for HPSV,HPCV,IPSV, IPCV , HPBYPASS VALVE, HPBYPASS SPRAY VALVES, HP BYPASS SPRAY ISOLATION VALVE 1 No. of each kind of valve
A-TG-13	VI/B	G-06	7 of 14	3.03.04 (ii) (b)	Oxygen content in condensate, at condensate collection tank outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.	Oxygen content in condensate, at ~~condensate collection tank~~ Hotwell outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.
A-TG-14	VI/B	A-07	15 of 25	6.05.06 (b)	-----	New Clause added- The lube oil for Main Turbine, Drive Turbine, TDBFP and MDBFP shall be kept same in view of ease of operation and maintenance.
A-TG-15	VI/B	G-01/OPERATING CAPABILITY OF PLANT	Page 2 of 4	1.04.01	Bidder shall design Turbine-Generator system meeting the load cycling conditions as indicated at clause no 1.04.00. In no case the design life of Turbine-Generator system shall be affected due to.....	Bidder shall design Turbine-Generator system meeting the load cycling conditions as indicated at clause no 1.03.00. In no case the design life of Turbine-Generator system shall be affected due to.....

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A-WS-01	VI /A	IA	9 OF 36	4.8	Water Pre-treatment Plant & Liquid Effluent Treatment Plant The Bidder/its sub-vendor should have designed, supplied, erected and commissioned at least one (1) number water/waste water treatment plant having capacity of not less than 1000 Cu.m/hr., comprising of clarifiers/tube settlers/thickeners or a combination thereof including civil works. The plant should have been in successful operation for at least one (1) year.	Water Pre-treatment Plant The Bidder/its sub-vendor should have designed, supplied, erected and commissioned at least one (1) number water/waste water treatment plant having capacity of not less than 1000 Cu.m/hr., comprising of clarifiers/tube settlers/thickeners or a combination thereof including civil works. The plant should have been in successful operation for at least one (1) year.
A-WS-02	VI/ A	VI	11 OF 27	2.00.00 (4)	4) Absorbant circulation Pumps – CW Chlorine Leak Absorption system Name of Items-Unit -QTY a) Impeller-Set- 1 b) Wearing rings – Impeller (if applicable)- Set-1 c) Wearing rings – Casing (if applicable) Set-1 d) Shaft -Set 1 e) Shaft Sleeves -Set -1 f) Mechanical Seal -Set -1 g) Pump bearings- Set- 1 Note : One set consists of quantity required for complete replacement for one pump	Deleted
A-WS-03	VI/ A	IIA-11	2 OF 4	1.02.01 (7)	Provision of six (6) numbers of Isolation (Gate valve) Valves (in the stub connections) for each unit at the locations where flow measurement is to be carried out by means of pitot tubes.	Provision of three (3) numbers of Isolation (Gate valve) Valves (with the stub connections) for each unit at the locations where flow measurement is to be carried out by means of pitot tubes.

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A-WS-04	VI/ B	A-01	56 OF 101	3.01.01		The common recirculation line for CW pumps shall be sized for minimum 30% (VT type) or 50% (CV type) of design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.
A-WS-05	VI/ B	A-15	20 OF 31	2.05.00	Clarified water from the clarified water tank shall be used as service water. Service water pumps shall take suction from this tank and supply water to the service water pipe network. Service water distribution shall be used for effective cleaning /washing of each area and shall also fill the service water (PVC tank of 100 liter capacity) tank provided on roof top of each building to supply water to toilets.	Clarified water from the clarified water tank shall be used as service water. Service water pumps shall take suction from this tank and supply water to the service water pipe network. Service water distribution shall be used for effective cleaning /washing of each area and shall also fill the service water tank provided on roof top of each building.
A-WS-06	6	VI/ A	IIA-11	2 OF 4	1.03.00	(1) 3X50% for TG and 2 X100% for SG Primary (DM) cooling water pumps of required capacity and head. (3) 3 X 50% for TG and 2 X 100% for SG Plate Heat Exchangers.

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A-WS-07	6	VI/ B	A-01	57 OF 101	3.03.00	Primary (DM) Cooling Water Pumps (TG and SG separate)- Horizontal Centrifugal Pumps 1 (a) Quantity - 3 X 50% for TG ECW system 2 X 100% for SG system Plate Heat Exchangers (TG and SG separate) 3 (a) Quantity - 3 X 50% for TG ECW system 2 X 100% for SG ECW system

S. No.	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
B-1	VI/ Part-B	Sub Sec- B-0 General Electrical Specifications	4 of 15	3.01.00 - d)	d) For the Generator and its excitation system specific design features incorporated and design/process improvements which are being offered considering modes of operation as per Sub Section A-01 - Operating Capability of Plant - in Technical Specification shall be submitted within 4 weeks of award of contract. Such design features and design/process improvements over and above conventional design, results of design analysis are required to be submitted as part of the EIFS (Engineering information flow system).	d) For the Generator and its excitation system specific design features incorporated and design/process improvements which are being offered considering modes of operation as per Sub Section G-01 - Operating Capability of Plant - in Technical Specification shall be submitted within 4 weeks of award of contract. Such design features and design/process improvements over and above conventional design, results of design analysis are required to be submitted as part of the EIFS (Engineering information flow system).
B-2	VI/ Part-B	Sub Sec- B-0 General Electrical Specifications	1 of 15	1.05.00 (d)	d) 220V/110V/48 V DC +/-15% to +10%	d) 220V/110V/48 V DC -15% to +10%
B-3	VI/ Part-A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	10 of 17	1.16.05 Vi)	Supply of all items for civil and structural works to include detailed route survey including survey for PTCC clearance, route marking, survey and selection of tower locations (including all crossings), route clearance / tree cutting, geo-technical investigation of soil, tower foundations for all types of soil at each location etc.	Supply of all items for civil and structural works to include Preliminary , detailed route survey including survey for PTCC clearance, route marking, survey and selection of tower locations (including all crossings), route clearance / tree cutting, geo-technical investigation of soil, tower foundations for all types of soil at each location etc.
B-4	VII/ Book 2 of 3 Price Bid			PRICE SCHEDULE - 10, SR. NO. 27	ADDITION OF NEW CLAUSE.	GIS Line Bay , Qty: 1no
B-5	VII/ Book 2 of 3 Price Bid			PRICE SCHEDULE	one complete 400KV GIS Dia (Line-III-TIE-Line-IV) Along with Associated GIS duct, AIS equipment, Termination, cable, cabling, control & protection and metering , civil works etc complete in all respect as per SLD and Technical specification.	TO BE DELETED.
B-6	VII/ Book 2 of 3 Price Bid			PRICE SCHEDULE	ADDITION OF NEW CLAUSE	one complete 400KV GIS Dia (Line-III-TIE-Line-IV) Along with Associated GIS duct, AIS equipment, Termination, cable, cabling, control & protection and metering , civil works etc complete in all respect as per SLD and Technical specification.

B-7	VI/ Part-A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	3 of 17	1.05.03	Switchgear / Numerical Relay Networking The Contractor's scope of work shall include the following for all the 33kV/11kV/ 3.3kV and LV Switchgears under this package. The communication architecture and design criteria have been explained in chapter B-05(B) of the specification. The Contractor's scope of work shall include complete design, engineering, supply, installation, testing and commissioning and AMC (Three Years) of the following. a) Communicable Numerical Relays (with IEC 61850) in all MV Switchgears & LV Switchgears in the bidder's scope. b) IEC 61850 Ethernet switches in Switchgear panels – Sufficient quantity of Ethernet switches as per requirement for all boards under bidder's scope. At least 2 ports per switch shall be kept as spare ports. c) Cat5e Ethernet cable / FO cable for connection of Numerical Relays to Ethernet switches in all Switchgears. d) Optical Fibre Cable with fire-retardant outer sheath as required for the complete numerical relay network. e) Optical Fibre Cable termination equipment such as LIU, patch cord, etc. for the complete network. f) HMI stations (Engineering & Operator Work Stations and printers) & suitable arrangement for integration of HMI to LVS in Control Room. g) GPS, Time synchronizing equipment & Digital Clocks. h) Laptops – 5 Nos & Interface cable for connection of Numerical relay front port to the laptop – One No. cable of length at least 5m per switchboard under bidder's scope. i) All other equipment required to meet the intended specification. j) The scope shall include the AMC Contract for the above specified system for a period of three years from the date of takeover by the Employer. k) Relay Test Equipment. 2 Nos. The typical configuration of such a proposed system is as enclosed in Drawings 0000-205-POE-A-001 & 0000-205-POE-A-002. The numerical relay network shall include relays on all MV & LV switchgears being supplied under this package including Employer's requirement indicated at 1.19.00.	Switchgear / Numerical Relay Networking The Contractor's scope of work shall include the following for all the 33kV/11kV/ 3.3kV and LV Switchgears under this package. The communication architecture and design criteria have been explained in chapter B-05(B) of the specification. The Contractor's scope of work shall include complete design, engineering, supply, installation, testing and commissioning and AMC (Three Years) of the following. a) Communicable Numerical Relays (with IEC 61850) in all MV Switchgears & LV Switchgears in the bidder's scope. b) IEC 61850 Ethernet switches in Switchgear panels – Sufficient quantity of Ethernet switches as per requirement for all boards under bidder's scope. At least 2 ports per switch shall be kept as spare ports. c) Cat5e Ethernet cable / FO cable for connection of Numerical Relays to Ethernet switches in all Switchgears. d) Optical Fibre Cable with fire-retardant outer sheath as required for the complete numerical relay network. e) Optical Fibre Cable termination equipment such as LIU, patch cord, etc. for the complete network. f) HMI stations (Engineering & Operator Work Stations and printers) & suitable arrangement for integration of HMI to LVS in Control Room. g) GPS, Time synchronizing equipment & Digital Clocks. h) Laptops – 5 Nos & Interface cable for connection of Numerical relay front port to the laptop – One No. cable of length at least 5m per switchboard under bidder's scope. i) All other equipment required to meet the intended specification. j) The scope shall include the AMC Contract for the above specified system for a period of three years from the date of takeover by the Employer. k) Relay Test Equipment. 2 Nos. The typical configuration of such a proposed system is as enclosed in Drawings 0000-205-POE-A-001. The numerical relay network shall include relays on all MV & LV switchgears being supplied under this package including Employer's requirement indicated at 1.19.00.																																											
B-8	VI / B		Sub- Section B-03	6 OF 11	12.08.00	Temperature rise: For dry type transformer the winding temperature rise shall be 95 Deg. C for Class-H insulation or 70 Deg.C for Claas – F Insulation.	Temperature rise: For VFD dry type transformer temperature rise shall be Class-F (90 Deg C rise) for Class-H insulation and Class-B (70 Deg C rise) for Class –F Insulation winding over an ambient of 50 Deg C."																																										
B-9	VI / B		Sub- Section B-06	8 OF 18	2.15.00	2.15.00 LIGHTING TRANSFORMER/WELDING TRANSFORMER <table><tr><td>1)</td><td>Type & Rating</td><td>Dry type/ 100 KVA (Welding TRF).</td></tr><tr><td>2)</td><td>Voltage Ratio</td><td>415/415, +/- 5% taps in steps of 2.5%</td></tr><tr><td>3)</td><td>Class of insulation</td><td>B or better</td></tr><tr><td>4)</td><td>One minute power frequency</td><td>2.5 kV</td></tr><tr><td>5)</td><td>Enclosure protection</td><td>IP-42</td></tr><tr><td>6)</td><td>Type Test</td><td>As per IS 2026</td></tr><tr><td>7)</td><td>Fault level</td><td>3.5 kA secondary side</td></tr></table>	1)	Type & Rating	Dry type/ 100 KVA (Welding TRF).	2)	Voltage Ratio	415/415, +/- 5% taps in steps of 2.5%	3)	Class of insulation	B or better	4)	One minute power frequency	2.5 kV	5)	Enclosure protection	IP-42	6)	Type Test	As per IS 2026	7)	Fault level	3.5 kA secondary side	2.15.00 LIGHTING TRANSFORMER/WELDING TRANSFORMER <table><tr><td>1)</td><td>Type & Rating</td><td>Dry type/ 100 KVA (Welding TRF), 50KVA(Minimum)(Lighting TRF)</td></tr><tr><td>2)</td><td>Voltage Ratio</td><td>415/415, +/- 5% taps in steps of 2.5%</td></tr><tr><td>3)</td><td>Class of insulation</td><td>B or better</td></tr><tr><td>4)</td><td>One minute power frequency voltage</td><td>2.5 kV</td></tr><tr><td>5)</td><td>Enclosure protection</td><td>IP-42</td></tr><tr><td>6)</td><td>Type Test</td><td>As per IS 2026</td></tr><tr><td>7)</td><td>Fault level</td><td>3.5 kA secondary side</td></tr></table>	1)	Type & Rating	Dry type/ 100 KVA (Welding TRF), 50KVA(Minimum)(Lighting TRF)	2)	Voltage Ratio	415/415, +/- 5% taps in steps of 2.5%	3)	Class of insulation	B or better	4)	One minute power frequency voltage	2.5 kV	5)	Enclosure protection	IP-42	6)	Type Test	As per IS 2026	7)	Fault level	3.5 kA secondary side
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B-10	VI-PartB	Chap:17	4 of 60	1.06.01	TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS & 400KV AIS CIRCUIT BREAKER	TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN 400KV GIS .																																											
B-11	VI-PartB	Chap:17	4 of 60	1.06.01	TYPE TEST REQUIREMENTS FOR GIS & 400KV AIS CIRCUIT BREAKER	TYPE TEST REQUIREMENTS FOR GIS_																																											
B-12	VI-PartB	Chap:17	6 of 60	1.07.00	Type tests to be conducted on 400KV AIS Circuit Breaker	deleted. Not applicable.																																											

B-13	VI/Part A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	13 of 17	19.00.00 (3)	addition of new clause	3. Requirement of employer's load of 2 MVA on each colony feeder and 5 MVA on each ext. CHP feeder to be considered for ST sizing and associated systems.
B-14	VI-PartB	Sub Sec- B-0 General Electrical Specifications	5 of 15	3.04.01	Station Transformer Scheme: Unit Transformers These transformers would be sized to meet the loads corresponding to auxiliaries required to meet the peak load requirements of the unit. Further, the unit transformers shall be able to withstand over voltages up to 140% for 5 seconds. Each unit transformer shall be sized for the following: a) The loads of One set of unit auxiliaries corresponding to 60% TMCR plus b) Loads due to outage of largest transformer connected to the bus plus d) SCR load requirement of 1 MVA plus c) Multiplied by no load voltage correction factor as defined at Cl. 3.04.00. Station Transformer Each Station transformer shall be sized to meet the requirements of the worst case of following contingencies: Case I : Outage of One Unit transformer a) Loads served by fully loaded Unit transformer as defined above plus b) MDBFP load for one unit plus c) Meeting the station loads distributed on the respective station boards plus d) Loads due to outage of largest transformer /outgoing feeder (except station to unit/station tie feeders) connected to the bus plus e) Multiplied by no load voltage correction factor as defined at 3.04.00. Case II : Outage of any one of the Station Transformer and all the connected loads on the set of Station boards are fed from other available Station transformer.	Station Transformer Scheme: Unit Transformers These transformers would be sized to meet the loads corresponding to auxiliaries required to meet the peak load requirements of the unit. Further, the unit transformers shall be able to withstand over voltages up to 140% for 5 seconds. Each unit transformer shall be sized for the following: a) The loads of One set of unit auxiliaries corresponding to 60% TMCR plus b) Loads due to outage of largest transformer connected to the bus plus d) SCR load requirement of 1 MVA plus c) Multiplied by no load voltage correction factor as defined at Cl. 3.04.00. Station Transformer Each Station transformer shall be sized to meet the requirements of the worst case of following contingencies: Case I : Outage of One Unit transformer a) Loads served by fully loaded Unit transformer as defined above plus b) MDBFP load for one unit plus c) Meeting the station loads distributed on the respective station boards plus d) Loads due to outage of largest transformer /outgoing feeder (except station to unit/station tie feeders) connected to the bus plus e) owner's requirement as mentioned in clause 1.19.00 (3) of Part A sub section IIB. (f) Multiplied by no load voltage correction factor as defined at 3.04.00.
B-15	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION 0	4 OF 15	3.03.00	Generator Busduct Isolated phase busduct, continuous, natural air cooled and positive pressure type, with enclosure of weather-proof, dust tight, non-magnetic minimum flux type. The continuous rating of the Generator circuit breaker and Generator busducts shall be such that the maximum continuous peak output of the steam turbine unit under VWO/ HP heater out condition etc. at any ambient temperature between 0 deg C and 50 deg. C can be delivered at the rated power factors and allowable generator voltage variations without exceeding the permissible temperature rise limits as specified for these equipments.	Generator Busduct Isolated phase busduct, continuous, natural air cooled and positive pressure type with enclosure of weather-proof, dust tight, non-magnetic minimum flux type. The continuous rating of the Generator busducts shall be such that the maximum continuous peak output of the steam turbine unit under VWO/ HP heater out condition etc. at any ambient temperature between 0 deg C and 50 deg. C can be delivered at the rated power factors and allowable generator voltage variations without exceeding the permissible temperature rise limits as specified for these equipments.
B-16	SECTION-VI, PART-B	SUB-SECTION B-17 SWITCHYARD	26 OF 60	5.0.04	CORE DETAILS OF 400kV VT(GIS) Output Burden – Minimum 75 VA	CORE DETAILS OF 400kV VT(GIS) Output Burden – MAXIMUM 50 VA
B-17	SECTION – VI, PART-B	SUB-SECTION-B-15	2 of 4	8.01.01	These motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for Inverter duty.	VFD shall be used to drive three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD application. These motors shall be provided with insulated bearing on at least one side for motor frame size above 250 frame. However, contractor's proven practice with respect to use of insulated bearing in VFD driven motor may be accepted subject to Employer's approval.

B-18	SECTION – VI, PART-B	SUB-SECTION-B-13	-	-	Annexure to Chapter B-13	Annexure to Chapter B-13

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	Annexure I to Chapter 13	
	Network Configuration and Equipment Characteristics	
1.1	INTRODUCTION This section describes the Fiber Optic Communication network configuration and the equipment characteristics for communication system to be installed under the project. The sub-systems addressed within this section are: (1) Fiber Optic Transmission System (FOTS) (2) DDF and Cabling (3) Craft Terminal based Network Management System (NMS) The requirements described herein are applicable to and in support of network requirements. The equipment supplied shall support existing regional network for Power system operational requirements. The security related requirements of the equipment shall be as per DoT (Department of Telecommunication) guidelines and all similar security requirements as amended by DoT on time to time basis shall be followed/complied by the vendor. The manufacturer shall allow the Employer and/or its designated agencies to inspect the hardware, software, design, development, manufacturing, facility and supply chain and subject all software to a security /threat check any time during the supplies of equipment The contractor shall ensure that the supplied equipment's have been got tested as per relevant contemporary Indian or International Security Standards e.g. IT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, Telecom and Telecom related elements against 3GPP security standards, 3GPP2 security standards etc. from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards until 31st March 2013. The certification shall be got done from authorized and certified agency/lab in India. The Contractor shall also ensure that the equipment supplied has all the contemporary security related features and features related to communication security as prescribed under relevant security standards. A list of features, equipment's, software etc. supplied and implemented in the project shall be given for use by the Employer The contractor shall get the Employer's equipment audited from security point of view once a year from a network audit and certification agency as identified by DoT. The audit of the equipment shall be carried once in a financial year till the maintenance service contract in the bid. In case of any deliberate attempt for a security breach at the time of procurement or at a later stage after deployment/installation of the equipment or during maintenance, liability and criminal proceedings can be initiated against the Contractor as per guidelines of DoT and any other Government department.	
1.2	General Network Characteristics	
1.2.1	Description	
	The fibre optic network shall be based on the Synchronous Digital Hierarchy (SDH) having bit rate of STM-16. The network shall consist of overhead fibre optic links with a minimum bit rate of	
TALCHER THERMAL POWER PROJECT STAGE-III (2x660MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART B BID DOC.NO.:CS:4540-001A-2	ANNEXURE –I TO SUB SECTION B 13 PAGE 1 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
1.2.2	Synchronous Transport Module-16 (STM-16). The Contractor can propose a system based on higher bit rate systems, if required, so as to meet the link budget requirements or any other specification requirement. The contractor shall develop numbering plan for the proposed voice communication system equipment. Functional Requirement The primary function of the communication network is to provide a highly reliable voice and data communication system for grid operation in support of the SCADA/EMS, RTUs & PMUs and for new technological requirements of Power System Operation such as Special Protection Scheme, Grid Security Expert System, Load Management, Advanced Protection System & Substation Automation System. The communications support requirement for SCADA/EMS, RTUs , PMUs system & EPABX system is for low & high speed data, express voice circuits and administrative voice circuits as defined in appendices. A brief summary of the communication system requirements is as follows: (a) High speed E1 channel support (b) 64kbps & nx64kbps data channel support (c) Low speed (300 -1200 bps) data channel support (d) Voice (2 wires, 4 wires) channel support and integration with EPABX system. The details of EPABX System shall be provided during detailed engineering. (e) Data transport supporting Network Management channels (f) The connectivity envisaged between Substation and Control Centre over TCP-IP using Ethernet interface for various services of data and voice such as for PMUs, RTUs , VOIP . 1.2.3 General Systems Requirements Required characteristics are defined and specified herein at the system level, subsystem level, and equipment level. 1.2.3.1 System Synchronization The Contractor shall synchronize the equipments under the contract using Master clock procured under the Substation Package. The contractor shall submit the synchronisation plan as per standard ITU-T G.811. All sync equipments proposed under this contract should meet ITU-T G.811 criterion. The holdover quality of slave clock, if any, shall meet ITU-T G.812 standard requirements. The Contractor shall provide system wide synchronization fully distributed throughout the telecom network and connected to all equipments new & existing. The Contractor shall submit the synchronization plan for the entire network meeting the requirement of ITU-T G.803. The system equipment requiring "clock" shall be connnceted to the master clock using external clocking. For this purpose, appropriate interfaces(s) in the transmission & termination equipment being supplied and all other associated hardware shall be provided by the Contractor.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 
1.2.3.2	System Maintainability To facilitate performance trending, efficient diagnosis and corrective resolution, the system shall permit in-service diagnostic testing to be executed locally by Craft Terminal. Such testing shall not affect the functional operation of the system.
1.2.3.3	System Upgradeability and Expandability Equipment supplied shall be sized (though not necessarily equipped) to support system/subsystem expansion to full capacity as provided by specified aggregate transmission rates. Equipment units provisioned for equipped subunits shall be terminated at appropriate patching facilities or termination blocks. Power supplies shall be sized for maximum equipped system capacity.
1.2.3.4	Equipment Availability The calculated availability of each fibre optic link (E1 to E1) shall be at least 99.999%. The calculated availability is defined as the theoretical availability determined by a statistical calculation based on the mean-time-between-failure (MTBF) and the mean-time-to-repair (MTTR) of the components and subsystems comprising the FOTS. For this analysis, an MTTR of at least 4 hours shall be assumed. The down time of the fibre optic cable shall not be considered in the aforesaid availability calculations. The calculated failure rates of the units and the calculated availabilities of the equipment being offered shall be provided by the Contractor during detailed engineering.
1.2.3.5	Revision Levels and Modifications All hardware, firmware and software delivered as part of the communications network shall be field proven and at the most of current revision level. All modifications and changes necessary to meet this requirement shall be completed prior to the start of the factory tests or under special circumstances, on written approval by Employer, prior to the completion of SAT.
1.2.3.6	Equipment Capacities Equipment supplied shall be sized and equipped with sufficient capacity and configuration to meet complete system requirement.. Each subsystem supplied shall be sized (to be equipped as specified) to support full subsystem expansion.
1.2.3.7	Redundancy Requirements and Protection Schemes Equipment redundancy and Automatic Protection Schemes (APS) are specified in the Table 2-1. The failure of one element shall not prevent the use of any other that has not failed.
TALCHER THERMAL POWER PROJECT STAGE-III (2x660MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART B BID DOC.NO.:CS:4540-001A-2 ANNEXURE –I TO SUB SECTION B-13 PAGE 3 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS															
	<table><tr><th colspan="4">Table 2-1 Equipment Redundancy Requirements Summary</th></tr><tr><td colspan="2">Fiber Optic transmission Equipment : SDH equipment Power Supply & Converters ----- Common Control* Cards -----</td><td colspan="2">1:1 APS or distributed power supply 1:1 APS</td></tr><tr><td colspan="4">* = Common control cards which are essentially required for operation of the equipment.</td></tr></table>				Table 2-1 Equipment Redundancy Requirements Summary				Fiber Optic transmission Equipment : SDH equipment Power Supply & Converters ----- Common Control* Cards -----		1:1 APS or distributed power supply 1:1 APS		* = Common control cards which are essentially required for operation of the equipment.			
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	Fiber Optic transmission Equipment : SDH equipment Power Supply & Converters ----- Common Control* Cards -----		1:1 APS or distributed power supply 1:1 APS													
	* = Common control cards which are essentially required for operation of the equipment.															
	The offered equipment shall support at least SNCP as per standard ITU-T G.841 . In case the equipment offered by the Bidder does not support the above mentioned minimum protection methods, the bidder shall have to provide all additional equipment needed to provide same level of flexibility, redundancy and functionality at no additional cost to Employer. The bidders shall provide details of protection schemes supported in the Bid document.															
The offered equipment shall support automatic switchover function between the redundant modules and all required modules and hardware to support the automatic switch over shall be provided by the Contractor.																
1.2.3.8	Lost Signal Recovery At any digital signal level, reapplication of a lost signal shall result in automatic resynchronization and full restoration to normal operation without manual intervention. All alarms incident to the signal failure, shall be automatically cleared at the equipment, rack and monitoring levels and normal operation indications restored and reported if applicable.															
1.2.3.9	Software Upgrades The Contractor shall provide antivirus software along with all the computer hardware/software which shall be upgraded periodically till the maintenance services contract in the bid. Further, to meet all the specifications requirements during implementation and maintenance, if upgrade in the hardware/software of supplied item is required, the same shall be done by the contractor without any additional cost to the Employer.															
1.2.3.10	General Site Considerations All fiber optic links up to 150kms/175kms/200kms/225kms/250kms transmission line length (as applicable) shall be implemented by the Contractor without repeaters. In order to meet the link budget requirement, the Contractor shall provide all the necessary equipments for remote end stations as well. The contractor may provide the optical amplifier, wave length translator, optical cards or high capacity SDH equipment with suitable rack/sub rack to meet the maximum distance limit.. The contractor will have to integrate all the new equipments with the existing NMS.															
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1.2.3.11

Proposed Optical Fibre Characteristics

The link budget calculations and equipment design shall be based on the specified fibre parameters. The optical cables shall have Dual Window Single Mode (DWSM) fibres conforming to ITU-T Recommendations G.652D and the major parameters of these optical fibre(s) are defined in Table-2-2:

Table-2-2 Optical Fibre Characteristics	
Fibre Description:	Dual-Window Single-Mode (DWSM)
Mode Field Diameter:	8.6 to 9.5 μm ($\pm 0.6 \mu\text{m}$)
Cladding Diameter:	125.0 μm + 1 μm
Mode field Concentricity Error:	< 0.6 μm

Table-2-2 Optical Fibre Characteristics	
Core-Clad concentricity error:	< 1.0 μm
Cladding non-circularity	< 1%
Cable Cut off Wavelength:	< 1260 nm
1550 loss performance	As per G.652D
Proof Test Level	0.69 C
Attenuation coefficient	@1310nm < 0.35 dB/Km @1550nm < 0.21 dB/Km
Attenuation variation with wavelength 1285 nm - 1330 nm 1525 nm – 1575 nm	Attenuation coefficient @1310 ± 0.05 dB Attenuation coefficient @1550 ± 0.05 dB
Point discontinuities	< 0.1dB
Chromatic Dispersion; Max.: Zero Dispersion Wavelength: Zero Dispersion Slope:	18.0 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) @ 1288-1339nm 5.3 ps/(nm x km) @ 1271-1360nm 1300 to 1324nm 0.092 ps/(nm ² xkm) maximum
Polarization mode dispersion coefficient	< 0.2 ps/km ^{1/2}

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Temperature Dependence:		Induced attenuation < 0.05 dB (-60 deg C - +85 deg C)	
	Bend performance:		@1310nm (75+2 mm dia Mandrel), 100 turns; Attenuation rise _ 0.05 dB @1550nm (30+1 mm dia Mandrel), 100 turns; Attenuation rise _ 0.10 dB @1550nm (32+0.5 mm dia Mandrel), 1 turn; Attenuation rise _ 0.50 dB	
1.2.4	Fibre Optic Link Lengths			
	The exact cable lengths shall be provided during detailed engineering.			
1.3	Fibre Optic Transmission System			
	The Fibre Optic Transmission System (FOTS) is defined herein to include ETSI digital optical line termination equipment. The FOTS shall be based on SDH technology. Minimum aggregate bit rate shall be STM-4/STM-16 and equipped with minimum 16nos. E1 interfaces (G.703) and minimum 16 nos. Ethernet interfaces (IEEE 802.3/IEEE 802.3u) supporting layer 2 switching as tributaries. The Ethernet interfaces shall support VLAN (IEEE 802.1P/Q), spanning tree (IEEE 802.1D) quality of service. Protection scheme for Ethernet traffic should be ERPS based (Ethernet ring protection scheme) as per ITU-T G.8032.			
	The Contractor shall provide (supply and install) connectorised jumpers (patch cords) for FODP-to-equipment and equipment-to-equipment connection. Two number spare jumpers shall be provided for each equipment connection. Fiber jumpers shall be of sufficient lengths as to provide at least 0.5m of service loop when connected for their intended purpose.			
1.3.1	SDH Equipment			
1.3.1.1	Functional Requirement			
	For the purpose of BOQ, the SDH Equipment is considered to be divided in three parts i.e. Optical interface/SFP, Tributary interfaces (Electrical tributaries such as E1 & Ethernet 10/100 Mbps) and Base Equipment (Consisting of Common Cards, Control Cards, Optical base card, Power supply cards, sub-rack, cabinet, other hardware and accessories required for installation of equipment i.e. everything besides optical interface/SFP and tributary interfaces).			
	If bidder is offering equipment with multifunction cards such as cross-connect or control card with optical interface/SFP or tributary interface, such type of multifunction card shall be considered as Common control card and shall be the part of base equipment. In case optical interface/SFP is embedded with control card, the adequate number of optical interface/SFPs shall be offered to meet the redundancy requirements of the specifications. Further, main and protection channel shall be terminated on separate cards and there shall not be single point of failure.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीपी NTPC				
	The equipment shall be configurable either as Terminal Multiplexer (TM) as well as ADM with software settings only. SDH ADM The aggregate interfaces shall be (at least) STM-16 towards at least three protected directions. At present the equipment shall be equipped with minimum16 nos. E-1 electrical tributary interfaces & minimum 16 nos. Ethernet interfaces. The equipment shall provide access to full STM-16payload. .							
1.3.1.2	Redundancy and Protection Two fibre rings shall be implemented wherever the network permits. On linear sections of the network, protected links using 4 fibres shall be implemented.							
1.3.1.3	Service Channel Service channels shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Muldem's that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and one data channel. There shall be a facility to extend the line system order-wire to any other system or exchange lines.							
1.3.1.4	Supervision and Alarms ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784. Additionally, F2/Q2 interfaces for a local craftsman terminal interface and remote equipment monitoring is required. The Equipment shall support collection of at least four (4) external alarms for monitoring and control of station.							
1.3.1.5	Synchronisation The equipment shall provide synchronisation as per Table 2-3. One 2MHz synchronisation output from each equipment shall be provided.							
1.3.1.6	Electrical and Optical I/O Characteristics and General Parameters Table 2-3 provides the electrical and optical characteristics as well as other general parameters for SDH equipment. <table><tr><th colspan="2">Table 2-3 Electrical and Optical I/O Characteristics and General Parameters</th></tr><tr><td>Optical Wavelength NOTE (1)</td><td>1310/1550nm</td></tr></table>				Table 2-3 Electrical and Optical I/O Characteristics and General Parameters		Optical Wavelength NOTE (1)	1310/1550nm
Table 2-3 Electrical and Optical I/O Characteristics and General Parameters								
Optical Wavelength NOTE (1)	1310/1550nm							
TALCHER THERMAL POWER PROJECT STAGE-II (2x660MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART B BID DOC.NO.:CS:4540-001A- 2 - -	ANNEXURE –I TO SUB_SECTION B_13	PAGE 7 OF 16					

CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.3.2.1			
	Optical Source NOTE (2)	Laser	
	Optical Source Lifespan	Better than 5 X105 hours	
	Optical Fibre Type	G.652 D	
	Optical Connectors	Type FC-PC	
	Transmission Quality	Per ITU-T G.821, G.823, G.826	
	Source Primary Power	-48 Vdc	
	Equipment Specifications	Per ITU-T G.783	
	Tributary, Electrical Interface	Per ITU-T G.703, 75	
	Ethernet Interface	10/100 Mbps	
	SDH Bit Rates	Per ITU-T G.703	
	Optical Interfaces	Per ITU-T G.957, G.958	
	Frame and Multiplexing Structure for SDH	Per ITU-T G.707	
	Synchronization	Per ITU-T G.813 Ω	
	Management Functions	Per ITU-T G.774, G.784	
	Protection Architectures	Per ITU-T G.841	
	Built In Testing and Alarms	Per ITU-T G.774, G.783, G.784	
	NOTE (1) Optical wavelength shall be finalised during detailed engg NOTE (2) Eye Safety for Laser Equipment: To avoid eye damage, when a receiver detects a line interruption, it is required that the optical power of the laser shall be reduced to safe limits on the transmitter in the opposite direction as per ITU-T G.958. NOTE (3) In case other than FC-PC connector is provided in the equipment, suitable patch cord with matching connector are to be provided to connect with FODP.		
	FODP to SDH Equipment		
	The Contractor shall be responsible for connectivity between the FODP and the SDH equipment. The Contractor shall provide FC PC coupled patch cords. The patch-cord length between the FODP & equipment rack shall be suitably protected from rodents, abrasion, crush or mechanical damage.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.4 1.4.1 1.5 1.6 1.6.1	DDF and Cabling For the purposes of the specification, the contractor shall provide cabling, wiring and DDF patching facilities to the wideband telecommunications system. Equipment and material components for DDF and cabling are also part of this procurement. It shall be the Contractor's responsibility to provide all cable support required for full supplied equipment interconnection and shall be in accordance with communications industry standard practices and the requirements mentioned in the technical specifications. Digital Distribution Frame Functional Requirements The Contractor shall provide DDF for Digital Signal Cross connect (DSX) Broadband-quality (better than 20 MHz) patching facilities configured "normally-thru" with Equipment, Line and Monitor Patch Jacks. DDFs shall provide the following basic functions: (i) "Normally thru" circuit routing (ii) Circuit rerouting via patch cord assemblies (iii) Circuit disconnect and termination All DDFs shall be sized and equipped to support the offered configuration of the provided equipment. Independent Transmit and Receive patch jack assemblies (line and equipment) shall provide for separate transmit and receive single-plug patching. Transmit and receive patch jack assemblies shall be located side-by-side such that dual-plug patch cord assemblies may be used to route both transmit and receive for the same circuit. Patch Cords The Contractor has to supply FC PC coupled Patch cords. The Patch cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB. Craft terminal based /Telecommunication Management Network/Network Management System Each equipment on the fibre optic communication network shall include provision for connecting a portable personal computer (PC) to be known as craft terminal to support local commissioning and maintenance activities. Through the use of this PC and local displays/controls, the operator shall be able to: a. Change the configuration of the station & the connected NEs. b. Perform tests c. Get detailed fault information The craft terminal shall be connected to the interface available in the communication equipment. Portable (laptop) computers (Craft terminals), each complete with necessary system and application software to support the functions listed above, shall be supplied to the employer. Hardware Requirements - Craft Terminal Craft Terminal shall be a laptop. The craft terminal shall have minimum configuration of 2.4 GHz, 2 GB RAM, 256 MB Video Graphics Memory, DVD RW drive, 160 GB Hard Disk Drive, keyboard, mouse etc., LAN port, serial/USB (2.0) ports to accommodate printers, and Data/Fax modem and a battery back-up of at least 60 minutes. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.6.2	General Software/Firmware Requirements Due to various alternative design approaches, it is neither intended nor possible to specify all software and firmware characteristics. It is the intent herein to provide design boundaries and guidelines that help to ensure a demonstrated, integrated program package that is maintainable and meets both hardware systems requirements and the customer's operational requirements.		
1.6.3	Operating System Software Operating system software shall be provided to control the execution of system programs, application programs, and management devices, to allocate system resources, and manage communications among the system processors. The contractor shall make no modifications to the OEM's operating system, except as provided as USER installation parameters.		
1.6.4	Applications Software All applications software shall be written in a high-level programming language unless developed using industry proven application programs and development tools provided with the system. The contractor shall make no modifications to the applications program except as provided as USER development tools.		
1.6.5	Software Utilities A utility shall be provided to convert all reports into standard PC application formats such as excel.		
1.6.6	Revisions, Upgrades, Maintainability All firmware and software delivered under this specification shall be the latest field proven version available at the time of contract approval. Installed demonstration for acceptance shall be required. All firmware provided shall support its fully equipped intended functional requirements without additional rewrite or programming. All software shall be easily user expandable to accommodate the anticipated system growth, as defined in this specification. Reassembly recompilation or revision upgrades of the software or components of the software, shall not be necessary to accommodate full system expansion.		
2.0	Software provided shall be compliant with national and international industry standards. List of Type Tests Test reports for following type tests shall be submitted . Reports / Certificates of tests conducted in accredited Laboratories (accredited by the national accrediting body of the country where the lab is located) are also acceptable. (a) SDH Equipment with all types of cards (optical card & Tributary card)		
2.1	List of type test to be conducted on Telecom equipment The type tests for SDH Equipment with all types of cards are described below:		
2.1.1	Temperature and Humidity Tests The tests listed below are defined in IEC Publication 60068. (a) Low Temperature Test: Operation to Specifications		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एन टी पी सी NTPC
	Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications: (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for sixteen (16) hours. Its performance is checked during the test. (2) Degree of Severity: Test shall be done at 0°C (3) Acceptance Criteria: No degradation of performance during and after the test. (b) Low Temperature Test : Operation without Damage Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications: (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 72 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (<i>Post-test</i>). (2) Degree of Severity: Test shall be done at -10° C (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the <i>post-test</i>. (c) Dry Heat Test: Operation to Specifications Dry heat test shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications: (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test. (2) Degree of Severity: As per table 3-1: operation to specification range. (3) Acceptance Criteria: No degradation of performance during and after the test. (d) Dry Heat Test: Operation without Damage Dry heat tests shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications: (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (<i>Post-test</i>). (2) Degree of Severity: Test shall be done at 55°C. (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the <i>post-test</i>.			
TALCHER THERMAL POWER PROJECT STAGE-III (2x660MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART B BID DOC.NO.:CS:4540-001A-2	ANNEXURE –I TO SUB SECTION B-13	PAGE 11 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS						
2.1.2	(e) Damp Heat Test Damp heat testing reveals aging with respect to the humidity level and applies basically to electronic equipment. This test shall be done as defined in IEC Publication 60068-2-78 with the following specifications: (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 10 days. Its performance is checked during the test. (2) Degree of Severity: Test shall be done at $(40 \pm 2) ^\circ\text{C}$ & $(93 \pm 3) \% \text{ RH}$ (2) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.						
	(f) Temperature Variation Test Temperature variation testing shall be as per IEC Publication 60068-2-14 (Gradual Variations, Method Nb). The equipment shall be powered on and various parameters shall be monitored continuously during the test period. (1) Number of cycles required is five (5) (2) The degree of severity: temperature TL:0°C, TH: As per table 3-1 (Operation to specification range) (3) Cycle duration for each temperature is three (3) hours. (4) Ramp : 1 oC/minute. (5) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.						
	Power Supply and EMI/EMC tests The test procedure and acceptance criteria shall be as defined in IEC 60870-2-1.						
	(a) Immunity Tests The list of Immunity tests are specified below in Table 4-4:						
	Table 4-4: Recommended Immunity Tests						
	S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
	1	Voltage Fluctuations	Yes	Yes	N/A	N/A	Table 11 of IEC 60870-2-1: 1995 - Level : 1
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CLAUSE NO.	TECHNICAL REQUIREMENTS					
						
2	Voltage dips and Interruptions	Yes	Yes	N/A	N/A	
3	1.2/50 - 8/20 μ s surges	Yes	Yes	Yes	N/A	Table 12 of IEC 60870-2-1: 1995 - Level : 4
4	Fast transient bursts	Yes	Yes	Yes	Yes	
5	Damped oscillatory waves	Yes	Yes	Yes	Yes	
6	10/700 μ s surges	N/A	N/A	N/A	Yes	
7	Electrostatic discharge	Yes				Table 13 of IEC 60870-2-1: 1995 - Level : 4
8	Power frequency magnetic field	Yes				Table 14 of IEC 60870-2-1: 1995 - Level : 4
9	Damped oscillatory magnetic field	Yes				
	Table 4-4: Recommended Immunity Tests					
S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control Signal & Telecom Line	Para-metres	
10	Radiated electromagnetic field	Yes				Table 15 of IEC 60870-2-1: 1995 - Level : 4
11	Power Frequency voltage on control and signal lines	N/A	N/A	Yes	Yes	IEC 61000-4-16 : 2002-07 Level : 4
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CLAUSE NO.	TECHNICAL REQUIREMENTS						
12	DC voltage on control and signal lines	N/A	N/A	Yes	N/A	IEC 61000-4-16 : 2002-07 Level : 4	
	(b) Emission Tests The list of Emission tests are specified below in Table 4-5						
	Table 4-5: Recommended Emission Tests						
S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para- metres	
1	LF disturbance voltages CCITT recommendation P.53	N/A	Yes	N/A	N/A	Table 17 of IEC 60870-2-1: 1995 - Class : B	
2	RF disturbance voltages CISPR 22	Yes	Yes	N/A	N/A		
3	RF disturbance currents CISPR 22	N/A	N/A	N/A	Yes		
	Table 4-5: Recommended Emission Tests						
S. NO.	Emission test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para- metres	
4	RF radiated fields CISPR 22	Yes					
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
2.1.3	(c) Insulation Withstand Voltages As per section 6 of IEC 870-2-1. Recommended class : VW1 of Table 18. Mechanical Tests (a) Mechanical Vibration Test The procedure for this test is described in IEC Publication 60068-2-6. The testing procedure shall be carried out in the sequence 8.1 + 8.2.1 + 8.1 as described in document 60068-2-6. For the vibration response investigation (clause 8.1 of 60068-2-6), the test shall be carried out over a sweep cycle under the same conditions as for the endurance test (described later), but the vibration amplitude and the sweep rate may be decreased below these conditions so that the determination of the response characteristics can be obtained. The endurance test conditions are selected according to the vibration withstand requirements. Transportation tests shall be performed with the equipment packed according to the Contractor's specifications. (b) Shock Test The procedure of this test is defined in IEC Publication 60068-2-27 (each test) with a semi-sinusoidal shape (clause 3.1.1.2). The recommended severity shall be A = 294 m/s², D = 18 ms. Three shocks per axis per direction shall be applied to the equipment packed according to the Contractor's specifications. Or Free Fall Test This test could be performed as an alternative to the shock or Bump test. The procedure is defined in IEC publication 60068-2-32. The equipment shall be packed according to the Contractor's specifications. The drop height shall be defined in accordance with IEC 68-2-32. The surface of the packing case which comes into contact with the ground is the surface on which the packing case normally rests; if the packing does not have any features (inscription, special shape, etc.) identifying this surface, the test is carried out successively on all the surfaces of the packing. Or Bump Test This test could be performed as an alternative to Shock test or Free Fall test. The procedure is defined in IEC 60068-2-29. Hands-on training shall be provided to O&M personnel at site .		
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Optical Fibre & Approach Cable Parameters

1. Required Optical Fibre Characteristics

The optical fibre to be provided should have following characteristics :

1.1 Physical Characteristic

Dual-Window Single mode (DWSM), G.652D optical fibres shall be provided in the fibre optic cables. DWSM optical fibres shall meet the requirements defined in Table 1-1(a) :

1.1.1 Attenuation

The attenuation coefficient for wavelengths between 1525 nm and 1575 nm shall not exceed the attenuation coefficient at 1550 nm by more than 0.05 dB/km. The attenuation coefficient between 1285 nm and 1330 nm shall not exceed the attenuation coefficient at 1310 nm by more than 0.05 dB/km. The attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 dB. The fibre attenuation characteristics specified in table 1-1 (a) shall be "guaranteed" fibre attenuation of any & every fibre reel.

Table 1-1(a)
DWSM Optical Fibre Characteristics

Fibre Description:	Dual-Window Single-Mode
Mode Field Diameter @ 1310nm:	8.6 to 9.5 μm ($\pm 0.6\mu\text{m}$)
Cladding Diameter:	125.0 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field concentricity error	$\leq 0.6\mu\text{m}$
Cladding non-circularity	$\leq 1\%$
Cable Cut-off Wavelength λ_{cc}	$\leq 1260 \text{ nm}$
1550 nm loss performance	As per G.652 D
Proof Test Level	$\geq 0.69 \text{ Gpa}$
Attenuation Coefficient:	@ 1310 nm $\leq 0.35 \text{ dB / km}$ @ 1550 nm $\leq 0.21 \text{ dB / km}$
Chromatic Dispersion; Maximum:	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm 1300 to 1324nm 0.092 ps/(nm ² xkm) maximum
Zero Dispersion Wavelength: Zero Dispersion Slope:	
Polarization mode dispersion coefficient	$\leq 0.2 \text{ ps/km}^{\wedge 1/2}$
Temperature Dependence:	Induced attenuation $\leq 0.05 \text{ dB}$ (-60°C to +85°C)
Bend Performance:	@ 1310 nm (75 $\pm$ 2 mm dia Mandrel), 100 turns; Attenuation Rise $\leq 0.05 \text{ dB/km}$ @ 1550 nm (75 $\pm$ 2 mm dia Mandrel), 100 turns; Attenuation Rise $\leq 0.10 \text{ dB/km}$ @ 1550 nm (32 $\pm$ 0.5 mm dia Mandrel, 1 turn; Attenuation Rise $\leq 0.50 \text{ dB/km}$

2 Fibre Optic Approach Cables

A fibre optic approach cable is defined as the Armoured underground fibre optic cable required to connect Overhead Fibre Optic Cable (OPGW) between the final in line splice enclosure on the gantry / tower forming the termination of the fibre cable on the power line and the Fibre Optic Distribution Panel (FODP) installed within the building.

2.1. Basic Construction

The cable shall be suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways.

2.2 Jacket Construction & Material

The Approach Cable shall be a UV resistant, rodent proof, armoured cable with metallic type of armouring. The outer cable jacket for approach cable shall consist of carbon black polyethylene resin to prevent damage from exposure to ultra-violet light, weathering and high levels of pollution. The jacket shall conform to ASTM D1248 for density.

2.3 Optical, Electrical and Mechanical Requirements

Approach cable shall contain fibres with identical optical/ physical characteristics as those in the OPGW cables. The cable core shall comprise of tensile strength member(s), fibre support/bedding structure, core wrap/bedding, and an overall impervious jacket.

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EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-01	VI/B	A-20				C&I Annexure I to Sub Section A-20 has been enclosed as “Annexure I_C&I” to this amendment
C-02	VI/A	II-B	5 of 17	1.08.00 (u)	Supply and Installation of Robotic cable tray cleaning. Refer IIIC-19 chapter in C&I part B for technical details and specifications.	Deleted

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS		
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.				
C-03	VI/B	IIIC-12	4 of 6	3.01.00				
					Requirements	Total Iron (Fe)	Requirements	Total Iron (Dissolved+ Un-dissolved with digestion system)
					Type	Continuous Flow Through sample	Type	Continuous Flow Through sample
					Accuracy	<±5 % of reading or ±0.005 ppm	Accuracy	<±5 % of reading
					Response Time (90 % of Full Scale)	≤ 15 min. (including sample switching)	Response Time (90 % of Full Scale)	≤ 30 min. (including sample switching)
					Range	0-50ppb, 0-150ppb, 0-300ppb, 0-1ppm, 0-5ppm freely programmable or as per the process requirement.	Range	2-500ppb freely programmable or as per the process requirement.
					No. of Streams	Multi stream with sequencer/ stream selector (min. 4streams)	No. of Streams	Multi stream with sequencer/ stream selector (min. 4streams)
					Temperature Compensation	Automatic	Temperature Compensation	Automatic
					Sample Flow	200ml/min (max)	Sample Flow	200ml/min (max)
					Analog output	4-20 mA output to DDCMIS	Analog output	4-20 mA output to DDCMIS
								

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<u>STOCKYARD MANAGEMENT SYSTEM</u> 1.00.00 General Requirements Stockyard management system shall provide Real Time Monitoring/operation of Stacker Reclaimer, Material tracking, Stock Profiling and 3D visualization including coal quality management, detection of Hotspot and automatic operation of Stockpile Sprinklers and S/R ready for unmanned operation. The Contractor shall provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications. Stockyard management system shall consist of the following systems : a) 3D Coal Stockpile Mapping and Visualization b) Hotspot Detection and Automatic Sprinkler Operation c) Ready for Unmanned operation of S/R. 2.00.00 3D Coal Stock-Pile Mapping and Visualization • 3D stockyard profiling system provided by Contractor shall primarily be either Laser based, or Radar based, or both Laser and Radar based in order to provide complete coal stockpile mapping. • System shall provide recording of material movement to and from stockpile, shape of the profile, distribution of material over the profile as the machine moves for performing stacking or reclaiming operation. The scanner(s) must be able to scan the stockpile while machine travelling with the boom centered over the yard conveyor. The data thus gathered shall be stored in a database and would be updated with each movement. • The system should present live update of stockyard inventory to the operator in CHP Control Room and E-house with an overview of all stock piles at Stock yard, Height Map of the Stockpiles, Slice View, Customized views creation, material ageing to enable FIFO / LIFO method of operations. Further, it shall provide reservations feature in yard for High GCV coal. It shall also have the feature of Mass Volume Balancing to enable proper reconciliation of Coal Tonnage and allow the operator to do manual corrections for Wind/Air/Rain impact and seasonal variations if any. • Material ageing system should further provide information to the operator time stamped data of the material stacked, material reclaimed and balance material available in Stockyard in different color formats so as to distinguish between new and old coal available in Stockyard. • System shall have capability to fill in data for stockyard areas which aren't available for direct scan (shadow area) with high end data modelling techniques. • Lifetime license version of operating system, Stockpile viewing software, along with any other software required for proper operation of the system. • Software shall have facility to correct maps/images manually (i.e. manual override) with higher privilege level. • 3D Stockyard Image Verification and Volumetric measurement accuracy shall be in the range of +/- 10%. System shall provide suitable interface with S/R PLC and CHP DDCMIS for complete control and operation of the machine. 3.00.00 Hotspot Detection and Automatic Sprinkler Operation 1. Hotspot Detection cameras shall be based on Infrared Thermal Imaging Technology. 2. No. of cameras, masts location etc. shall be planned such that they cover more than 90 % of the coal piles and shall be finalized during detailed engineering. Camera should be capable to detect hot spot patch of 0.3 x 0.3 mtr, effectively with correct temperature measurement having accuracy of +/- 2% of measured value or better.		
TALCHER TPP STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.:	C&I ANNEXURE TO SUB- SECTION-A-20 COAL & BIOMASS HANDLING PLANT	PAGE 1 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	3. Thermal Images of all the installed cameras should be seen live on server screen. Operator should be able to see temperature of any and every spot by moving mouse cursor on thermal image for manual image analysis purpose. Thermal images should be saved automatically with temperature details in event of alarm. Alarm will be raised based on user defined temperature threshold setting. This alarm shall be immediately recorded in stockyard management system and in CHP DDCMIS. 4. Entire coal pile area to be divided into zones/sub-zones and alarm should be raised with location information to ensure pin pointed and fast action. The zones shall be limited to maximum of 10MX10M for ease of location. 5. Lifetime license version of operating system, application software along with any other software required for proper operation of the system shall be provided. 6. Automatic Solenoid sprinklers (of Stainless Steel material) based plain water sprinkler system operation shall be integrated with Hot spot detection system specified above. Group of Sprinklers identified in this system should start automatically based on fire alarm generated by Hot spot detection system. Separate PLC for performing the input and output operation for controlling the Sprinklers is to be provided by the Contractor under this system located at CHP control room.			
4.00.00	Readiness for Unmanned Operation of S/R 1. Stockyard Management system shall be capable to provide unmanned operation of Stacker / Reclaimer from the CHP control room, away from the machines so that stacker / reclaimer can be operated fully automatically from remote or local in manual mode. 2. Once an order have been scheduled, the automation system must be able to locate the machine to the correct position and execute the full order without any operator actions. 3. The Automation system shall provide a "Machine Simulator" functionality which can mimic any of the system implemented machines and pre-execute order scheduling information to validate operator inserted order information. 4. The simulator must be able to provide tonnage estimates for simulated stacking/reclaiming orders and show stacking/ reclaiming pattern movements. 5. Positioning system should have proper safety interlocks for safe unmanned operation of the stacker reclaimer. 6. The stacker / reclaimer machine shall ensure safe operation in all modes. Accordingly, the unmanned operation of the stacker/ reclaimer machine along with necessary sensors/ systems shall comply to SIL2 safety level. 7. System should provide the accuracy of +/-10% of the order value (in TPH) for unmanned operation. 8. System shall be capable of stacking and reclaiming from all the positions (pile Start/intermediate/end) of the identified pile. 9. System shall be designed to operate inside covered stockyard without interruption and communication breakdown.			
6.00.00	Operating modes for S/R Machine in Stockyard Management System Following Operating modes shall be provided in this system: Manual Mode: An operator should be able to control the stockyard machine locally from the onboard cabin. Safety devices or functions such as Anti-collision avoidance system and overload protection as well as all necessary interlocks must remain active in this mode and assure suitable safety level for people and other machines. Automatic Mode: Stacking and reclaiming process in this mode shall be performed from the central control room based on the available information from the instruments i.e., piles location and scanning data, algorithms, parameters inputted by an operator or other required information. All protections and interlocks of S/R machine shall be seamlessly integrated with the system.			
7.00.00	Features of Automatic operation The system must use the surface profile from the obtained terrain model acquired using 3D scanning technology, to take into account already existing material when planning new			
TALCHER TPP STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.:	C&I ANNEXURE TO SUB- SECTION-A-20 COAL & BIOMASS HANDLING PLANT	PAGE 2 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	stacking operations. The automatic stacking operation must allow for stacking operation to continue on existing piles (where possible) for stacking in extension, on top or next to an existing pile. The system must provide continuously updated estimates for the remaining tonnage available for current stacking order. While reclaiming the system shall ensure that the reclaiming bucket is at least 80%full. System shall have adequate built in intelligence for Un-commanded movement detection so that the system is able to detect uncommand movements due to malfunctions of PLC or other controls for e.g. variable frequency drives (VFDs) etc., in order to prevent accidents. Encoders, inclinometers, limit switches and other back up devices shall also be provided so as to bring the machine to parking position in case failure of positioning system. System must take into account the scanned surface profile of the stockyard to calculate potential collision points to avoid collisions of the boom against the pile, Machine to Machine collision, Machine to any personnel etc. If any additional instrument/ system is required to implement anti-collision system, then same shall be provided in this package.			
8.00.00	CCTV The cameras provided for the system shall be colored, suitable for day and night operation and network compatible & with Full HD resolutions. PTZ cameras shall be high speed integrated dome type. Minimum 4 nos. of cameras per S/R shall be provided covering the complete S/R and stockyard, however the exact location shall be finalized during detailed engineering after checking the coverage. Basic Video analytics features e.g. Object identification based on shape, big boulders, sharp metal objects etc. should also be provided			
9.00.00	Interfacing with Other Systems and Packages at Site The system shall be interfaced with CHP DDCMIS, the Station LAN and other third party systems as required. It shall be capable to exchange data via web services. It shall be able to interface with ERP system available with Employer and help in planning and procurement of Coal.			
10.00.00	System Hardware Following system hardware / equipment for Stockyard Management System shall be provided but not limited to: • Redundant servers with suitable networking components and ports for interfacing various systems, for stockyard management system • Redundant PLC system along with HMI for Stacker/ Reclaimer. • PLC for Automatic Sprinkler system located in CHP control room • Separate Operator work Stations (OWS) of size 21” in Control Room and S/R operating cabin for 3D profiling, unmanned operation and Hotspot Detection. • Suitable furniture & control desk shall be provided to be located in CHP control room. • UPS power supply in redundant configuration along with distribution and cabling shall be provided for the system by the Contractor • All the clamps and fixtures of the sensors for Anti-Collision, Wireless Antennas, Limit switches, Boom Boxes, Scanners etc. shall be suitably designed such that they are shock proof and are suitable for dusty environment like Coal Stockyard. All the sensors shall be mounted inside protective cover as required.			
11.00.00	Online Healthiness Monitoring of Bearings & Gearboxes of Stacker & Reclaimer Machine For online monitoring of healthiness of bearings and gearboxes of Stacker and Reclaimer machines a real time health monitoring system shall be installed on the Stacker Reclaimer machines. The system shall at all the times provide the operator a health report card of all major drives / equipments of the S/R machine in form of a report / alarms. The system shall be capable of providing predictive information of all incipient failures in bearings and gearboxes at a very initial stage so that the same can be identified at its initial stage and attended / arrested.			
TALCHER TPP STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.:	C&I ANNEXURE TO SUB- SECTION-A-20 COAL & BIOMASS HANDLING PLANT	PAGE 3 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
12.00.00	Comprehensive Annual Maintenance Contract The contractor shall provide comprehensive Annual Maintenance Contract (AMC) for 3 years after completion of defect liability period (warranty).This shall cover total maintenance of hardware & software related to Stockyard Management System & shall include free repair/replacement of all components/cables/equipment etc. In case, any part of the system/ equipment is to be taken out for servicing / calibration etc., then substitute equipment / device shall be available at plant up to end of AMC period so that at no stage operation of Stacker / Reclaimer machine and Stockyard management system is affected in anyway. The above shall also include provision of software updates for software & database servers including OS security updates & firmware upgrades. During AMC period, the contractor's engineers shall reach site within 48 hours of reporting of the complaint.		
13.00.00	Site Acceptance test All the systems specified herein shall be fully integrated i.e. 3D profiling, Thermal imaging, S/R PLC, GPS etc. Further other systems like CHP DDCMIS, Solenoids of Sprinkler System, station LAN, Employer ERP system shall also be interfaced to make system complete. Stacker/ Reclaimer shall be commissioned along with all sensors/ systems like anti-collision, GPS, Laser/ Radar sensors for 3D profiling etc. and should be operational both in manned and unmanned modes of operation. When above conditions are ready, the SAT shall be conducted for 7 days to demonstrate all the specified features as per SAT procedure finalized during detailed engineering. OEM expert of each system shall be available at site during complete Site Acceptance Test.		
14.00.00	Training The contractor shall include training for all the systems at the OEM works. The training shall include design, installation and commissioning, operation, programming/configuration and diagnostic/ troubleshooting aspects of the hardware and software being supplied in this package.		
TALCHER TPP STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.:	C&I ANNEXURE TO SUB- SECTION-A-20 COAL & BIOMASS HANDLING PLANT
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Specification Reference					Existing	Read As
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.		
D1-1	VI/A	I	7 of 8	4.10.00	The Contractor shall also jointly facilitate in resolution of Land Acquisition issues related to the Project. Any due payments arising out of the Land Acquisition process shall however be paid by NTPC to the appropriate Authorities. The vendor / contractor shall visit the site to ascertain the position of land acquisition etc. and it is presumed that the contractor submitted his bid after considering the facts on the ground and that once vendor / contractor is successful in his bid, he will work in cooperation with the client for smooth execution of the project.	The vendor / contractor shall visit the site to ascertain the position of land acquisition etc. and it is presumed that the contractor submitted his bid after considering the facts on the ground and that once vendor / contractor is successful in his bid, he will work in cooperation with the client for smooth execution of the project.
D1-2	VI/A	IA	36 of 37	9.0	Bidder shall have the option of awarding the BOP system(s) on EPC basis to qualified sub vendor(s). The qualified sub-vendor(s) for BOP EPC shall meet the following requirements: The BOP EPC sub vendor should have executed on Engineering, Procurement and Construction (EPC) basis, minimum one (1) no. coal based/Lignite based power plant of at least 500 MW unit capacity comprising of at least a) Coal/Lignite handling plant, b) Cooling Tower, c) Water / waste water treatment plant or DM plant ,including associated civil works, Structural and Electrical systems for the above equipment(s) and systems as a single package, which is in successful operation for a period of not less than one (1) year prior to the date of techno-commercial bid opening. The BOP EPC sub vendor shall source the equipment(s)/ Sub system(s) from such qualified vendors who meet the provenness requirements as stipulated in technical specification for the respective equipment(s)/ Sub system(s).	Bidder shall have the option of awarding the BOP system(s) on EPC basis to qualified sub vendor(s). The qualified sub-vendor(s) for BOP EPC shall meet the following requirements: The BOP EPC sub vendor should have executed on Engineering, Procurement and Construction (EPC) basis, minimum one (1) no. coal based/Lignite based power plant of at least 500 MW unit capacity comprising of at least a) Coal/Lignite handling plant, b) Natural Draught Cooling Tower, c) Water / waste water treatment plant or DM plant ,including associated civil works, Structural and Electrical systems for the above equipment(s) and systems as a single package, which is in successful operation for a period of not less than one (1) year prior to the date of techno-commercial bid opening. The BOP EPC sub vendor shall source the equipment(s)/ Sub system(s) from such qualified vendors who meet the provenness requirements as stipulated in technical specification for the respective equipment(s)/ Sub system(s).
D1-3	VI/A	IID	3 of 13	1.00.00	b. Dismantling of facilities at Sl. No. 4(a)-xv is in employers scope.	b. Dismantling of facilities at Sl. No. 4(a)-xv is in employers scope. However dismatling, clearance and disposal of substructure of these facilities is in bidder's scope.
D1-4	VI/A	IID	3 of 13	1.00.00	d. ETP Facility at Sl No. 4(a)-xvi shall not be dismantled. Same is to be utilized for Stage-III.	d. Dismantling of ETP facility at Sl No. 4(a)-xvi is in bidder's scope.
D1-5	VI/A	IID	3 of 13	1.00.00	j. Demarcation between township and stage-III in the scope of bidder. It is to be done at the beginning of works.	j. Demarcation by providing temporary fencing between township and stage-III is in the scope of bidder. It is to be done at the beginning of works. Construction of boundary wall in between township and Stage-III is also in bidder's scope.

D1-6	VI/B	D-1-5	64 of 120	5.17.05.07	(i) The tower shall be provided with two numbers external FRP Staircase , leading to a heavy duty door giving access to the distribution system. Staircase shall be minimum 1000 mm wide (clear), with landings of minimum width of 1000 mm at not more than 2500 mm height intervals unless approved otherwise. The steps shall have a rise of about 175 mm and tread of about 250 mm. Anti - skid nosing at each step shall be provided	(i) The tower shall be provided with two numbers external RCC Staircase , leading to a heavy duty door giving access to the distribution system. Staircase shall be minimum 1000 mm wide (clear), with landings of minimum width of 1000 mm at not more than 2500 mm height intervals unless approved otherwise. The steps shall have a rise of about 175 mm and tread of about 250 mm. Anti - skid nosing at each step shall be provided
D1-7	VI/B	D-1-5	64 of 120	5.17.05.07	Walkways and platforms, atleast two in each orthogonal direction, shall be provided inside the tower at distribution pipe level. walkways shall be at least 1000mm wide with 50 mm (minimum) safety kerbs along each edge. These walkways and platforms shall provide safe and clear access to all sprayers and all distribution pipes. A FRP platform of 1500 mm clear width shall be provided around the tower periphery which will be a means of access to next walkways and all end valves. Access ways shall be clear of all obstructions such as distribution pipe support beams, drift eliminator support beams, etc. The walkways shall be provided with transverse slots or other opening which will permit the free passage of air and water. FRP handrails shall be provided on all sides of over ground platforms and around hot water basin and cold water outlet.	Walkways and platforms, atleast two in each orthogonal direction, shall be provided inside the tower at distribution pipe level. walkways shall be at least 1000mm wide with 50 mm (minimum) safety kerbs along each edge. These walkways and platforms shall provide safe and clear access to all sprayers and all distribution pipes. A RCC platform of 1500 mm clear width shall be provided around the tower periphery which will be a means of access to next walkways and all end valves. Access ways shall be clear of all obstructions such as distribution pipe support beams, drift eliminator support beams, etc. The walkways shall be provided with transverse slots or other opening which will permit the free passage of air and water. FRP handrails shall be provided on all sides of over ground platforms and around hot water basin and cold water outlet.
D1-8	VI/E				Drg No. 4540-001-POC-A-007 Rev-A “RAW WATER RESERVOIR LAYOUT”	Drg No. 4540-001-POC-A-007 Rev-B “RAW WATER RESERVOIR LAYOUT”
D1-9	Section-VI/Part-B	D-1-5	97 OF 120	5.23.02	At the location where the overhead conveyor gallery crosses road / rail line, <u>minimum clearance of 8.0m above the road crest / rail top</u> shall be provided.	At the location where the overhead conveyor gallery crosses road / rail line, minimum clearance of 8.5 m above the road crest / rail top shall be provided..
D1-10	Section-VI/Part-B	D-1-5	104 OF 120	5.23.17.01	Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the owner's coal slurry settling pond.	Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the coal slurry settling pond .

D1-11	Section-VI/Part-B	D-1-5	107 OF 120	5.23.20.2	The grade slab shall consists of 230 mm thick rubble soling (63 mm downgraded hard stone aggregate as per IRC specification, watering and compaction to minimum of 90% Standard Proctor density, including filling the interstices of stone aggregates with sand), over well compacted earth, overlaid by 75 mm thick P. C. C. M-7.5 and 100 mm thick RCC of grade M-20 with minimum 8 mm dia bars placed at 200 mm C / C in either direction respectively. There will be minimum 50 mm thick metallic hardener finish over the RCC slab. All buildings (including Wagon Tippler and machinery hatches, truck hopper, penthouse, MCC rooms, pump houses, transfer houses and crusher house) and ground conveyors shall be provided with 750 mm wide plinth protection all around. It consists of 50 mm thick P.C.C. M-20 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed, consolidated and grouted with fine sand. An area of 5 m width all round the water tanks near pump house, transfer houses and crusher house, Gypsum storage shed, truck tippler area, lime storage silo shall be paved. This paving will be in addition to plinth protection. The paving construction shall be as per specifications for the grade slab at ground level. However, 50 mm thick metallic hardener finish is not required to be provided in paved area. Paving shall also be provided in HGTU and VGTU	The grade slab shall consists of 230 mm thick rubble soling (63 mm downgraded hard stone aggregate as per IRC specification, watering and compaction to minimum of 90% Standard Proctor density, including filling the interstices of stone aggregates with sand), over well compacted earth, overlaid by 75 mm thick P. C. C. M-7.5 and 100 mm thick RCC of grade M-25 with minimum 8 mm dia bars placed at 200 mm C / C in either direction respectively. There will be minimum 50 mm thick metallic hardener finish over the RCC slab. All buildings (including Track Hopper and machinery hatches, truck hopper, penthouse, MCC rooms, pump houses, transfer houses and crusher house) and ground conveyors shall be provided with 750 mm wide plinth protection all around. It consists of 50 mm thick P.C.C. M-25 grade with 12 mm maximum size aggregate over 200 mm thick stone soling using 40 mm nominal size rammed, consolidated and grouted with fine sand. An area of 5 m width all round the water tanks near pump house, transfer houses and crusher house, Gypsum storage shed, truck tippler area, lime storage silo shall be paved. This paving will be in addition to plinth protection. The paving construction shall be as per specifications for the grade slab at ground level. Paving shall also be provided in HGTU and VGTU
D1-12	Section-VI/Part-B	D-1-6	8 OF 24 102 OF 120	6.03.08 5.23.12	The loads for all railway load bearing structures e. g. wagon tippler, tunnel, culverts and underground transfer houses etc. and the analysis and the design of these structures shall be made strictly in accordance with the provisions of Indian Railway Bridge rules (latest edition), and Indian Railway Codes of practice (latest edition) with all amendments up to the date of opening of bids. The axle load for analysis and design shall be considered as "DFC loading (32.5t axle load)" of Heavy mineral loading as per Indian railway standard. Coal heap of 1.2m height shall be considered above hopper top for design of hopper and supporting elements of wagon tippler.	The loads for all railway load bearing structures e. g. Track hopper, tunnel, culverts and underground transfer houses etc. and the analysis and the design of these structures shall be made strictly in accordance with the provisions of Indian Railway Bridge rules (latest edition), and Indian Railway Codes of practice (latest edition) with all amendments up to the date of opening of bids. The axle load for analysis and design shall be considered as "DFC loading (32.5t axle load)" of Heavy mineral loading as per Indian railway standard. Coal heap of 1.2m height shall be considered above hopper top for design of hopper and supporting elements of Track hopper.

D1-13	Section-VI/Part-B	D-1-6	9 OF 24 102 OF 120	6.03.08 5.23.12	For design of all underground structures / foundations, ground water table shall be assumed at the formation level (i. e. the adjoining ground level).For all underground structures like wagon tippler, tunnels and underground transfer points crack width shall be restricted to 0.2 mm.	For design of all underground structures / foundations, ground water table shall be assumed at the formation level (i. e. the adjoining ground level).For all underground structures like Track hopper , tunnels and underground transfer points crack width shall be restricted to 0.2 mm..
D1-14	VI/ Part-B				Service Building Architectural Features This building shall be four storeyed (Ground + 3 stories above) and shall be provided with floor area of 3700 sq.m with RCC framed structure. Autoclave Aerated Concrete Block masonry wall shall be provided for the full height of the building for both external and internal walls. Floor-to-floor height shall be minimum 4.25m.	Service Building Architectural Features This building shall be five storeyed (Stilt + 4 stories above) and shall be provided with floor area of 3700 sq.m with RCC framed structure. Autoclave Aerated Concrete Block masonry wall shall be provided for the full height of the building for both external and internal walls. Floor-to-floor height above the stilt floor shall be minimum 4.25m. Height of stilt floor shall be 8 meters (clear)
D1-15	VI/ Part-B	D-1-5	45 of 120	5.12.04	Fuel Oil Unloading Pump House Fuel Oil Unloading Pump house shall be a covered building with RCC columns and Structural Steel Roof truss (with rafter and tie level plan bracings), purlins and roof slab. The roof slab shall comprise minimum 40 mm thick (above the crest of metal deck sheet) RCC slab supported on profiled metal deck. 250mm thick external brick wall shall be provided with provisions for fire proof door, windows & rolling shutters.	Fuel Oil Unloading Pump House Fuel Oil Unloading Pump house shall be a covered building with RCC columns and Structural Steel Roof truss (with rafter and tie level plan bracings), purlins and roof slab. The roof slab shall comprise minimum 40 mm thick (above the crest of metal deck sheet) RCC slab supported on profiled metal deck. One Brick thick external brick wall shall be provided with provisions for fire proof door, windows & rolling shutters.
D1-16	VI/ Part-B	D-1-5	47 of 120	5.14.00	GATE COMPLEX Gate Complex shall include Central Industrial Security Force (CISF) building. The CISF Building shall be a two (2) storied RCC super structure with office complex in ground floor & first floor. The building shall be constructed with 250mm thick brick wall with provisions for doors, windows & ventilators.	GATE COMPLEX Gate Complex shall include Central Industrial Security Force (CISF) building. The CISF Building shall be a two (2) storied RCC super structure with office complex in ground floor & first floor. The building shall be constructed with One Brick thick brick wall with provisions for doors, windows & ventilators.
D1-17	VI/ Part-B	D-1-5	102 of 120	5.23.12	Staircases All stairs of over ground portion of transfer houses & crusher house shall be of steel (minimum 1200 mm wide) and maximum rise should not be more than 180 mm and minimum tread width 250 mm.	GATE COMPLEX All stairs of over ground portion of transfer houses & crusher house shall be of steel (minimum 1200 mm wide) and maximum rise should not be more than 180 mm and minimum tread width 275 mm.
D1-18	VI/ Part-B	D-1-5	1/2 of 31	9.03.01	Water Supply and Sanitation Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc. Service water tank shall be of RCC construction.	Water Supply and Sanitation Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc. Service water tank shall be of RCC construction. In Service Building, Administration Building, Canteen Building Roof water Tank shall be of RCC.

D1-19	VI/ Part-B	D-1-5	9 of 31	9.08.06	Pre-Fabricated Insulated Metal Sandwich Panels For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels before starting sheeting work at site.	Pre-Fabricated Insulated Metal Sandwich Panels For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels before starting sheeting work at site. The insulation shall be of Polyurethane type. The polyurethane shall be Chlorofluorocarbon (CFC) free and self-extinguishing and shall conform to IS 12436: 1988. It shall have Modular Density 40 +/- 2 Kg/m3 and Thermal Conductivity @ 10 Deg.C 0.017 - 0.020 W/M Ok, Water absorption (% by vol) 3.1, Critical Oxygen Index 23 and Compressive Strength 1.2 Kg/sq.cm.
D1-20	VI/ Part-B	D-1-5	11 of 120	5.2.09	Main Power House iii Architectural Features B Row portion in TG Hall fronting Control Room & CER and glazed partitions in CER/ CCR/Offsite Control room shall be of 25 mm thick Hermetically sealed double glass of Fire resistant of min 11mm thick clear, toughened, interlayered 120 minute fire rated for both integrity & radiation control and 6 mm thick toughened tinted glass with 8 mm gap and with suitable fire resistant frame of 1.6 mm thick powder coated steel sheet. Mullion-less charged glass wall shall be provided in between the control room and the Visitor's gallery.	Main Power House iii Architectural Features B Row portion in TG Hall fronting Control Room & CER and glazed partitions in CER/ CCR/Offsite Control room shall be of 30 mm thick Hermetically sealed double glass of Fire resistant of min 14mm thick clear, toughened, interlayered 120 minute fire rated for both integrity & radiation control (EW 120) with symmetrical (Bi-Directional) fire protection and 6 mm thick toughened tinted glass with 10 mm gap and with suitable fire resistant frame of 1.6 mm thick powder coated steel sheet Mullion-less glass wall with motorized curtain shall be provided in between the control room and the Visitor's gallery.

D1-21	VI/ Part-B	D-1-9	14 of 31	9.12.06	Internal glazed partition, 8mm thick clear toughened glass shall be provided.	Internal glazed partition, 8mm thick clear toughened glass shall be provided. Internal Glazed partition in in MPH shall be Vetrotech Saint-Gobain fully glazed fire rated fixed partition with 120 minutes of integrity and radiation control (EW 120) with symmetrical (Bi-Directional) fire protection. The frames shall be cold rolled profiles As per EN standard EN 10327/Indian Standard (IS 513) . The frames are cold rolled from 1.5 mm steel sheet to form a profile of 50 mm x 50 mm on all sides. he system shall be tested as per EN 1364-1/(Indian Standards) IS 16945:2018 in an accredited laboratory. The glass shall be Contraflam Lite 14mm (MADE IN INDIA)clear 120 min fire rated for Integrity, Radiation control (EW 120) and partially insulation (EI 20) Non Wired Toughened Interlayered glass with a light transmission of 86% and a sound reduction of 38 dB and manufactured in UL & TUV audited Facility and including UL-EU Certification and compliant to class 1(B)1 category of Impact Resistance as per EN 12600. The glass shall be tested and certified for no formation of bubbles or yellowing after 5000 hours of exposure to UV radiation by TUV Rheinland as per EN 12543-4 The glass shall provide bi-directional (Symmetrical) fire protection. The base glass and processed glass must be made in INDIA. The glass shall be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on non-combustible 5 mm Calcium Silicate setting blocks. The maximum glazing size shall be as per the test certification. The profile has to be fixed to the supporting construction by means of M10 or bigger steel bolts at every 150 mm from the edges and every 500 mm (approx.) c/c. The Partitions shall offer C4 level of wind resistance when tested as per EN12211 and shall provide class 4 level of air permeability as per EN 1026. The Partitions shall also be tested for class 5 of impact resistance when tested as per EN 13049. The Partitions shall also be tested for class 4 level of Mechanical strength when tested as per EN13115. The Partitions shall have water tightness level of 8A when tested as per EN 1027. Partitionr shall be of Makes - Saint Gobain,Acodora , IGI , Matrix ,Tata Pravesha.

D1-22	VI/ Part-B	D-1-9	14 of 31	9.11.11	Electrically operated, self operable/closing, aluminium framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building.	Electrically operated, self operable/closing, aluminium framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building. At the entrance of all common control rooms in MPH G.I. framed with fire resistant glass, sliding doors shall be provided. The other doors in common control rooms in MPH shall be G.I. framed with fire resistant glass as per fire zoning .FIRE RESISTANT GLAZED DOOR SYSTEM shall be of UNIFORM PROFILE 50X50 mm with 14mm EI 20 GLASS For Interior Application FIRE RESISTANT GLAZED DOOR SYSTEM shall have 120 minutes of integrity and radiation control (EW 120) with symmetrical (Bi-Directional) fire protection. The frames shall be cold rolled profiles as per EN standard EN 10327/ Indian Standard IS 513 . The door frames are cold rolled from 1.5 mm steel sheet to form a profile of 50 mm x 50 mm on all sides. The door shutter shall have the top rail, side rail and bottom rail dimensions of 50 mm x 50 mm. The overall door opening shall be as per tested evidence and tested as per EN 1634-1/ ISO 834-1 / ISO 3009 /(Indian Standard) IS 16947:2018 in an accredited laboratory. The glass must be minimum 14mm clear (MADE IN INDIA)120 min fire rated for Integrity, Radiation control (EW 120) and partially insulation (EI 20) Non Wired Toughened Interlayered glass with a light transmission of 86% and a sound reduction of 38 dB and manufactured in UL & TUV audited Facility and including UL-EU Certification and compliant to class 1(B)1 category of Impact Resistance as per EN 12600. The glass shall be tested and certified for no formation of bubbles or yellowing after 5000 hours of exposure to UV radiation by TUV Rheinland as per EN 12543-4.The base glass and finished glass must be made in India . The shutters shall be fixed to the frame using Weld-on hinges of dimensions 179mm X 20mm. The profiles shall have grooves to incorporate Fire Resistant gaskets. The glass shall be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on non-combustible 6 mm Calcium Silicate setting blocks. The door shall be fitted with offset pull handle and door closer of Dorma (TS 73V, TS 83V, TS93V), Geze (TS 2000NV) or equivalent. The inactive leaf (in case of double leaf only)shall be fixed to the frame using a tower bolt at meeting edge at top or as per the tested evidence. The doors shall be manufactured in a TUV audited facility. The maximum glazing size shall be as per the test certification. The profile has to be fixed to the supporting construction by means of M10 or bigger steel bolts at every 150 mm from the edges and every 500 mm (approx.) c/c. The doors shall offer C4 level of wind resistance when tested as per EN12211 and shall provide class 4 level of air permeability as per EN 1026. The door shall also be subjected to durability tests as per EN 12400 for C5 classification (200,000 cycles). The doors shall also be tested for class 5 of impact resistance when tested as per EN 13049. The doors & partition shall also be tested for class 4 level of Mechanical strength when tested as per EN13115. The door shall have water tightness level of 8A when tested as per EN 1027. Fire Rated Door shall be of Makes- Saint Gobain, Acador , IGI, Matrix.

D1-23	VI/ Part-B	D-1-5	48 of 120	5.15.00 & 5.16.00	Watch Towers & Safety Park Building	Table-A Changed in subsection D-1-9
	VI/ Part-B	D-1-5		5.26.00 & 5.27.00	Canteen & Fire Station Building	Table-A Changed in subsection D-1-9
	VI/ Part-B	D-1-9	19 of 31	9.17.00 Table A	Toilet False ceiling - Main Power House building	Table-A Changed in subsection D-1-9
	VI/ Part-B	D-1-9	25 of 31	9.17.00 - Table A - 05	Fire Water Pump House - Not used	Table-A Changed in subsection D-1-9
	VI/ Part-B	D-1-9	26 of 31	9.17.00 - Table A - 07	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Ash Water recirculation Pump House/ Transport air compressor house/ HCSD pump house/Fuel Oil Unloading Pump House with switchgear building& control room /H2 generation Building/ Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Pump house, Switchgear room, control room/Any other Building	Table-A Changed in subsection D-1-9
D1-24	VI/ Part-B	Section- D-1-5	38 of 120	5.05.15	Architectural Features of Ash Handling and Ash Water Recirculation System Buildings a. All buildings shall be fully covered with brick masonry cladding and Aluminium and Steel doors/ windows/ rolling shutters / ventilators. b. Safety norms shall be followed as applicable. The buildings shall be provided for Pump houses, Switch Gear Room, Control Room etc. as per ash handling system requirements	Architectural Features of Ash Handling and Ash Water Recirculation System Buildings a. Building shall have Aluminium and Steel doors/windows/ rolling shutters / ventilators. b. Safety norms shall be followed as applicable. The buildings shall be provided for Pump houses, Switch Gear Room, Control Room etc. as per ash handling system requirements

D1-25	VI/ Part-B	Section- D 1-9	6 of 31	9.07.04	For ESP Control Room Building, wall shall be of Autoclaved Aerated Concrete Block. Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of 625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part III).The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in IS 6041 – 1985, IS - 1905.	For ESP Control Room Building, wall shall be of Autoclaved Aerated Concrete Block. Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of 625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part III).The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in IS 6041 – 1985, IS - 1905. For control room , control equipment room in MPH Building , walls shall be of factory made composite modular light weight aerated concrete panels,(minimum 2 hours of fire rating) consisting of 2 fiber reinforced cement sheets (minimum 4 mm thick) on either side of light weight concrete core, having minimum compressive strength of 35 Kg / Cm2 and the density in the range of 700-900 Kg. / cu.m. of the thickness and fire rating as specified below, to provide external wall and internal partition at all levels, capable of sustaining wind pressure of 3.00 M height (H) within limiting deflection of span/250, fixed in position in tongue and groove jointing system by screwing the panels to top and bottom U channels, (channels minimum 1.25 mm thick and galvanised to grade 180 (minimum) as per IS : 277), fixing U profiled top and bottom channels to concrete / primary steel members which are placed at the maximum vertical spacing of 4.5m with the help of galvanised steel expansion fasteners, filling the joints from both faces with silicon acrylic paste and making the same water tight by covering with fibre glass tape (minimum 50 mm wide and minimum 0.5 mm thick) or by any other suitable material, so as to ensure that the entire construction done with the light weight aerated concrete panels are weather proof and panel surfaces are flush for painting, creating opening for doors / windows /ventilators / ducts / pipes/fans/AC etc. and finishing the opening face with the same U profiled galvanized steel channel which is used at the top and bottom.
D1-26	VI/B	D-1-5	37 of 120	5.05.09	All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method excepted by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines. The railway track crossings are to be designed in accordance with railway Standard/RDSO guidelines and all necessary approvals from the concerned Railway authorities shall be obtained by the Bidder, without any financial implications to the owner.	All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method accepted by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines. The railway track crossings are to be designed in accordance with railway Standard/RDSO guidelines and all necessary approvals from the concerned Railway authorities shall be obtained by the Bidder, without any financial implications to the owner.

D1-27	VI/B	D-1-5	40 of 120	5.07.00	SEWERAGE SYSTEM: Complete sewerage system including Sewage Treatment Plant for facilities within the plant is in bidder's scope. Bidder shall provide 'De-centralized Sewage Treatment' units. The capacity of the Decentralized Sewage Treatment units should be as per the design requirements, subject to minimum combined capacity of 75 Cum/day. Design of Sewage treatment plant shall be as per CPHEEO manual. Primary, Secondary and Tertiary treatment to be provided. Cement concrete pipes of class NP-3 as per IS 458 shall be used below ground level for sewage disposal in all areas other than main plant area. However, for pressure pipes and in main plant areas, and under roads spun Cast Iron pipes conforming to IS 1536 of required class shall be used. RCC manholes with CI cover shall be provided at every 30m along the length, at connection points, and at every change of alignment, gradient or diameter of a sewer pipeline. This shall be as per IS 4111. Sewage pump stations shall be provided as per IS 4111. BIDDER SHALL HAVE TO PROVIDE COMPLETE ARRANGEMENT for sewage disposal up to the sewage treatment plant including pumping facilities.	SEWERAGE SYSTEM: Complete sewerage system including Sewage Treatment Plant for facilities within the plant is in bidder's scope. Bidder shall provide 'De-centralized Sewage Treatment' units. The capacity of the Decentralized Sewage Treatment units should be as per the design requirements, subject to minimum combined capacity of 75 Cum/day. Design of Sewage treatment plant shall be as per CPHEEO manual. Primary, Secondary and Tertiary treatment to be provided. Treated sewage water shall be used for horticulture purpose as per quality requirement of CPHEEO manual. Cement concrete pipes of class NP-3 as per IS 458 shall be used below ground level for sewage disposal in all areas other than main plant area. However, for pressure pipes and in main plant areas, and under roads spun Cast Iron pipes conforming to IS 1536 of required class shall be used. RCC manholes with CI cover shall be provided at every 30m along the length, at connection points, and at every change of alignment, gradient or diameter of a sewer pipeline. This shall be as per IS 4111. Sewage pump stations shall be provided as per IS 4111. BIDDER SHALL HAVE TO PROVIDE COMPLETE ARRANGEMENT for sewage disposal up to the sewage treatment plant including pumping facilities.
D1-28	VI/A	IID	3 of 13	1.00.00	5. Construction of Raw Water Reservoir and dismantling, removal, disposal of waste material of existing reservoirs and levelling to FGL.	Construction of Raw Water Reservoir and dismantling, removal, disposal of waste material of existing reservoirs and levelling to FGL. The interconnection of Stage -III reservoir inlet pipe with existing MUW pipe line of Stage-II & I including booster pump, if required, shall be under Bidder's scope.
D1-29	VI/B	D-1-12(P)			Annexure-P	Annexure-P
D1-30	VI/E	Tender Drawings			4540-001-POC-A-006, Rev 0	4540-001-POC-A-006, Rev 1
D1-31	VI/B	D-1-6	11 of 24	6.03.08.18	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter. Edge protection angles shall be provided as specified elsewhere	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter or 6mm flats . Edge protection angles shall be provided as specified elsewhere
D1-32	VI/B	D-1-5	11 of 127	5.02.09	Windows on south side at accessible level at operating floor level shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting.	Deleted
	VI/B	D-1-5	13 of 127	5.02.10	Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting.	Deleted
	VI/B	D-1-5	114 of 127	5.30.00	Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing. The glazing area shall be increased accordingly for proper lighting.	Deleted
D1-33	VI/B	D-1-5	83 OF 127	5.19.02.02.01	The tank foundation shall be as per IS:803 and as specified in Cl. No.7.01.04.	The tank foundation shall be as per IS:803 and as specified in relevant clause of foundation chapter.

D1-34	VI/E	Tender Drawings			4540-999-POC-F-001	4540-999-POC-F-001
D1-35	VI/A	IID	12 of 13	2.02.00	2. Construction Power Scope of supply of construction power is specified in SECTION – VI, PART-B, SUB SECTION B-19 of Technical specification.	2. Construction Power Scope of supply of construction power is specified in SECTION – VI, PART-B, SUB SECTION B-18 of Technical specification.
D1-36	VI/A	IID	11 of 13	2.01.00	a)Development of Bidders temporary staff colony and labour colony along with toilets & fencing etc. Bidder may use Area-A for Labour Colony. For safety of labour, bidder to provide separate approach road for their movement, as per site conditions, which shall be completely isolated from material movement road/path. No material movement shall be allowed on approach road meant for Labour colony.	a)Development of Bidders temporary staff colony and labour colony along with toilets & fencing etc. Bidder shall use Area-A for Labour Colony. For safety of labour, bidder to provide separate approach road for their movement, as per site conditions, which shall be completely isolated from material movement road/path. No material movement shall be allowed on approach road meant for Labour colony.
D1-37	VI/A	IID	13 of 13	2.03.00	DEVELOPMENT OF LAYDOWN AREA IN ABANDONED ASH DYKE Bidder shall use abandoned ash dyke as a Lay down area. Details of proposed laydown area along with approach to laydown area is indicated in Annexure-J of Part-B (Civil works). Three areas marked as ‘A’, ‘B’ and ‘C’ totalling 70 acres (approx.) are identified as laydown /preassembly area. Fencing of the laydown area and raising/lowering of 33kV line in the area marked for laydown is in Owner’s scope. Construction of wire fencing in the proposed laydown area shall be completed within 4 months from NOA. Contractor can do the site preparation work parallelly.	DEVELOPMENT OF LAYDOWN AREA Bidder may use abandoned ash dyke as a Lay down area and/or any other area arranged by him in the vicinity of the project site. The area used for laydown has to be developed as per requirement inline with technical specifications. Details of proposed laydown area in abandoned ash dyke along with approach to laydown area is indicated in Annexure-J of Part-B (Civil works). Areas marked as ‘B’ and ‘C’ totalling 55 acres (approx.) are identified as laydown /preassembly area. Fencing of the laydown area and raising/lowering of 33kV line in the area marked for laydown is in Owner’s scope. Construction of wire fencing in the proposed laydown area shall be completed within 4 months from NOA. Contractor can do the site preparation work parallelly.

D1-38	VI/B	D-1-5		5.25.00	O&M WORKSHOP BUILDING The O&M Workshop Building shall be a two bay fully covered building. The two bays shall comprise of workshop bay and office complex bay. The minimum span of workshop bay shall be 25m with RCC columns with structural steel roof truss and purlins supporting pitched roof. Roofing shall be permanently colour coated insulated sandwiched metal roofing sheet. The Gantry girder for the EOT crane in the workshop building shall be structural steel plate girder supported on RCC corbels at column locations. The gantry girder shall be complete with chequered plate walkways (at both sides) and the cage ladder. The Central Workshop Building shall be designed considering EOT crane of 50T capacity. The adjacent Office Complex bay shall have RCC superstructure. The minimum bay width shall be 6.50m. Architectural Features: The building shall be fully covered with brick wall masonry in office portion. For workshop portion brickwall shall be provided upto lintel level and permanently colour coated insulated sandwiched metal cladding sheet above lintel level upto the roof. Provision of doors, windows & Rolling shutters shall be included based on architectural detailed drawing to be developed by the bidder. The rainwater down comers shall be provided at every column location and they shall be suitably connected to the building surface drain. The minimum operating floor area for the workshop bay shall be 20mX50m. The minimum head room of workshop bay shall be evaluated by the bidder based on approved EOT Crane Clearance diagram and crane rail level. The office complex shall be 6.50mX110m in plan area. The office complex shall be made 2 storied for adequate space for operating personnel, MCC room, stores, Laboratories, Toilets, Conference room & Tool room. The floor to floor/ roof clear height shall be 4.50m.	O&M WORKSHOP BUILDING The O&M Workshop Building shall be a two bay fully covered building. The two bays shall comprise of workshop bay and office complex bay. The minimum span of workshop bay shall be 20m with RCC columns with structural steel roof truss and purlins supporting pitched roof. Roofing shall be permanently colour coated insulated sandwiched metal roofing sheet. The Gantry girder for the EOT crane in the workshop building shall be structural steel plate girder supported on RCC corbels at column locations. The gantry girder shall be complete with chequered plate walkways (at both sides) and the cage ladder. The Central Workshop Building shall be designed considering EOT crane of 50T capacity. The adjacent Office Complex bay shall have RCC superstructure. The minimum bay width shall be 6.50m. Architectural Features: The building shall be fully covered with brick wall masonry in office portion. For workshop portion brickwall shall be provided upto lintel level and permanently colour coated insulated sandwiched metal cladding sheet above lintel level upto the roof. Provision of doors, windows & Rolling shutters shall be included based on architectural detailed drawing to be developed by the bidder. The rainwater down comers shall be provided at every column location and they shall be suitably connected to the building surface drain. The minimum operating floor area for the workshop bay shall be 20mX50m. The minimum head room of workshop bay shall be evaluated by the bidder based on approved EOT Crane Clearance diagram and crane rail level. The office complex shall be 6.50mX50m in plan area. The office complex shall be made 2 storied for adequate space for operating personnel, MCC room, stores, Laboratories, Toilets, Conference room & Tool room. The floor to floor/ roof clear height shall be 4.50m.

D1-39	VI/B	D-1-5	64 of 120	5.17.05.03	Exterior surfaces of cooling tower shell and all surfaces of raker columns shall be given three coats of waterproof cement paint of approved make and colour. No painting is envisaged for internal surfaces of cooling tower shell and internal grillage columns and beams.	Exterior surfaces of cooling tower shell and all surfaces of raker columns shall be given three coats of waterproof cement paint of approved make and colour. All concrete surfaces below Eliminator level such as internal surface of CT shell, all surfaces of raker columns, beams & internal columns, platforms, walkways and any other RCC/PCC components shall receive high build heavy duty polyurethane coating having formulation of 100 % solids, solvent free after grit blasting of the concrete surface. Thickness of polyurethane coating shall be 2.0 mm. Suitable primer as per standard practice/manufacturers' recommendation shall be used. The detailed specification of the coating system on concrete surfaces is given in Annexure Q.

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
1.	Main power house Building.			
	a) Unloading Bay	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Cable vault	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	c) Balance area including passage	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	d) SWAS Room	Matt Finished Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns upto false ceiling level	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	e) Equipment Area, ESP SWGR/ ACP Room/ UAF Room	Cement concrete with Metallic hardener topping	Acrylic distemper.	Acrylic distemper (except metal deck area)
	f) UPS Battery charger room	Matt finished Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns upto false ceiling level	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	g) Deaerator floor	Cement concrete with Metallic hardener topping.		-

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	h) Operating Floor	20 mm thick heavy duty anti skid full body vitrified tile in TG Hall. Rubber flooring at TG deck.	Colour coated Metal cladding on A-Row& Gable end, up to crane girder level.	Metal deck roofing (bottom of sheeting with RAL 9002 finish)
	i) General circulation and movement areas	20 mm thick heavy duty anti skid full body vitrified tile		Acrylic distemper (except metal deck area).
	j) Switchgear room	Heavy duty tiles (Cement Concrete tiles 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)
	k)MCC Room	Heavy duty tiles (Cement Concrete tiles 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)
	l) Control room area including control room	Matt Finish Vitrified ceramic tiles flooring of size 1000 x1000 mm	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Designer metal false ceiling

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	m) control equipment room,	Matt finish Vitrified ceramic tiles.	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Designer metal false ceiling
	n)Conference room, senior executive room., Computer Room	Matt finish Vitrified ceramic tiles	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Designer metal false ceiling
	o)Record room	ceramic tiles	Acrylic distemper.	Designer metal false ceiling
	p)Locker room	Ceramic Tiles	Acrylic Emulsion Paint	Allu Designer metal false ceiling
	q)Toilet area	ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Calcium Silicate False Ceiling

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	r) Office Room, Staff Room	Matt Finished Vitrified ceramic tiles.	Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	s)Laboratory area	Vitrified Ceramic / Acid/alkali resistant tiles.	Designer ceramic wall tiles up to False Ceiling Height/ Aluminium composite panel cladding for columns and walls in case of A.C Panel	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	t) RCC Stair case	18mm thick Granite (Polished and honed Finished) stone	Polished Granite Stone up to 1.2m. ht. & Acrylic Distemper Paint over wall putty finish for balance height.	Acrylic Distemper
	u) Lift and Staircase Lobby	18mm thick polished granite stone as pattern.	18mm thick polished granite & glass mosaic tile cladding up to False Ceiling Height	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	v) Passages and general circulation areas.	Deleted	Deleted	Deleted

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	w) Battery Room	Acid and alkali resistant tile.	Acid and alkali resistant tile up to 1.2m height and chemical resistant paint for balance height	Chemical Resistant paint except in locations where Metal deck has been provided
	x) Oil canal, oil room, oil purification Tank and other areas where oil spillage is likely to occur.	Oil resistant paint (epoxy based) 150 micron over primer.	As above except oil canal Oil resistant Paint	As above except oil canal.
	y) Pathways including roof area.	22mm thick concrete chequered tiles.	-	-
2.	Service Building/Administration Building			

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	a) Entrance Lobbies and Lift areas/Foyer/Exhibition space.	18mm thick polished granite stone as/ pattern.	Combination of 18mm thick polished granite cladding, lacquered glass cladding and Fiber Reinforced Plastic murals based on local art in lift lobby & foyer	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	b) Conference room, senior executive room.	11 mm thk. Laminated wooden flooring	Glazed partition with Aluminium frame/ Acrylic emulsion paint.	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design.
	c) Office Room, Staff Room	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint./ Designer Glass mosaic tile mural in combination with textured paint in Canteen	Mineral fiber board false ceiling in combination with GRG plaster board border in column depth or as per approved design
	d) Passage	Digitally glazed Vitrified ceramic tiles.	Acrylic emulsion paint.	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	e) RCC Stair case	18mm thick Granite (Polished and Honed Finished) stone	Glass Mosaic Tile cladding in murals and pattern based on local art upto ceiling level	Acrylic Distemper.
	f) Toilet/ Pantry/ Kitchen	ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Acrylic distemper in kitchen / Calcium Silicate false ceiling in toilet and pantry
	g) AHU/ A.C. Plant room/MCC Room/Store	Cement concrete with Metallic hardener topping.	Acrylic distemper / Wall insulation in AHU as per HVAC Requirement	Acrylic distemper / Underdeck insulation in AHU as per HVAC Requirement
	h) Stilt parking area	Cement concrete with Non-Metallic hardener topping.	-	-
	i) Pathways including roof area.	22mm thick concrete chequered tiles.		
3	ESP control building/Air compressor house			
	a) Operating/Maintenance areas	Cement concrete with Metallic hardener topping	Pre color coated metal panel cladding.	Acrylic distemper (except metal deck area)

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	b) Office Room, Staff Room	Digitally glazed Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns	Mineral fiber Board False Ceiling
	c) Control Room	Digitally glazed Vitrified ceramic tiles.	Aluminium composite panel cladding on walls and columns in ESP Control Room Building	Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design
	d) MCC Room	Heavy duty tiles (Cement Concrete 300mmx300mm)	Acrylic distemper	Acrylic distemper (except metal deck area)
	e) RCC Stair case	18mm thick Granite (Polished and Honed Finished) stone	Polished Granite stone up to 1.2m.ht. & Acrylic Distemper	Acrylic Distemper (except metal deck area)
	f) Battery Room	Acid, Alkali resistant tile	Acid, Alkali resistant tile 1.2m height / chemical resistant paint above dado	Chemical resistant paint (except metal deck area)
	g) AHU/ AC Plant room/ Cable vault	Cement concrete with Metallic hardener topping	Acrylic Distemper	Acrylic Distemper (except metal deck area)
	h) Toilets	ceramic tiles.	Designer ceramic wall tiles dado up to false ceiling level.	Calcium silicate false ceiling.

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
4.	Mill & Bunker building/ T.P.s / Conveyor Galleries	Cement concrete with Metallic hardener topping	Acrylic distemper on masonry walls/ color coated Metal panel cladding	color coated Metal panel cladding
5.	Canteen Building			
	Dining area/ billing counter/ waiting area			
	Preparation area/wet storage area/ Serving area/ Pot cleaning area	Ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2200	Acrylic distemper
	Dry storage area/Gas storage	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	Toilet/Hand wash	Ceramic tiles.	Digitally glazed ceramic wall tiles dado up to false ceiling level	Acrylic distemper
6.	Fire water pump house/ Fire water booster water pump house.			
	a) Maintenance /Pump floor/PLC	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Control room /PLC.	Matt Finished Vitrified Ceramic Tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling.

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	Toilet area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2200 mm	Acrylic distemper
7.	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Ash Water recirculation Pump House/ Transport air compressor house/ HCSD pump house/Fuel Oil Unloading Pump House with switchgear building& control room /H2 generation Building/ Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Pump house, Switchgear room, control room/Any other Building..			
	a) Operating/Mainte nance areas/ MCC room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	b) Control room /PLC /Office area.	Matt Finished Vitrified Ceramic Tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling.
	c) Toilet/Pantry area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2200 mm	Acrylic distemper
8.	Fire Station Building		.	
	Fire tender area/ storage area	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	Office area, rest rooms, locker room	Matt Finished Vitrified Ceramic Tiles	Acrylic emulsion paint.	Mineral fiber board false ceiling.
	Toilet/Pantry area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2200 mm	Acrylic distemper
9.	O&M store building/Dozer Shed			
	a) Stores/dozer shed	Cement concrete with Metallic hardener topping.	Acrylic distemper/ color coated Metal panel cladding	Acrylic distemper (except metal deck area)

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	b)Office Room, Staff Room/ Electronic Store	Matt Finished Vitrified ceramic tiles.	Acrylic emulsion paint.	Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area
	c)Passages	Matt Finished Vitrified Ceramic Tiles	Acrylic distemper	Acrylic distemper
	d)RCC Stair case	18mm thick polished Marble stone finish.	Marble stone up to 1.2m.ht. & Acrylic Distemper above.	Acrylic Distemper
	e) Toilets	ceramic tiles.	Designer ceramic wall tiles dado up to 2.1 m Height from FFL.	Acrylic distemper
10	Rest Room for O&M Workers			
	Rest room	Cement concrete with Metallic hardener topping.	Acrylic distemper	Metal roof

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	Toilets	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above	Metal roof
10	Occupational Health Centre with Crèche Facilities			
	a)Waiting Lobby cum Reception/ Doctor's Chamber /First Aid Room/ Patient Room	Matt finish vitrified tiles	Acrylic Emulsion paint	Acrylic Emulsion paint
	b)Driver's Room	Digitally Glazed vitrified tiles	Acrylic Distemper Paint	Acrylic Distemper Paint
	c)Toilet area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to false ceiling level.	Calcium Silicate False Ceiling

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	Creche	5 mm thick vinyl flooring	Glass mosaic tiles in murals & patterns and Acrylic Emulsion Paint	Acrylic Emulsion paint
11	Watch Tower			
	Viewing area	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper

- Note :
1. All wall and roof areas above false ceiling shall be plastered.
 2. The colour and pattern of finish shall be as per approved details.
 3. All materials shall be of reputed and established brand approved by Engineer-in-charge.
 4. Wherever alternative materials are specified, the final selection rests with Engineer-in-charge.
 5. This finishing schedule shall also be applicable to similar functional areas for all other buildings and facilities.
 6. All the finishing materials shall be applied/provided as per manufacturer specification and guidelines under the supervision & guidelines of manufacturer.
 7. Requirement given above are suggestive and minimum. Bidder is welcome to suggest alternative scheme conforming to design functional requirement subject to approval of the Engineer-in-charge.

Annexure-P

Details of facilities to be dismantled

Sl. No.	Name of facility	Total No. of Units	Plinth Area per Unit {Sq.m.}	Total Plinth Area {Sq.m.}	Type of Super-structure	Type of Sub-structure	Storey Configuration	Scope of Dismantling	Facilities envisaged under TTPS Stage-III	Type & Present Location of facility
1	E-type & F-type Qrts in BHEL sector	39	150	5850	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	PT Plant	Residential facilities in Township area
2	4R3/4 - Temp Sector	1	620	620	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
3	3R21/22 - Sector 2	1	350	350	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
5	2R 49-68 - Sector 2	5	190	950	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Bay	
6	2R 69-108 - Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - tranformer Yard & FO Handling area	
9	1R type - Sector 2	16	220	3520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	FO handling area, Aux. Boiler, CT & Switchyard	
10	2RB type - Setor 3	4	140	560	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Admin Building area	
11	C 3/4 - Sector 1	1	220	220	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
12	C9-12 - Sector 3	2	220	440	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Admin Building area	
13	D type 9-13/21-32 - Sector 3	5	300	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Switchyard	
14	2R 7 2RA - Sector 4	15	200	3000	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Construction Office & Workshop	
15	3R 1-16 Sector 2	8	350	2800	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Hall & FO handling area	
16	3R 17-21/ 62-65	4	350	1400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
17	NC 1-4 Temp sector	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
18	ND 1-8 Temp sector	8	200	1600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
19	E 139-186 Temp sector	8	150	1200	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Track Hopper + Ash Silo	
20	F 1-56 Sector 4	7	300	2100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	BOP Batching Plant area	
21	Club Auditorium	1	698	698	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	Non-residential facilities in Township area
22	Club dining hall	1	556	556	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - ESP	
23	Stadium gallery	1	1170	1170	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Main Plant area - Boiler	
24	POLICE OUTPOST	1	128	128	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
25	Outpost front shop	1	49	49	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
26	Medicine store	1	32	32	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
27	ATM (SBI)	1	15	15	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
28	Cable tv room	1	46	46	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
29	Mangla mandir	1	75	75	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
30	Kalayani Mandap	1	82	82	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
31	shopping centre	1	600	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
33	Durga Mandap	1	575	575	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
37	DAV TT HIGH SCHOOL	1	1410	1410	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
39	LITTLE ANGEL SCHOOL	1	250	250	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
40	DAV TT HIGH SCHOOL	1	1053	1053	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
44	BADMINTON HALL	1	406	406	Structurel Steel with sheet cladding	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - Boiler	
45	OAT Stage	1	298	298	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
46	OLD EWA Building	1	221	221	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
53	RC	1	2880	2880	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
54	Security barrack	1	1084	1084	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	Facilities in Plant area
55	DAV TT H.SCHOOL C.STAND	1	365	365	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area -ID Fan	
58	Vehicle Parking Sheds	1	400	400	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area	
59	Store Sheds	28	640	17920	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Ash handling, TAC,CAC & ESP	
60	Under ground Diesel tank	1	100	100		Under ground RCC sump		Sub-structure	Main Plant - ID fan area	
61	Watch Towers	7	20	140	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Main Plant & CHP area	
62	Admin Building	1	2998	2998	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -CPU area	
63	C&M office Building	1	378	378	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -TAC	
64	Old Admin BUILDING	1	1622	1622	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
65	Safety building	1	103	103	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
66	Weigh Bridge Room	1	40	40	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -TAC	
67	DG room	1	53	53	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
68	plant tea stall	1	86	86	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - Boiler	
69	ETP Building with associated equipments	1	NA	NA	RCC and Brick	RCC	-	Sub-structure and Super Structure	Coal stock Pile	
70	Coal conveyor#16,17,R1,R2,TP#14&10B,stacker cum Reclaimer,stacker,R2 shed	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		
71	Heavy Machinery Shed	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		

SL. NO.**ANNEXURE – Q****SPECIFICATIONS FOR 100% SOLIDS , HIGH BUILD, ELASTOMERIC
POLYURETHANE COATING FOR
CONCRETE IN SEAWATER APPLICATIONS**

- 1.00.00 The coating shall meet minimum requirements for materials, equipment, application, inspection, repair and handling aspects associated with the coating of Concrete In Sea water Applications using 100% Solids (Solventless) Two Component, Fast Curing Elastomeric Polyurethane Coating classified under ASTM D -16, Type V.
- 1.01.00 The polyurethane on the external / internal surface of the Concrete shall provide a hard yet flexible, impermeable barrier with outstanding adhesion impact and abrasion resistance as well as crack spanning capability to protect the Concrete from corrosion and abrasion. It shall cover all variations associated with operating conditions of NDCT.
- 1.02.00 Supplier or his licensed applicator shall obtain prior written approval from the Owner for any deviations from the requirements of this specification and / or the standard referred herein.
- 1.03.00 The work shall conform to following documents (latest revision or as specified) and as referred in this specification.
- a) SSPC-PS Guide 17.00, 1 Aug, 1991 Guide for Selecting Urethane Painting System
 - b) RP 0892-92 NACE International
Linings Over Concrete For Immersion Service
 - c) RP 0187-96 NACE International
Design Considerations For Corrosion Control of Reinforcing Steel In Concrete.
 - d) ASTM D 4541 Method for Pull Off Strength of Coatings Using Portable Adhesion Testers
- 2.00.00 **GENERAL REQUIREMENT**
- 2.01.00 The bidder shall perform all work in accordance with this specification and other requirements noted herein.
- Bidder shall submit a detailed written description in the form of a manual covering coating equipment, procedure, materials, inspection, tests and repair etc, for Owner's approval.
- 2.02.00 The bidder shall also supply copies of test reports conducted by in internationally reputed test agencies evidencing that materials conform to minimum performance requirements. The bidder shall also supply certificates from coating manufacturer as under.

- That the materials (with batch numbers, dates of manufacture and shelf life) are free from all manufacturing defects.
- That the materials will meet performance criteria as given below when applied.
- That the bidder or his applicator possesses the necessary technical skills and equipment to apply these materials and is authorized by the manufacturer for this purpose.

100% Solids, Two Component Polyurethane are specialized coatings characterized by very short pot lives. The coating shall be applied either by the coating material manufacturer himself or by his authorized applicator. The authorized applicator should have been trained and certified by the coating manufacturer and shall possess the necessary specialized equipment, trained crew and experience in spraying fast setting plural component polyurethane coatings. Contractor shall provide, for the owner's approval, details of coating manufacturer's authorized applicator including details of equipment, experience in spraying fast setting 100% Solids Polyurethane Coatings and client references for verification. In no case shall coating application be undertaken by coating contractors without prior track record of applying these materials. In addition, contractor shall provide certificate from coating materials manufacturers that the applicator possesses the necessary technical skills and equipment to apply these materials and is authorized by the manufacturer for this purpose.

2.03.00 Applied coating will be tested for dry film thickness and adhesion and hardness.

All coating operations shall be performed under the supervision of, and performed by, personnel skilled in the application of the coating system.

2.04.00 The bidder shall provide access, during all phases of work, to the Owner and their representatives.

2.05.00 All cleaning, priming and coating machines shall be equipped with rubber or wheels overlaid with hard fiber to prevent damaging the concrete surface.

2.06.00 The materials shall be applied by Airless Spray System, as per the standards specified by the material manufacturer.

2.07.00 100% Solids Polyurethane systems are solvent free eliminating solvent health hazards and flammability concerns All safety precautions warranted by good industrial hygiene practices and regulated by local, state or central laws must be taken into consideration while applying these coatings.

3.00.00 MATERIAL SPECIFICATIONS

3.01.00 ELASTOMERIC POLYURETHANE COATING :

Spray applied, Impermeable, 100% Solids, Elastomeric Aromatic Polyurethane Coating (Non Tar Extended), as per ASTM D-16, Type V (Two Component, Chemical Cure). Shall meet following criteria. All tests at ambient (25 C) unless otherwise specified.

• NOMINAL THICKNESS	2,000 Microns
• TENSILE STRENGTH ASTM D-638	17 N / mm ²
• ADHESION ASTM D-4541 (Elcometer Pull Off)	2 N / mm ²
• RECOVERABLE ELONGATION ASTM D-638	50% Min.
• SURFACE HARDNESS ASTM D 2240 (Cured Film - Shore D)	50 Min.
• WATER VAPOUR PERMEABILITY ASTM E - 96 / F-1249-90	0.3 gms. / 24 Hour / M2 Max.
• RESISTANCE TEMPERATURES	0° C to 60°C
• FLEXIBILITY 180° Bend -1.0 mm thick ASTM D 1737	Pass over 12 mm Mandrel
• ACCELERATED WEATHERING ASTM G – 154 53 / BS 3800 2,000 Hours	Excellent. Some Discoloration.
• ABRASION RESISTANCE ASTM D 4060 /FTMS 141 Taber Abraser H - 10 Wheel 1,000 gms., 1,000 cycles	Weight Loss 0.05 gms. Max
• CHEMICAL RESISTANCE Immersion of 30 days in sea water followed by	
(%) Weight Change	< 1.0 %
(%) Hardness (Shore D) Change	< 5.0 %
(%) Tensile Strength Change	< 5.0 %

3.02.00 **PRIMER**

Primer shall be used on new concrete surfaces before application of PU coating.

Damp tolerant, penetrating, sealing primer shall be applied at 100-125 Microns Wet Film Thickness in accordance with the recommendation of the Polyurethane Coating manufacturer.

4.00.00 **SURFACE PREPARATION**

4.01.00 The bidder shall be responsible for the structural integrity of the concrete.

The use of form release agents shall be compatible to the coating. Contractor shall take measures in concrete casting to provide a suitable surface finish that shall be compatible with subsequent application of coating. The measures shall include providing well compacted, dense concrete with minimal air entrainment and a relatively smooth surface finish. Pond floor shall be vacuum dewatered.

Remove any fins or protrusions using power grinding. These may also be required to be removed for applications requiring an even finish.

Residual bug – holes beneath the surface of the coating shall be opened by sweep blasting and flooded with Polyurethane coating during spray application. Any larger voids shall be filled with Elastomeric Polyurethane hand mix material or compatible grout. Active cracks shall be bridged by using Elastomeric Polyurethane over Industrial Nylon / Polyester Fabric. Any exposed steel surfaces shall be wire brush cleaned and primed before coating application.

- 4.02.00 Exterior waterproofing shall be applied to the structure below the finished ground level and upto atleast 300 mm above it. The structure shall be sealed from the exterior (soil side) to block capillary action of moisture through the concrete. Leaks from groundwater can permeate the entire concrete thickness. The exterior waterproofing system must be suitable for the expected exposure condition.
- 4.03.00 Before general surface preparation, surface contaminants (if any) shall be removed. Oil and Grease shall be removed by multiple detergent wash, preferably using steam. (Solvents shall not be used as they will cause the petroleum products to penetrate the concrete surface). Chemically contaminated concrete shall be neutralized prior to complete surface preparation. Acidic surfaces shall be neutralized using an alkaline cleaner and rinsed with fresh water and then cleaned with steam and detergent. After chemical cleaning, surface will be tested for residual chemicals. pH shall be tested using ASTM D - 4262 using pH test paper on rinse water . Concrete shall be dried thoroughly thereafter.
- 4.04.00 Sweep blast the concrete surface using expendable abrasive. The blast nozzle should be kept at sufficient distance to avoid over blast and exposing of aggregate. Following blasting remove dust using air jet (with the abrasive turned off) .
- 4.05.00 Any of the following methods of surface preparation may be used to achieve a near white blast cleaned surface :
- a) Dry abrasive blasting using compressed air, blast nozzles and abrasive.
 - b) Dry abrasive blasting using a dosed cycle, re-circulating abrasive system, with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.
 - c) Dry abrasive blasting using a dosed cycle, re-circulating abrasive system with centrifugal, wheels and abrasive (such as Wheelabrator).
- 4.06.00 Compressed air used for blast cleaning shall be dean, dry and free of moisture and oil. Moisture separators, oil separators, traps or other equipment may be necessary to achieve dean, dry air.

- 4.07.00 Blast cleaning operations shall be done in such a manner that no damage is done to partially or entirely completed portions of the work.
- 4.08.00 Dry blast cleaning shall not be concluded during times when the surface will become wet after blast cleaning.
- 4.09.00 Non-metallic disposable mineral abrasive such as silica sand shall be the chosen abrasive for open blasting operations. Steel grit and shot are approved abrasive media for blast cleaning in closed cycle, recirculating abrasive systems (compressed air, vacuum and centrifugal wheel) . No other abrasive media shall be used without prior approval.
- 4.10.00 The cleanliness and size of recycled abrasive shall be maintained to ensure compliance with this standard.
- 4.11.00 The blast cleaning abrasive shall be dry and free of oil, grease and other contaminants. Applicator shall use abrasive media of size that will ensure the necessary roughness desired.
- 4.12.00 Dust and residues shall be removed from prepared surface by brushing, blowing off with clean , dry air or vacuum cleaning. Moisture separators, oil separators, traps or other equipment may be necessary to achieve clean, dry air.
- 4.13.00 Prior to the application of Elastomeric Urethane on new concrete surface, sufficient time must pass to allow the excess moisture to evaporate. This time will vary on conditions and is normally 14-28 days. After the curing period has elapsed, concrete must be checked for the presence of excess moisture on and beneath the surface using a Delmhorst BD-8 Moisture Detector. A reading of 2% and under indicates that the concrete is ready to be coated. The moisture content must not only be checked on the surface but beneath it by driving nails 6-12 mm into the concrete and placing the probes on the nail - heads. Alternatively the moisture may be tested by the Plastic Sheet Test ASTM D-4263 . The test involves taping a 450 mm X 450 mm , 0.1 mm thick clear plastic sheet to the surface of the concrete for a duration of 16 hours. Absence of any droplets of moisture underneath the plastic sheet indicates that the concrete is ready for coating.
- In cases of continued ingress of moisture from localised areas of concrete, apply propane blow torch to ensure that the moisture content as specified above is achieved.
- 5.00.00 **PRIMING**
- 5.01.00 Before beginning priming and coating, measure the humidity using a sling psychrometer and calculate the dew point. The relative humidity must be lower than 85%. Temperature of concrete surface must be at least 3°C higher than the dew point. Under controlled conditions, it is possible to heat the concrete surface to eliminate condensation problems.
- 5.02.00 The type of primer used shall be as described in the coating specification 3.02.00.
- 5.03.00 Primer shall be sprayed onto the cleaned surface with a wet film thickness of 75-125 Microns. Since the primer penetrates into the concrete surface, no DFT measurements

will be taken and estimation shall be on volumetric basis. The primer on application shall be free from runs or drips or areas of excessive thickness.

5.04.00 The primed surface shall be protected so that it will not come into contact with rain, dust or other substances until completely hardened and coated with the Elastomeric Polyurethane Top Coat.

5.05.00 Primed surface should be over coated within the time recommended for the approved type of primer. In the event that the re-coat interval of primed surface is exceeded without top-coating with the Elastomeric Polyurethane, the surface must be re-primed.

6.00.00 **COATING**

6.01.00 Nominal thickness of the Elastomeric Polyurethane shall be 2,000 Microns, measured in accordance with 7.02.02. Being a thixotropic, high build, non-levelling coating, the Elastomeric Polyurethane coating shall take the contour / profile of the substrate.

Coating shall be done only at times when the substrates temperature is at least 3°C over the dew point. Hourly measurements of dew point and surface temperatures shall be made prior to and when coating is under progress. Surface temperature should be minimum 5°C and should not exceed 70°C.

6.02.00 Equipment for the spray application shall be in conformity with system specification, meeting minimum specified by the coating manufacturer. Equipment shall consist of Material Feed Pumps, Purge Pump, Proportioning Pump, Mix Manifold, Static Mixer, Interconnecting Hoses etc.

6.03.00 Partially used and unused material drums must be tightly sealed and contain a blanket of nitrogen to prevent moisture contamination when not in use.

6.04.00 Before application on the substrate apply a test patch for runs or drips and gel time as well as tack free time.

6.05.00 The proportioning pump shall be fitted with a numeric counter to keep track of the volume while spraying.

6.06.00 Entire thickness shall be built up in a single application (with a number of passes) . If the surface is large enough to require more than one day for the coating, the edges of the coated areas shall be feathered and roughened with a grinding too) prior to beginning priming and coating.

6.07.00 Areas not to be coated shall be masked with disposable plastic sheets, cardboard etc.

6.08.00 Visual inspection shall be made for film discontinuities such as air bubbles, blowholes, skips, shadows. Such defects will be marked and repaired with Elastomeric Polyurethane hand mix kit with slower pot life after roughening the edges.

7.00.00 **INSPECTION**

7.01.00 All work under this specification shall be subject to inspection by the owner or his representative. All parts of work shall be accessible. The applicator shall correct such work as is found defective and not as per the specifications.

7.02.00 The following tests shall be made :

During coating application the wet film thickness will be measured using Nordson wet Film Gauge as per ASTM D 4414.

7.02.01 Adhesion

Pull Off adhesion to Concrete measured using an portable adhesion tester such as Positest AT-CM Elcometer or equivalent as per ASTM D4541 on fully cured (7 days) concrete. Frequency shall be 3 readings per 1,000 Sq.M of coated area. The average of readings from three ~~five~~ randomly selected areas shall constitute the adhesion and shall be minimum 2 N/mm² (see below). Test area to be flat (without curvature). The following method will be used to determine whether coating meets adhesion requirements

Elcometer Reading	Type of Failure		Result / Conclusion
> 2 N / mm ²	T1	90% or more of break at coating - concrete interface	Coating meets adhesion criteria. Take actual reading of bond strength.
	T2	90% of more of break within the concrete	Concrete Failure. Coating adhesion exceeds 2N/mm ²
< 2 N / mm ²	T1	90% or more of break at coating - concrete interface	Coating does not meet adhesion criteria. Take actual reading of bond strength achieved.
	T2	90% of more of break within the concrete	Concrete lacks sufficient strength to provide necessary adhesion figure. Coating adhesion accepted.

7.02.02 Film Thickness (DFT)

The film thickness shall be determined from the thickness of the coating detached along with the Elcometer dollies of the adhesion test and the readings shall be recorded. Frequency shall be identical to adhesion test. Average of 3 reading shall constitute the film thickness and shall be at least 2,000 Microns. Minimum spot reading shall be 1,800 Microns. Recommended spread rate by the manufacturer for the specified thickness of the PU coating shall be ascertained and adhered to during the coating process.

7.02.03 Hardness (Durometer)

Cured films (7 days) shall be tested for hardness using Durometer (Shore D) as per ASTM D 2240.

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
E-QA-01	SECTION - VI /PART – B	SUB-SECTION-E-2 ELECTROSTATIC PRECIPITATOR	Page 1 of 1	1.03.00 c	(ii) For plates of 25mm < thickness < 32mm - 10% RT and 100% MPI.	(ii) Please refer Chapter E-01clause no. 1.02.11, c, ii for NDT requirements.
E-QA-02	SECTION - VI /PART – B	SUB-SECTION-E-4 FLUE GAS DESULPHURISATION SYSTEM	Page 3 of 5	1.08.03	ii) For plates of 25mm<=thickness<32mm-10% RT and 100% MPI.	(ii) Please refer Chapter E-01clause no. 1.02.11, c, ii for NDT requirements.
E-QA-03	SECTION - VI /PART – A	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	PAGE 3 OF 4	6.04.0	6.04.00 Computed Radiographic Testing (RT)– Computed RT shall be used as an advanced Engineering Practice. Main contractor to ensure minimum 10% computed radiography of weld joint to be performed in construction phase. Main contractor to ensure the transfer & storage of these records in Server	6.04.00 Computed Radiographic Testing (RT)– Computed RT shall be used as an advanced Engineering Practice. Main contractor to ensure minimum 10% computed radiography of weld joint to be performed in construction phase for scope agreed in FWS for boiler pressure parts. Main contractor to ensure the transfer & storage of these records in Server

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A	NON – DESTRUCTIVE TESTING (NDT) EQUIPMENT		
1	Digital Radiography Portable X-ray Source: It should have following minimums specification: - Portable constant potential metal ceramic x-ray tube with maximum capacity not less than 300 KV. The working voltage should be adjustable and lowest working voltage should be 50KV or less. - Focal Spot size (As per EN12543) not be more than 1 mm. - Minimum current adjustment ranges at least from 0.5 to 4.5 mA. - Max tube power not less than 900 W. - Emergent Beam shall be of ~ 30 X 60°. - Capability to operate in ambient temp and shall be rugged enough to work in industrial environment - Continuous exposure at full capacity for at least 1 Hr at 25°C. - It should comply with the DIN 54113 or other international Standards. Flat Panel Detector: A flat panel detector to be used with X-ray source (up to 300 KV) and Gamma radiation source such Iridium 192 & Cobalt 60, is required radiographic inspection of power plant components in the field conditions as well as in laboratory. 2.1 Detector: It shall have following minimums specification: - It should be rugged enough to use in industrial field application. - Amorphous silicon based flat panel detector with suitable scintillating material such as Gadolinium Oxysulfide etc. Pixel pitch should be equal or better than 200 micron. - Size of the detector shall not be less than 8*8 inch and active/imaging area of the detector shall not be less than 200*200 mm. - Weight of the detector shall not be more than 5.5 kgs. - It shall have wireless and wired interface/communication with acquisition/analysis work station (either laptop or tablet). A suitable communication cable of 50 meters length shall also be supplied. - It shall able to operate in ambient temperature conditions (-10 to 50°C) - Equipment shall work with AC power supply (230V, 50Hz). Necessary attachments/charger/adaptor to be supplied for making the equipment work/charge with Indian style 3 pin sockets. - Equipment shall also work rechargeable batteries and same shall be supplied. Separate battery charger required shall also be supplied.	1 no	

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2	Radiation Survey Meter as per requirement	1 no	
3	Radiography film viewer as per requirement	2 nos	
4	Personal digital dosimeter as per requirement	2 no	
5	Radiography Film densitometer as per requirement	1 no	
6	Radiography Film samples (ASME) as per requirement	1 no	
7	Computed Radiography (CR) Scanner Computed Radiography Scanner: - It shall have basic spatial resolution of 50 microns or better. - Built in erasing feature to erase the IP. - Scanner shall be capable of scanning image plates of size of at least up to 14-inch width. - Scanning capture/grey level – 16 bit or better for higher sensitivity - It shall comply with the requirements of ASME (Sec-V, article-2), EN 14784-1 or ASTM 2445 or EN 2446-06 or ISO 17636-2 specifications or related national / international Standards. - Provision for output in each of the image formats-DICONDE, TIFF, JPEG etc. - Provision for PC Connectivity - Scanner should be BAM certified - Capability to operate in ambient conditions (at least up to 35° C) and shall be rugged enough to work in industrial environment. - Equipment shall work with AC power supply (230V, 50Hz, single phase). Necessary attachments/charger/adaptor to be supplied for making the equipment work/charge with Indian style 3 pin sockets. If equipment is capable on working with rechargeable battery, same shall also be supplied.	1 no	
8	Ultrasonic testing machine -Conventional with Probes and calibration blocks ULTRASONIC FLAW DETECTOR (A- SCAN AND ‘B’ FACILITY) AND ITS ACCESSORIES. Portable ultrasonic equipment for flaw detection in power plant components (with A scan and B facility) with following features – - Test range: Minimum 0- 2mm (steel velocity), Maximum 0- 5000 mm (steel velocity) - Test mode should be pulse echo and transmit/receive (dual type). - Gain range should be 0 to 110 db (minimum) with provision of digital adjustment of gain.	1 no	

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	4. Measurement frequency range: For dual and single crystal, narrow band (- 3dB) frequency upto 15 MHz (minimum). 5. Rectification: Should be Full wave, Half wave (positive and negative) and un-rectified RF mode 6. There should be LCD display. The pulse repetition frequency should be up to 1KHz. (minimum). 7. Equipment should operate on mains supply (AC 230 V single phase, 50 Hz) as well as on battery fitted in the in-built compartment and there should be provision for recharging of the batteries inbuilt as well as separately. Equipment should be supplied with leak-proof rechargeable battery of type -Ni-Cd / NiMH / Li-Ion, with minimum continuous operation of 6 hours. 8. Equipment should have two nos. gates, which could start from 0% to 100% of screen and width of gate should be adjustable from 1 to 100 % of screen. There should be provision of alarm which could be activated after crossing the threshold values and threshold values should adjustable. 9. Equipment should have provision of DAC (Distance Amplitude Correction Curve) and DGS curve 10. The equipment should have capability of direct calculation of sound path, surface distance and flaw path and their display on screen.		
9	Ultrasonic testing machine -PAUT with scanner, Probes and calibration blocks A portable Ultrasonic Phased Array (UTPA) and Time of Flight Diffraction (TOFD) System include Ultrasonic Phased Array & TOFD equipment, Magnetic Scanner, Softwares, Probes & Wedges, calibration blocks and accessories Capability of driving phased array probes of 16:128 or 32:128 or higher configuration (max no. of active pulser elements: total no of receiver path) [having capability of simultaneous excitation of 16 or 32 or higher elements, as the case may be	2 nos	
10	ToFD Equipment for weld inspection A portable Ultrasonic Phased Array (UTPA) and Time of Flight Diffraction (TOFD) System include Ultrasonic Phased Array & TOFD equipment, Magnetic Scanner, Softwares, Probes & Wedges, calibration blocks and accessories Capability of driving phased array probes of 16:128 or 32:128 or higher configuration (max no. of active pulser elements: total no of receiver path) [having capability of simultaneous excitation of 16 or 32 or higher elements, as the case may be	1 no	
11	Magnetic Particle Inspection-Yoke Type	1 no	

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	Portable Electro Magnetic Crack detector yoke type equipment and accessories shall be used for detection of Surface/ sub-surface cracks in ferromagnetic materials. Equipment shall confirm to ASTM E1444/ IS 3703 or any other international standard Magnetic Crack Detector Yoke Type Equipment must be electric shock proof and must have not any spark or hot spot on the job during operation Articulated legs to suit differing component contours. Inter pole distance adjustable from 0 to 300 mm. Mode of Operation: AC/DC at 220 -240 VAC, 50 Hz Single phase Lifting power (in AC Mode): 4.5 Kg min. at 100 mm leg spacing Lifting power (in DC Mode): 18 Kg min. at 100 mm leg spacing Weight (Yoke equip, excluding cable)-: Not more than 3.5 Kg Control system: On/Off Switch, AC/DC Switch		
12	Magnetic Particle Inspection-Coil Type with cables This specification is for a mobile (moving on wheels) MPI equipment, as described in ASME Boiler & Pressure Vessel Code, Section V-2001(ASTM E-1444-01) for detection of surface & sub-surface cracks of power plant components in service namely, turbine shafts (including bore), blades etc. using coil wrap, prod, or central conductor method of magnetization. Technical features sought in the equipment include: Max. Magnetising Current Output: AC (rms vales) & HWDC (average) Magnetising current output of the equipment should be as follows for different length of copper cables in cable wrap method of magnetisation –for each length there would be two copper cables of that length in parallel configuration and each having 120 sq mm cross section of copper conductor: Output 6000 A (AC/HWDC) for 10 or 12 m standard length of cable Output not less than 4500 A (AC/HWDC) for 15 m length of cable Output not less than 4000 A (AC/HWDC) for 20 m length of cable (b) Line Input: 415 V, 3 phase, current not exceeding 250 Amp. (c) Magnetising cable: Supply of high current cables with copper connectors at each end to be used with the equipment - (i) Standard length 10 m or 12 m (to carry output current 6000 A AC/HWDC) (ii) Additional cable of length 15 m (to carry output current not less than 4500 A AC/HWDC with this length of cable) (iii) Additional cable of length 20 m (to carry output current not less than 4000 A AC/HWDC with this length of cable) for each of the above three length of cable, there would be two copper cables of that length in parallel configuration and each having 120 sq mm cross section of copper conductor:	1 no	

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	(iv) A pair of cables of length 5 m each of size 120 sq. mm copper conductor with plugs and prod with copper tip with copper braiding or copper pad and trigger switch for carrying out MPI with prod.		
13	Pie Gauge for MPI as per requirement	1 no	
14	Gaussmeter for MPI as per requirement	1 no	
15	Ni-Cr Panel for DPT as per requirement	1 no	
16	UV lamp for Fluorescent MPI & DPT as per requirement	1 no	
17	Remote Field Eddy current testing/Advance Electromagnetic testing as per requirement	1 no	
B	MECHANICAL TESTING AND MEASURING EQUIPMENT		
1	Hardness tester (Rebound Type) A non-destructive type of portable hardness tester (CONFORMING TO ASTM A956-97) for measurement of hardness of power plant components namely, pipes, headers, valves, rotor, blades, casing, diaphragm etc., in in-situ condition Range: Lower limit not more than 200 HL, Upper limit not less than 890 HL (Leeb value)	1 no	
2	Hardness tester (UCI method) A non-destructive type Ultrasonic contact Impedance (UCI base) portable hardness tester for measurement of hardness of power plant components namely, pipes, headers, valves, rotor, blades, casing, diaphragm i.e equipment should be capable of measuring the hardness of broad variety of metals on surfaces (flat, round, thin or large surfaces etc.), in <i>in-situ</i> condition. The equipment used for the proposed hardness tester should consist of UCI probe with a resonance device/ indenter having a diamond crystal/pyramid at the tip. Diamond pyramid should have an angle 136°. There should be provision for automatic conversion of Hardness values between Vickers (HV), Rockwell (HRC) & Brinell (HB) as per the VDI/VDE guidelines 2616, page1 or DIN 50150, ASTM 140, or ASTM A1038-05 or latest and specific confirmation thereto should be given.	1 no	
3	Ultrasonic Thickness meter (D-Meter-Digital) Ultrasonic thickness gauge should be portable, light weight and capable of measure metal thickness/thickness loss of on account of corrosion/erosion even when the metal surface is coated or painted using pulse echo method (A scan display)	2 nos	

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	<i>Weight of Ultrasonic thickness gauge with cable should not exceed 1.0 kg.</i> Equipment should operate at 220-230 V, a.c. main supply and with inbuilt chargeable battery (Ni Cd battery) and operate for at least 25 hrs in normal measurement mode with backlight off. Equipment should have the following features- Min. thickness gauge range- 0.25 – 1.27 mm. Max. thickness gauge range – 0.080 – 635.0mm Material velocity range – 0.508 – 13.998 mm/micro-second. Resolution -0.01 mm. Transducer frequency range- 2 –15 MHz. Operating temperature – 0- 50° C. Sealed color-coded keypad with tactile and audible feedback. Water resistant case with sealed connectors. Liquid crystal display with backlight and contrast keypad Rectification in full wave, half wave positive or negative & RF mode Size and weight should not be exceeded by 240x140x38 mm and 1.0 Kg respectively.		
4	Vernier 300 mm Scale	2 nos	
5	Vernier 600 mm Scale	2 nos	
6	Outside Micrometre as per requirement	2 nos	
7	Inside Micrometer 25-750 (dial)	2 nos	
8	Measuring Tape as per requirement	2 nos	
9	Helium Leak Detector as per requirement	1 no	
10	Ultimate Tensile Testing M/C (UTM) 100 KN Servo Electric Elevated Temperature Universal Testing Machine	1 no	
11	Paint thickness Meter(Elcometer)-Ultrasonic digital as per requirement	1 no	
12	Paint adhesion testing kit as per requirement	1 no	
13	Hardness tester (TIV-Through Indentation viewing) The optical Through-Indenter-Viewing method (TIV)-GE Make	1 no	
14	ABI (Automated Ball Indentation) Tester for Mechanical properties (TS, YS, Hardness, Fracture toughness) Advanced Automated Ball Indentation (ABI) System, accessories, and additional bench top mount etc., suitable for (a) Nondestructive ABI tests on in-service components (in the field) to measure key mechanical properties including yield strength, flow properties (true-stress versus true-plastic-strain curve), strain hardening parameters, and fracture toughness of various power plant components like rotors, piping, headers, casings etc.	1 no	

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	(b) ABI test on small volume of metals (samples in lab) for measuring above mechanical properties (c) Destructive testing of mini-tensile specimen and disc-compact fracture toughness specimen. (d) System should be capable for testing on material such as Inconel 617, P11, P12, P22, P91, Carbon Steel, X20, IN 738, High Cr-Mo-V Steel, Nickel and Nickel base Alloys, HSLA Steel, Al, Medium Carbon Steel, Copper etc. The variations between values obtained for tensile and fracture properties with conventional testing and with the testing by the supplied system should be within $\pm 5\%$. (e) The components/parts/all external cables of the Advanced ABI system (especially the electronics) shall be rugged enough and tropicalized to withstand wear and tear of site operation without failure. (f) The mechanical components of the system shall be as under: a. Load Frame: Two columns with very high stiffness, weight of the load frame should not exceed 18 kg with at least 3 m (10 ft) cables. b. Actuator: (a) Mechanical ball screw actuator driven by a motor with high torque capability for 4.45 KN or more force. c. Load Cell: Two numbers, each not less than 113.4 Kg, Tension/Compression type precision load cells with 150% safe operational range and having non-linearity not exceeding 0.2% of full scale, non-repeatability not exceeding 0.05% of full scale and output 2 mV/V, complete with signal conditioner. d. Grips/fixtures: Grips and fixtures suitable for holding the indenter, test piece (round or flat) along with miniature tensile grips and grips & fixture for disc compact fracture toughness (required for field and lab testing as described in sl no. 1 above). The test component could be magnetic or non-magnetic and test area could be flat or round. Indicative range of outer diameter (OD) of magnetic or nonmagnetic pipes is 300 to 1000 mm. e. Linear variable differential transducer (LVDT): Two numbers AC-AC ultra-precision LVDT should be included with the system – the second LVDT is a spare sensor for field use with following characteristics: Working range - ± 0.5 mm (± 0.020"), Sensitivity - 5mV/V/0.025 mm (0.001") or		

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	better, Linearity - $\pm 0.20\%$ FS or better, Repeatability - 0.00010 mm (0.000004") or better. f. Indenter and holder: System should be capable to use precision tungsten carbide ball indenters of various sizes in the range of 0.508 - 1.575 mm (0.020 - 0.062") diameter to be used with the appropriate load cells. Four numbers of indenters of 0.76mm (0.030 in) diameter for field testing and four numbers of indenters of diameter 1.575mm (to be used in lab with 454 Kg load cells) are to be supplied with the system.		
15	Ultrasonic Tensile tester as per requirement	1 no	
16	Exfoliation Meter for SS tubes <u>Portable Boiler Tube Oxide Scale Nondestructive Tester Along with Accessories</u> Portable Boiler Tube Oxide Scale Nondestructive Tester Along with Accessories, suitable for in-situ measurement of the spalling and accumulation of oxide skin (Magnetic) in stainless steel pipe (Non Magnetic) of power plant boiler. This measuring instrument should be suitable for the measurement of laminated rust in non-magnetic stainless steel tube. The equipment should be powered with a rechargeable battery, suitable for field environment operation for at least 4 hours with full charging. The supplied equipment should have following features/capabilities: a. Power supply: AC 220V/0.5A. b. Test range: 20.00 mWb with peak hold function. c. The accuracy of DC magnetic field should be better than 1.0% (corresponding to the full range of each gear). d. Minimum resolution of magnetic field: 10 uWb. e. Volume: 250mm × 180mm × 100mm; weight should not be more than: 1.3kg. f. Operating environment: 0 °C to +50 °C; humidity: 35 ~80%. g. It should be capable to operate on battery and battery for the same to be supplied along with the charger/adaptor.	1 no	
17	Oxide Measurement for Boiler Tubes	1 no	
18	Thermography camera as per requirement	1 no	
19	Holiday Detector as per requirement	1 no	
20	Engineering stethoscope as per requirement	1 no	
21	Portable Vibration Meter as per requirement	1 no	
22	Comparator as per requirement	1 no	
23	Surface roughness meter as per requirement	1 no	
24	Spirit level as per requirement	2 nos	
25	Noise level meter as per requirement	1 no	
26	Torque wrench as per requirement	1 set	

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27	Pressure gauge (accuracy class 0.25%, Range-up to 100 Kg/cm ² , LC-1 kg/cm ² Min)	2 nos	
28	Mercury thermometer (accuracy up to 0.1 Deg. C, up to 1000 Deg. C)	2 nos	
29	Infra Red Thermometer, Non-contact type (up to 1600C)	1 no	
30	Digital Techometer (Non-contact type) as per requirement	1 no	
31	Digital Techometer (Contact Type) as per requirement	1 no	
32	Thermocouple test furnace up to 1400 deg C with uncertainty of 1 deg C	1 no	
33	Barometer(aneroid) 660 to 800 mm/dg accuracy, +/- 0.3 % of full scale	2 nos	
34	Manometer (test & U tube) as per requirement	1 no	
35	Hygrometer as per requirement	1 no	
36	Thermocouple test furnace up to 1400 deg C with uncertainty of 1 deg C	1 no	
37	Barometer(aneroid) 660 to 800 mm/dg accuracy, +/- 0.3 % of full scale	2 no	
C	METALLURGICAL TESTING EQUIPMENT		
1	Replica kit for in-situ Metallography Portable In- situ Metallography Equipment & Accessories, consumables including portable Microscope and C-mount Camera are required to reveal microstructure and to take replica of microstructure on the flat and curved surfaces to assess the material degradation. Portable microscope with C-Mound Camera shall be used to examine the microstructure under direct viewing of microstructure as well as to take direct photograph of the microstructure of different types of metals.	1 no	
2	Optical microscope for replica interpretation Optical microscope and Image Analysis System Stereo Microscope with Camera Attachment	1 no	
3	Sample preparation tools / machines (Cutting, grinding & Polishing) Specimen preparation facility - Abrasive cutting m/c Specimen preparation facility - Automatic Mounting Press Specimen preparation facility - Automatic Grinding Polishing M/c Micro-hardness testing machine Portable X-ray Residual Stress system	1 no	
4	Internal oxide scale measuring system with Probe (UT based) Portable system for measurement of streamside (i.e. on internal side) oxide scale thickness on superheater and reheater tubes of power plant in in-situ condition and transfer/storage/printing of data/ waveform through laptop computer. Tubes are generally made of low alloy steels (grades SA 213 T 11 & SA 213 T22, as per ASME code for boiler & pressure vessels code) and they have nominal thickness in the range of 5 to 8 mm and nominal diameter in the range of 45 to 75 mm.	1 no	
5	In-situ Metallogrpahy kit- Grinder and polisher with accessories	1 no	

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D	VISUAL TESTING EQUIPMENT		
1	Videoscope / Borescope for Boiler tube, Header Inspection & retrieval tool An industrial Videoimagescope System & accessories suitable for inspection of pipings, headers, rotor bore, tubes etc. to visualize inter-ligaments crackings/discontinuities, oxide deposits, pitting, corrosion, foreign material, distortion of internal geometry, breakage and damage etc. and for measurement of the observe defect's size, depth, length, area, point to line distance etc. The system should consist of video-probe (with CCD located at the tip of the probe), light and power source as required, CCD camera, camera control unit function, handy LCD monitor (size not less than 6 inch) and others essential accessories for viewing as well as measuring of defects or discontinuity. The image should be seen simultaneously on both handy monitor and laptop computer screen and moving image should be stored on the laptop computer hard disk. Insertion tube working Length – 20 meter and above Tip Articulation for straight tube – (up/down, left/right) - minimum 90° Insertion tube should– - of tungsten wire braid with higher durability - Consist of Temperature sensor - Be Flexible - Be Abrasion resistant - Be waterproof - Must include retrieval tool	1 no	
2	Binoculars as per requirement	2 nos	
3	Laser alignment Kit with target kit as per requirement	1 no	
4	Video imagescope with measuring facility Advanced industrial Videoimagescope System & accessories having measurement facility.	1 no	
5	Magnifying glass as per requirement	4 nos	
E	WELDING AND PWHT		
1	Welding Simulator as per requirement	1 no	
2	MCF (Magnetic Stauroscope) for assessment of quality of PWHT Portable Magnetic Structurescope (<u>MC-04H-2</u>) System (Magnetic Coercive Force (MCF) Measurement), suitable for in-Situ Measurement of Magnetic Coercive Force (MCF) of Welds of ferromagnetic materials for the evaluation of post-weld heat treatment (PWHT) quality based on magnetic coercivity. The equipment should also be capable for estimation of residual stresses, fatigue changes and residual life evaluation of the component.	1 no	

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3	Argon Purity tester as per requirement	1 no	
4	Inspector Kit for Welding Inspection as per requirement	1 set	
5	SMAW Equipment as per requirement	2 nos	
6	GTAW Equipment as per requirement	2 nos	
7	Temperature Gun up to 90 to 1000 degree C	1 no	
F	CIVIL TESTING EQUIPMENT		
1	Impact Testing Machine as per requirement	1 no	
2	Crushing Value Testing Machine as per requirement	1 no	
3	Los Angeles Abrasion Testing Machine as per requirement	1 no	
4	Flakiness and Elongation Index Test Gauges as per requirement	2 nos each	
5	Aggregate Water absorption Test set up as per requirement	1 set	
6	Pycnometer as per requirement	2 nos	
7	IS Sieves for Coarse Aggregate as per requirement	1 set	
8	IS Sieves for Fine Aggregate as per requirement	1 set	
9	Automatic Sieve Shaker as per requirement	1 no	
10	Bitumen Extractor Machine as per requirement	1 no	
11	Vicat Apparatus with Despot as per requirement	2 set	
12	Le-Chatlier Flasks and Moulds as per requirement	1 no	
13	Burette as per requirement	2 nos	
14	Measuring Cylinders as per requirement	4 nos	
15	Trowel (small & big), Trays, Sampling Scoop and Steel Buckets as per requirement	4 each	
16	Cement Cube Moulds as per requirement	18 nos	
17	Automatic/Manual Mortar Mixer as per requirement	1 no	
18	Vibrating Machine as per requirement	1 no	
19	Curing Tank with Controlled Temperature as per requirement	1 no	
20	Atterberg Limits set-up (Liquid Limit and Plastic Limit) as per requirement	1 set	
21	Shrinkage Limit Apparatus with mercury as per requirement	1 no	
22	Hydrometer Analysis Set-up as per requirement	1 no	
23	Free Swell Index Apparatus as per requirement	1 no	
24	Proctor Testing Equipment as per requirement	1 set	
25	Core Cutter Test set up for in-situ density (min. 6 mould) with 01 hammer as per requirement	1 no	
26	Sand Replacement Test set up for in-situ density as per requirement	1 set	
27	Moisture Container for OMC by conventional Method as per requirement	10 nos	
28	Hot Air Oven as per requirement	2 nos	
29	Physical Balance (Electronic) as per requirement	1 no	
30	Rapid Moisture Meter as per requirement	1 no	
31	Thermometer for measurement of room temperature as per requirement	1 no	
32	Thermometer for measurement of temperature of bitumen, concrete as per requirement	1 no	

	TALCHER SUPER THERMAL POWER PROJECT STAGE - III	DOC NO.	Annexure-III
	FQA – NETRA LABORATORY – LIST OF EQUIPMENT	REV NO.	01
	LIST OF MEASURING & TESTING EQUIPMENT	DATE	06.04.2022
SN	EQUIPMENT DESCRIPTION	QUANTITY	
33	Digital Compression Testing Machine 2000 KN capacity	1 no	
34	Digital Compression Testing Machine 500 KN capacity	1 no	
35	Measuring Tape – 3m, 10m, 30m, 50m	2 nos each	
36	Concrete Cube Moulds as per requirement	18 nos	
37	Concrete Mixer 0.5 cum capacity (Electrically operated)	1 no	
38	Concrete workability Test by compaction factor Test	1 set	
39	pH meter	1 no	
40	Paint thickness Meter (Elcometer)-Ultrasonic digital	1 no	
41	Dial Callipers	2 nos	
42	Vernier Callipers	2 nos	
43	Digital Micrometre	2 nos	
44	Outside Micrometres	2 nos	
45	Depth Gauge	2 nos	
46	Density Basket & Density Pot	1 each	
47	Slump test apparatus	2 nos	
48	Electric Platform Balance (150 Kg)	1 no	
49	Electric Pan Balance 10 Kg (1gm)	1 no	
50	Precision Balance 600 gm (0.1 gm)	1 no	
51	Measuring flask	4 nos	
52	UPV (Ultrasonic Pulse velocity) tester	1 no	
53	Rebound Hammer	1 no	
54	Core flattening machine	1 no	
55	End Immersion test for Flush Door Sutter	1 no	
56	Flexural test apparatus for Beam	1 no	
57	Core cutting setup for concrete	1 no	
58	Rebar detector to locate reinforcement before core cutting	1 no	
G	CONVEYOR BELT TESTING EQUIPMENT		
1	Tensile Tester (Range: 0-2500N)	1 no	
2	UTM (Range: 0-50 KN)	1 no	
3	Flame Tester as per ISO-340	1 no	
4	Drum Friction machine (0-600 Deg C) as per CAN/CSA/M422-M87, Type-C	1 no	
5	Ageing Oven (Digital Temperature recorder (Six Channel)	1 no	
6	Digital Insulation Tester (Megger) (50V-1KV)	1 no	
7	Humidity Chamber (0 to 50°C/0 to 100%RH)	1 no	
8	Electronic Balance (0-60gm)	1 no	
9	Sp. Gravity Balance (200gm)	1 no	
10	Digital Weighing Balance(up to 300 gm)	1 no	
11	Abrasion Tester	1 no	
12	Digital Timer (0-99 sec)	2 nos	
13	Digital Temperature Indicator (0-1200 deg C)	1 no	
14	Dial Thickness Gauge (0-20 mm)	2 nos	

	TALCHER SUPER THERMAL POWER PROJECT STAGE - III	DOC NO.	Annexure-III
	FQA – NETRA LABORATORY – LIST OF EQUIPMENT	REV NO.	01
	LIST OF MEASURING & TESTING EQUIPMENT	DATE	06.04.2022
SN	EQUIPMENT DESCRIPTION	QUANTITY	
15	Digimatic Caliper (0-150 mm)	2 nos	
16	Shore Hardness (0-100 Shore A)	2 nos	
H	ELECTRICAL TESTING EQUIPMENT		
1	Multimeter (Digital & Analog)	2 each	
2	Megger (0-5 KV) Motorised, 0-1KV hand operated	1 each	
3	Tong tester-AC & DC (400 AMP)	2 nos	
4	H.V. Tester (0-50 KV)	1 no	
5	Earth tester	2 nos	
6	Fault Locator (cable test kit)	1 no	
7	Grounding device/Earthing Device	2 nos	
8	Pressure gauge (accuracy class 0.25%, Range-up to 100 Kg/cm ² , LC-1 kg/cm ² Min)	2 nos	
9	Wattmeter, Ammeter, Voltmeter	1 each	
10	Resistance Bridge: Kelvin Bridge	1 no	
11	Relay Test Kit	1 set	
12	BDV tester for Oil	1 no	
13	Vibration meter	1 no	
14	Ductor for Transformer winding, “R”	1 set	
15	Variable AC/DC source (0-220V)	2 nos	
16	Dead Weight test (accuracy class min 0.05%)	1 no	
17	Electro Pneumatic calibrator (accuracy 0.1% of full scale)	1 no	
18	Fluidised Temp Bath (100-600 deg C, stability +/-0.2 % deg C)	1 no	
19	Portable V-meter Calibrator	1 no	
20	Resistance thermometer (bridge 0-2000, resolution 0-001, accuracy +/-0-005, sensitivity 0.001%, Amb Temp 50 deg C +/- 0.005% of span per 1 deg C)	1 no	
21	Decade resistance Box	1 no	
22	Rheostat	2 nos	
23	Test (reference) RTD	2 nos	
24	Digital storage Oscilloscope	1 no	
25	Sweep Frequency Response Analyser (SFRA)	1 no	
26	Frequency Domain Spectroscopy (FDS)	1 no	
27	Electromagnetic Core Imperfection Detector(EICID)	1 no	
28	Recurrent Surge Oscilloscope for Gen. Rotor(RSO)	1 no	
29	Portable PD Test set	1 no	
30	Tan delta test Kit	1 no	
31	Transformer Winding Resistance	1 no	

	TALCHER SUPER THERMAL POWER PROJECT STAGE - III	DOC NO.	Annexure-III
	FQA – NETRA LABORATORY – LIST OF EQUIPMENT	REV NO.	01
	LIST OF MEASURING & TESTING EQUIPMENT	DATE	06.04.2022
SN	EQUIPMENT DESCRIPTION	QUANTITY	

General Notes: -

1. The field laboratory for QA and QC activities shall be established and installed with the adequate facilities to meet the requirement of envisaged day to day tests. The range & accuracy of equipment shall be such as to cover the testing requirements of the installed machinery/equipment/systems.
2. The equipment shall be latest & shall conform relevant governing standards.
3. Before handing over, all equipment and instruments shall be calibrated by NABL or such accrediting agency complying with ISO/IEC-17025 accreditation as per the manufacturer's recommendation and the calibration reports shall be submitted to EIC for their review and acceptance.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SN	SPECIFICATION REFERENCE			EXISTING	READ AS
	SEC/ PART	PAGE NO.	CLAUSE NO.		
F-1	SECTION – VI, PART-B, SUB- SECTION-A-25 SOLAR P.V.	1 of 26	1.3	Determination of optimal grid connected solar PV systems for south facing walls (BIPV) of different buildings of this package.	Deleted
F-2	SECTION – VI, PART-B, SUB- SECTION-A-25 SOLAR P.V.	10 of 26	13	BIPV (BUILDING INTEGRATED PHOTOVOLTAIC) A BIPV system is a photovoltaic system in which the PV modules satisfy the definition above for BIPV products. It includes the electrical components needed to connect the PV modules to external AC or DC circuits and the mechanical mounting systems needed to integrate the BIPV modules into the building. BIPV facade system is to be install on the south facing building of this package with proper ventilation. Bidder shall follow all suitable standards for BIPV system with latest amendments.	Deleted

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SN	SPECIFICATION REFERENCE			EXISTING	READ AS
	SEC/ PART	PAGE NO.	CLAUSE NO.		
F-3	SECTION – VI, PART-B, SUB- SECTION-A-25 SOLAR P.V.	1 of 26		The final plant capacity (Rooftop/ sheds/ south facing walls) shall be as per detailed approved engineering design of each of the building's rooftops. During detailed engineering EIC may leave or relocate the building/sheds or walls of buildings depending on site conditions.	The final plant capacity (Rooftop/ sheds) shall be as per detailed approved engineering design of each of the building's rooftops. During detailed engineering EIC may leave or relocate the building/sheds depending on site conditions. Approx. Roof top Capacity & Solar PV Capacity on Car park/ Coal Stock Yard etc, are: 900kWp & 500KWp, respectively. If the actual capacity during project execution varies from the estimated capacity, the variation in capacity shall be adjusted based on unit rate for addition/deletion of capacity on per kWp basis.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
G-01	VI/C	GTR	44 of 114	26.02.00 (b)	The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.	The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours with demonstration of the capability of the machine to raise load upto 105% of full rated load.
G-02	VI/C	GTR	44 of 114	26.03.00	The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up Engineer shall make the unit ready to conduct such test before start of initial operation. Such test shall be conducted along with the Initial Operations.	The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. To conduct such tests, the contractor's Commissioning, start-up Engineer shall make the unit ready (including tuning and all other enabling activities as required for PG tests) before start of initial operation. Such test shall be conducted along with the Initial Operations.
G-03	VI/A	I	5 of 8	4.02.00	Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose. Further, during execution any requirements (of coal & fuel oil) beyond the quoted quantities by the successful bidder would be issued by NTPC but charged back to the contractor as per the prevailing landed rate at site at that time. There shall be no rebate to the Contractor if the coal & oil quantities as consumed during execution (up to the initial operation as above) remains lesser than the quoted values.	As per Annexure-I

Annexure-I

Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. **Such quoted quantity shall include all pre-commissioning & commissioning activities (including running of units for tuning or any other purpose as required before commencement of initial operation) and considering consumption during initial operation considering average load of 60% of rated value for both the units.**

These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose.

Further, during execution any requirements (of coal & fuel oil) beyond the quoted quantities by the successful bidder would be issued by NTPC but charged back to the contractor as per the prevailing landed rate at site at that time. **For this purpose, Bidder's quoted coal consumption quantity shall be corrected for variation above/below 60% of rated load during the period of initial operation as per following:**

The coal quantity quoted by the bidder for both units = X kg for average load of 60% of rated value during initial operation

Average Load for both units during Initial Operation = L % of rated load

Coal Consumption for both units during Initial Operation = Y kg

Corrected quoted coal consumption during execution = $X + [Y * (L - 60) / L]$

There will be no correction for quoted consumption of oil. There shall be no rebate to the Contractor if the coal & oil quantities as consumed during execution (up to the initial operation as above) remains lesser than the quoted **consumption for oil and corrected quoted consumption for coal.**

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
A-MH-33	VI/A	IIA-16	1 of 18	1.01.03	The equipment and materials to be supplied by the Contractor shall form a fully comprehensive Ash handling and Ash Water Recirculation system. The equipment and specifically excluded.	The equipment and materials to be supplied by the Contractor shall form a fully comprehensive Ash handling and Ash Water Recirculation system within Plant . The equipment and specifically excluded.
A-MH-34	VI/A	IIA-16	2 of 18	1.01.04 (f)	Ash water recirculation system for recycling ash water from Mine Void.	Ash water recirculation stream within plant for recycling ash water from Mine Void end.
A-MH-35	VI/A	IIA-16	11 of 18	1.01.08 (ii)	Four (04) lengths of combined ash slurry disposal MS pipe lines from combined ash slurry pumps up to Mine Void including garlanding at mine end and extensions into the mine void at number of discharge points complete with basalt lined pipe bends, fixtures, elbows, gaskets, nuts, bolts, structural steel supports and other accessories as specified and as required. For garlanding of Mine Void, MS bends shall be provided. The length of combined Ash disposal pipe lines shall be 52,000 m (excluding fittings and including branch pipes for garlanding of mine void).	Four (04) lengths of combined ash slurry disposal MS pipe lines of Diameter 500 NB from combined ash slurry pumps up to 5 m inside Plant Boundary , complete with basalt lined pipe bends, fixtures, elbows, gaskets, nuts, bolts, structural steel supports and other accessories as specified and as required.
A-MH-36	VI/A	IIA-16	11 of 18	1.01.08 (v)	Sixteen (16) nos. of manually operated plate valves at the slurry disposal pipeline outlets in mine void area as specified and as required.	Deleted
A-MH-37	VI/A	IIA-16	13 of 18	1.03.00	ASH WATER RECIRCULATION SYSTEM The scope of these specifications shall..... In any case, scope shall not be less than that detailed below.	ASH WATER RECIRCULATION SYSTEM The scope of these specifications shall..... In any case, scope shall not be less than that detailed below.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

A-MH-38	VI/A	IIA-16	13 of 18	1.03.01 (a)	Three (3) Nos (2 W + 1 S) Horizontal centrifugal type Ash Water Recirculation pumps, each of capacity 1000 m ³ /hr and head as required, located in the mine void end pump house, complete with drive motors, base plate , foundation plates and accessories as specified and as required. Provisions shall be there for locating another Pump in the Pump House, for future use.	Deleted
A-MH-39	VI/A	IIA-16	13 of 18	1.03.01 (b)	One (1) No. Electric operated Hoist for handling of above pumps, motors etc. for the above pump house complete with runway rails, with necessary clamps, bolts, slice bars and end stops for each of the runway.	Deleted
A-MH-40	VI/A	IIA-16	13 of 18	1.03.01 (c)	Six (6) Nos (4W + 2S), Pontoon/ Barge floatable into.....Pontoon/Barge shall be complete with all structural, electrical, instrumentation etc requirement.	Deleted
A-MH-41	VI/A	IIA-16	13 of 18	1.03.01 (d)	Following pipelines complete with..... as specified and as required. (i) There shall be two (1W+1S) lengths of the header by Flexible Hoses. (ii) There shall be one pipeline from decanted ash water recirculation pump house to ash water sump inside Plant. The length of Pipe from AWRS pump house to Plant end shall be 12,500 m. (iii) All the interconnecting pipes to common header. (iv) Recirculation line to suction sump. (v) All the necessary clamping arrangements along with guides, bolts, nuts etc. In addition to major pipelines..... in the scope of the Bidder.	Following pipelines complete with..... as specified and as required. (i) Deleted (ii) There shall be one pipeline of Diameter 650 NB from 5 m inside plant boundary to ash water sump inside Plant. (iii) Deleted (iv) Deleted (v) All the necessary clamping arrangements along with guides, bolts, nuts etc.
A-MH-42	VI/A	IIA-16	13 of 18	1.03.01 (e)	All necessary valves, fittings, specialties etc for various equipments, pumps piping etc. Necessary piping, valves, specialties etc for inter-connection of associated equipment. Size of valves shall be same as respective pipelines size.	All necessary valves, fittings, specialties etc Size of valves shall be same as respective pipelines size.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

A-MH-43	VI/A	IIA-16	13 of 18	1.03.01 (f)	All necessary instrumentation for safe, reliable and auto operation of the whole system as required and as specified.	All necessary instrumentation for safe, reliable and auto operation of the whole system as required and as specified.
A-MH-44	VI/A	IIA-16	13 of 18	1.03.01 (h)	Thermal stress and transient analysis for..... transient analysis study shall be implemented by bidder.	Not applicable
A-MH-45	VI/A	Chapter -03	11 of 13	10.01.00	Horizontal Centrifugal Pumps (Each Type & Model) (1) to (6)	Deleted
A-MH-46	VI/B	A-01	89 of 101	4.01.02 (M)	(i) Pumping distance to be considered for arriving of Ash Slurry Pump head is 12.5 K.M. (ii) Pumping distance to be considered for arriving of AWRS Pump head is 11.75 K.M. Static lift to be considered for Pontoon/Barge mounted Pumps- 30 meters Static lift to be considered for Ash Slurry Pump - 80 meters.	(i) Pumping distance to be considered for arriving of Ash Slurry Pump head is 12.5 K.M. (ii) Pumping distance to be considered for arriving of AWRS Pump head is 11.75 K.M. Static lift to be considered for Pontoon/Barge mounted Pumps- Not applicable Static lift to be considered for Ash Slurry Pump – Not applicable.
A-MH-47	VI/B	A-01	89 of 101	4.01.02 (J)	iv) AWRS Sump:- Thirty (30) minutes	Not applicable
A-MH-48	VI/A	III	18 of 18 Terminal Point & exclusion & owners' input	1.03.00	Employers' cross-country conveyor shall be routed along the Ash slurry disposal corridor from plant end towards mine void where corridor space is limited. Bidder has to ensure that there shall not be any hindrance due to Ash slurry & AWRS corridor for supporting structures of Employers' pipe Conveyor. Employers' pipe conveyor may be taken-up in parallel or in near future.	Terminal Point for Ash slurry disposal piping and AWRS piping shall be 5 m inside plant boundary. Ash slurry piping & AWRS after 5 m from plant boundary towards Mine Void shall be excluded from the Bidders' scope.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

A-MH-49	VI/A	IIA-16	15 of 18	1.04.06	Eight (8) nos. Pump tanks/Air lock tank for each coarse ash hopper and four (4) nos. of pump tanks/air locks tank for fine ash hopper for transportation of coarse fly ash and fine fly ash respectively, to silos provided for dry fly ash storage silos meant for Road and Rail loading.	Eight (8) nos. Pump tanks/Air lock tank for each coarse ash hopper and four (4) nos. of pump tanks/air locks tank for fine ash hopper for transportation of coarse fly ash and fine fly ash respectively, to silos provided for dry fly ash storage silos meant for Road and Rail loading. Provisions shall be provided to convey & store Fine Ash to another Coarse Fly ash Silo in addition to Fine Fly Ash Silo.
A-MH-50	VI/A	IIA-16	15 of 18	1.04.07	Additionally, the fine ash shall be pneumatically conveyed to another fine ash silo, located in Fly ash silo complex with the provision of bagging plant.....	Additionally, the fine ash shall be pneumatically conveyed to fine ash silo, located in Fly ash silo complex with the provision of bagging plant.....
A-MH-51	VI/B	A-21	26 of 40	3.07.00	Sump Drainage Pumps Design requirement- To transfer silo (BA & FA) area (with 30% ash by weight) upto HCSD system mixing tanks.	Sump Drainage Pumps Design requirement- To transfer silo area (with 30% ash by weight) upto Ash slurry Sump
A-MH-52	VI/B	A-21	32 of 40	5.01.02	DATA SHEET FOR COMBINED / BOTTOM ASH SLURRY DISPOSAL LINE VALVES AT MINE VOID / DYKE END	Not applicable
A-MH-53	VI/B	A-21	33 of 40	6.00.00	- DATA SHEET FOR AWRS PUMPS - MATERIAL OF CONSTRUCTION FOR VERTICAL CENTRIFUGAL PUMPS-AWRS	Not applicable
A-MH-54	VI/B	A-21	35 of 40	7.12.00	E) AWRS PUMP HOUSE	Not applicable

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

A-MH-55	VI/A	IIA-16	15 of 18	1.04.14	The bags shall be stored in suitable closed storage area having a provision to store bags filled in 8 hours. Mechanized transportation of fly ash bags from bagging machine up to the storage shed and from bagging machine to load into Truck directly. Adjustment to load bags in all types of Trucks shall be provided.	The bags shall be stored in suitable closed storage area having a provision to store bags filled in 8 hours. Mechanized transportation (without manual intervention) of fly ash bags from bagging machine up to the storage shed and from storage shed to load into the Trucks, by suitable conveying system along with associated arrangements. Provisions for direct loading of bags into trucks without storing shall also be there. Adjustment to load bags in all types of Trucks shall be provided.
A-MH-56	VI/Part E			Tender Drws.	4540-001-POM-A-040 (option-01), Rev-B 4540-001-POM-A-040 (option-02), Rev-B 4540-001-POM-A-030, Rev-A 4540-001-POM-A-031, Rev-A	4540-001-POM-A-040 (option-01), Rev-C 4540-001-POM-A-040 (option-02), Rev-C 4540-001-POM-A-030, Rev-B 4540-001-POM-A-031, Rev-B
A-MH-57	VI/A	Sub-section IV FUNCTIONAL GUARANTEES	23 of 73	1.01.07.01 (e)	Ash Handling Plant List of drives with corresponding weightage factors thereof for which power consumption is to be guaranteed is as follows: 10. Ash Water Recirculation Pumps: 1 11. Barge mounted Recirculation Pumps: 1	Ash Handling Plant List of drives with corresponding weightage factors thereof for which power consumption is to be guaranteed is as follows: 10. Ash Water Recirculation Pumps: Not applicable 11. Barge mounted Recirculation Pumps: Not applicable
A-MH-58	VI/B	A-20	37 of 101	4.29.00	All equipment furnished by the Contractor following standard, rules, acts. IE (Indian Electricity) Rules and Acts	All equipment & system, furnished by the Contractor shall be complete in every respect and shall comply 'Safety Module' as per 'ANNEXURE- I TO SUB-SECTION A-20'
A-MH-59	VI/A	SS-I Intent of specification	3 of 8	1.02.00	Ash Handling system with AWRS	Ash Handling system with AWRS (Inside Plant)

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20			
	SAFETY MODULE			
1.00.00	GENERAL			
1.01.00	All equipment furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, commissioning and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes. All equipment shall be ‘fail safe’ in any conditions.			
1.02.00	CODES AND STANDARDS			
	Technical specification stipulates compliance to applicable statutory regulations and safety codes of India as well as of the locality where those will be installed. In particular, the CHP shall conform to the latest edition of the following standards, rules, acts. ▪ NTPC Safety Rules for Construction and Erection ▪ NTPC Safety Policy ▪ IS:7155 : Codes of Practice for Conveyor Safety. ▪ ASME B20.1 "Safety Standard for Conveyors and Related Equipment". ▪ ASME Standard B15.1 "Safety Standard for Mechanical Power Transmission Apparatus" ▪ ISO 7149, “ Continuous handling Equipment-Safety Code-Special Rule” ▪ ISO 12944 - Corrosion protection of steel structures ▪ IS:3764 EXCAVATION WORK CODE OF SAFETY ▪ Occupational Safety and Health Administration- Guidelines ▪ CEMA Publication No. 201, “ Safety Label Brochure” ▪ IE (Indian Electricity) Rules and Acts			
2.00.00	GENERAL SAFETY REQUIREMNT FOR COAL/LIMESTONE/GYPSUM HANDLING PLANT			
2.01.00	CONVEYING SYSTEM			
	Belt conveyors’ safety generally begins with sound design that, as far as is practical, avoids foreseeable dangers and hazards. Diligence in safety considerations must be applied during the course of design, engineering, manufacture, installation, and establishment of operation and maintenance policies and procedures. Important aspects of conveyor safety are elaborated as follows:			
2.01.01	Safety devices- Pull cord switches, belt sway switches, zero speed switches, and plugged chute switches are to be provided on conveyors to provide maximum protection to both personnel and equipment.			
2.01.02	Conveyor Take up- Two (2) meter safety fencing along with suitable gate and locking arrangement shall be provided around gravity take-up at the base level / ground level. In case of double stream conveyors, a partition of 3.15 mm steel plate shall be provided between the			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT	PAGE 1 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20 		
2.01.03	two take-up pulleys along entire travel zone of take-up pulleys. Intermediate platforms shall be provided in the take-up zone for maintenance of take - up pulleys / counter weight. Pulleys- Suitable guards shall be provided for all tail pulleys and bend pulleys for safety of operating personnel.		
2.01.04	Conveyor Bridges- Seal plates throughout the length of the conveyor gallery to be provided in such a way that complete gallery's bottom surface area forms a single water proof floor and no water / coal/Limestone falls down from conveyor gallery. Safety Handrails to be provided all along walkways along with toe guard. In case of conveyor angle is more than 10 deg, stepped walkways are to be provided along the conveyor.		
2.01.05	Fire Fighting- Structures and floors shall be so designed as to provide suitable space for routing of firefighting pipe with water, cables and conduits. Firefighting arrangement is to be provided as specified elsewhere in technical specification. Fire Escape provision along with cage ladder to be provided on each trestle.		
2.01.06	Movable discharge pulleys and movable belt feeders- The complete discharge pulley movement area shall be covered with proper sealing arrangement. The discharge chute opening shall be provided with proper handrails for the safety purpose. Suitable rotating strobe lights and siren on mobile equipment shall be provided to warn personnel at the time of operation.		
2.01.07	Hooter alarm is to be activated before the start of conveyor/ equipment. The operating staff is cautioned and would stay away from the vicinity of conveyor. The beacon lamp is activated simultaneously with the starting of conveyor. The same is to be incorporated in control philosophy.		
2.01.08	Manual Stone Picking arrangement at a suitable location in the conveyor gallery before the crusher house shall be provided complete with platforms, overhead lighting, handrailings, suitable seating with good ergonomic arrangement, safety hook & holding arrangement/ safety belt for manual pickers, disposal chutes to ground level etc. Suitable provision of alarm in conveyor gallery to be provided for non-compliance with applying of safety hook and safety belts by stone pickers.		
2.01.09	All movable parts giving access through mechanical handling equipment shall be designed so that they cannot be opened whilst the equipment is working.		
2.01.10	All the lubrication points used frequently shall be accessible without it being necessary to remove the guards.		
2.01.11	It is recommended that equipment be so designed that cleaning is facilitated.		
2.01.12	Overhead gantry portion of road and rail crossings, walkways, galleries, work places under the overhead conveyors used by the personnel, shall be protected by means of suitable covering such as plates/steel sheet covers to prevent falling of the material/objects over such areas/personnel.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT PAGE 2 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20 		
2.01.13	Gangways, hand-rails, staircases, ladders, guards, etc shall be erected before the installation is put into service.		
2.01.14	The gallery should as far as possible be erected as a box section keeping all the vertical and horizontal bracing tied in proper position. The gallery should be checked for all erection stresses that are likely to develop during handling and erection and if required, temporary strengthening of gallery members during erection shall be made.		
2.01.15	Coal conveying tunnels shall be provided with fire escape at every 50 m in case of tunnel length exceeds 100m.		
2.02.00	CHP BUILDINGS		
2.02.01	The design and construction of CHP Buildings shall comply with all the currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed.		
2.02.02	All CHP buildings shall have sufficient space to accommodate all equipment and ample space shall be provided for maintenance purposes. The clear space around equipment to be maintained minimum 1200 mm for ease of maintenance and man movement safely.		
2.02.03	Openings and edges in the floors of CHP buildings (i.e. TPs/CH etc.) shall be provided with curb of 100 mm high along with top of handrails and toe guard at 1200 mm for safety purpose.		
2.02.04	Necessary facilities for ventilation of track hopper, tunnels, underground buildings, control/MCC rooms, WT control room and Bunker bay shall be provided as specified elsewhere.		
2.02.05	External fire escape stair case along with internal staircase shall be provided for all MCC/control rooms & Crusher house. External staircases shall be provided for all transfer points. All buildings shall have the fire protection provisions to meet TAC and IS – 3034 regulations.		
2.02.06	All stairs of over and underground portion of transfer houses & crusher house shall be of minimum 1200 mm wide and maximum rise should not be more than 180 mm with safety Handrails of 1200 mm all along the flight to protect fall protection. Numbers and arrangement (including enclosures etc.) of stair cases shall be such as to meet the fire safety requirement as per guide lines of statutory regulatory bodies. Minimum headroom in all staircases and all levels shall be 2200 mm from floor finish level.		
2.02.07	Staircase with minimum width of 1200 mm shall be provided for approach to elevated structures at 5m height from the nearest platform. Below this height a vertical cage ladder with minimum clear width of 600 mm may also be acceptable. Proper Clear headroom of 2200 mm on all maintenance platforms to be provided. Handrails of minimum 1500 mm height, are to be provided around all maintenance platforms.		
2.02.08	Safety chain or handrails or side sheeting to be provided up to working safe level near Monorail doors at sides of Transfer towers/VGTU's.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT PAGE 3 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20	एनटीपीसी NTPC		
2.02.09	Monorail Hoist for handling of equipment weighing more than 500 kg is to be provided.			
2.02.10	Extent of the RCC floor in CHP buildings (i.e. TPs/CH etc.) shall flush with the cladding.			
2.02.11	Deck sheet should be placed in such a way so that deck sheet profile should be along shorter direction.			
2.02.11	Loading/ Unloading zones in CHP buildings (TPs/CHs) shall be marked permanently for identification of zone and capacity.			
2.02.12	Erection shall be done as per approved erection scheme. Erection of bracing/ties elements simultaneously along with column/beam elements is very essential for stability of structure and transfer of lateral load both at the completed and under erection stage.			
2.02.13	Any excavation greater than 1.5 m shall be planned as per 'IS 3764 - <i>Excavation Work Code Of Safety</i> '.			
2.03.00	WAGON TIPPLER & ASSOCIATED SYSTEM-Not applicable			
2.04.00	TRACK HOPPER & ASSOCIATE SYSTEM			
2.04.01	Safety requirement above ground Track Hopper area:			
	a. Proper walkway and handrail all along the Track Hopper length shall be provided as per the specification. b. Steel grating (as specified elsewhere) shall be provided securely at Hopper top. c. Proper barricading of the Crane/Hoist floor opening shall be provided. d. Proper illumination shall be provided throughout the entire area of Track Hopper Complex. e. Track Hopper walkway area shall be free from any intermediate crossing of utility pipes, structures, cables etc.			
2.04.05	Safety requirement underground Track Hopper area & equipment:			
	a. Direct Communication from track Hopper (inside) & Paddle Feeder with the Control Room shall be provided. b. Side walkway inside Track Hopper shall be of adequate width & free from any intermediate crossing of utility pipes, structures, cables etc. Width/height of central walkway shall be sufficient for ease working of maintenance people. c. Proper illumination shall be provided inside Track Hopper area so that Side walkways & central portions between two Track hopper conveyors and Hopper table shall be clearly visible. Emergency lighting shall also be provided in case of tripping of regular lighting supply. d. Staircase inside Track Hopper shall be with minimum 1200 width with proper Hand railing & toe guards. e. All drains and sump pump pit inside hoppers shall be covered with gratings. f. Underground area shall be well ventilated as specified elsewhere.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT	PAGE 4 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20 
2.04.06	Deep excavation for Track Hopper shall be done as per approved excavation and dewatering scheme. It shall adhere IS: 3764 safety code for excavation work. Due care for dewatering shall be taken care while excavation and construction.
2.05.00	STOCKYARD AREA
2.05.01	Stacker Reclaimer:-
	Protective guards to be provided on all the drives. A maintenance platform to be provided for the drives with combination of handrail and dog chain all around it. The lowering and raising system shall be fitted with a safety device to prevent accidental lowering or lifting of the boom, and to prevent any collision of boom structure with the Stock Pile. Operator's cabin to be located as to enable the operator to get clear vision of both sides of the track and the cutting of coal by buckets. The cabin shall be suitable for operation in monsoon and tropical conditions and the inside ambient temperature shall be maintained at 27°C. For operation in winter/rainy conditions, fog lights, in addition to normal lighting, outside cabin for clear view of stockpiles from cabin to be provided. The cabin shall be provided with toughened glasses with wipers and the arrangement shall be such that glasses can be cleaned from outside without any scaffolding, Cabin door shall be provided with hydraulic door closers. The cabin shall be kept in horizontal position through hydraulic cylinders irrespective of the angle of inclination of the boom conveyor.
2.06.00	Tripper Floor
2.06.01	Provision shall be kept for automatic tripping of bunker bay conveyor in the event of travelling tripper getting dragged (i.e. travel speed in excess of rated speed). Emergency push button to be provided on tripper floor.
2.06.02	Wheels or rollers of travelling conveyors and of additional travelling equipment shall be guarded at points accessible to personnel under normal working conditions.
2.06.03	Whenever an operator remains on the travelling equipment, a platform shall be provided and be so designed as to prevent any accidental contact with mobile components or any part of the fixed installation.
2.06.04	When mobile appliances or equipment travel, warning devices, audio as well as visual, shall be provided.
3.00.00	Electrical Safety
	1. Electrical Insulation mats in front of every switchgear/MCC shall be provided as per relevant Indian standards. 2. All trailing cables/festooning arrangement in trippers, hoists etc., shall be easily accessible with proper approach for operation & maintenance people. 3. All electrical/switchgear buildings shall have necessary electrical and general safety instruction charts, Caution/Danger safety labels, properly insulated tools and accessories for handling electrical equipment.
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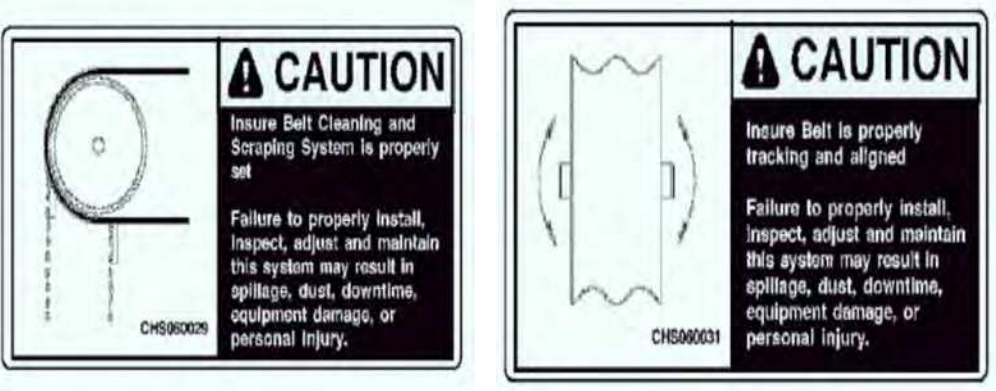
CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20			
	4. Earthing and Lightning protection of all buildings/equipment shall be as per latest electrical acts / rules/ amendments / guidelines. 5. All lighting fixtures in TPs, Crusher house shall be wall mounted type and shall be easily accessible with proper approach for operation & maintenance people. 6. "Earth mat of CHP area" shall be connected to nearest "main plant area earth mat" at minimum of two locations. All buildings/structures shall be interconnected together by minimum two parallel conductors. 7. Minimum Safety clearances for electrical apparatus as per BIS (Bureau of Indian Standard) shall be maintained so that sufficient space is available for easy operation and maintenance without any hazard to the operating and maintenance personnel working near the equipment and for ensuring adequate ventilation. However, any additional stringent requirement for clearance specified elsewhere in the specifications shall prevail. 8. Where a transformer or transformers are used, suitable provision shall be made, either by connecting with earth, a point of the circuit at the lower voltage or otherwise, to guard against the danger by reason of the said circuit becoming accidentally charged above its normal voltage by leakage from or contact with the circuit at the higher voltage. 9. Where the oil filled transformers with capacity more than 2000litres are installed, suitable baffle walls of four hours fire rating shall be provided. 10. Only dry type transformers shall be used inside the buildings. 11. Transformers having capacity more than 10MVA capacity and more than 2000 liters of oil are to be provided with firefighting system as per IS-3034:1993 or with Nitrogen Injection Fire Protection System. 12. All switchgear /MCC shall be "Closed door" operation type. 13. Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity. Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs and rails etc., of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. 14. All switchgear room shall have minimum two exit doors suitable for two hours of fire rating. 15. All cable shall be Fire Retardant Low Smoke (FRLS) type having minimum two hours of fire rating. 16. All cable trestles and trenches shall have a minimum of clear 600mm walkway for ease of accessibility. 17. All cables shall be segregated by voltage wise as HV/MV/LV/Control/ instrumentation type and a minimum of 300mm clearances shall be maintained between cable trays of each type. 18. Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires, in addition to fire extinguishers suitable for dealing with fires, shall be conspicuously marked and kept in convenient locations in the electrical buildings. 19. First aid boxes or cup boards conspicuously marked and equipped with such contents as the state government may specify shall be provided and maintained in each electrical building. 20. Instruction chart for resuscitation of persons suffering from electric shock in English or Hindi and the local language of the district shall be affixed in a conspicuous location in electrical buildings. (where Hindi is local language it shall be in English and Hindi).			
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CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20			
	21. Adequate number of gas masks shall be provided in each electrical building. 22. Adequate precautions shall be taken to ensure that no live parts are so exposed as to cause danger. 23. All equipment shall be conspicuously marked and identified. 24. Permanent metallic (MS) ladders shall be provided to access walkway at every 100 meters of cable trestle. 25. Suitable Earth flat shall be laid along the cable trays and connected to nearest earth riser at every 50 meters. 26. All push button stations in CHP area shall be IP65 degree of ingress protection. 27. Lighting fixtures and lamps shall meet the illumination lux levels of different areas as specified elsewhere and all areas shall have aesthetically pleasing and glare free illumination. 28. Minimum twelve (12) nos of lighting masts shall be provided for coal stockyard and Wagon Tippler area illumination. 29. Battery rooms shall have relevant acid/alkali resistant flooring and skirting. Ventilation fans in battery rooms shall be flame proof type. An easily accessible wash basin with mirror shall be provided in the battery room. 30. All outgoing feeders of lighting panels shall have suitable earth fault protection devices (ELCB/RCCB) 31. All welding receptacles shall have suitable ELCB/RCCB. 32. CHP 220V DC system shall be separate and independent from other DC systems of plant. The DC emergency lighting fixtures shall be fed from bidder's 220 V LDBs through DC lighting panels so that tracing and isolation of DC earth fault is convenient. Each switchgear/MCC room shall have a DC LDB and corresponding LPs. 33. The DC emergency lighting fixtures shall be mounted suitably on wall/columns at strategic locations for safe movement of operating personnel and access to important control points during an emergency, when the normal AC lighting system fails. The supply to the DC lighting panels shall be automatically switched on in case of loss of AC supply. The DC supply will be automatically switched off after about 3 minutes following the restoration of AC lighting system. 34. 100W,220V incandescent (or equivalent LED) DC Emergency lighting shall be provided as follows: One (1) no. in each local control area Three (3) nos. in each MCC/ Switchgear room and control room One (1) no in each office room and each pump house Six (6) nos. in Track hopper shed Twelve (12) nos in track hopper tunnels Two (2) nos in each underground portion of TPs One (1) no at every 5.0m height interval in the staircases of various TPs and buildings under contractor's scope One (1) no in each drive floor in each TP under contractor's scope			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT	PAGE 7 OF 11	

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20			
4.00.00	Eight (8) nos in wagon tippler tunnel 35. Four (4) nos. 240V AC lighting fixtures fed from UPS shall be provided on each stacker re-claimer machine as emergency lighting. 36. MCCs located on the Stacker re-claimer, paddle feeders, travelling trippers shall be fixed type, compartmentalized, single front and suitable for the system fault level. 37. Degree of protection for the MCCs mounted on paddle feeders and travelling trippers shall be IP-65. 38. All motors shall be provided with coupling guards.			
	Control & Instrumentation Safety a. Area classification should be done for CHP to identify Hazardous area if any and instrumentation to be upgraded accordingly. b. All the instruments and actuators mounting shall be reachable for maintenance or suitable platform/ arrangement shall be provided for maintenance. c. Contractor shall comply all AERB requirements for nucleonic instruments like Coal Analysers (if applicable) and provide suitable symbols/ sign boards in all the relevant locations. d. In this package unmanned operation of Stacker/ Reclaimer has been envisaged. Contractor shall provide all the safety systems for safe operation of un-manned operation of Stacker / Reclamer considering the safety of man and machine. e. Contractor shall provide specific marking on the protective devices like EPBs in field. f. CCTV analytics shall be suitably utilised for safe operation of planned and human safety. g. In CHP DDCMIS fail safe single command philosophy is implemented. Therefore, in case of failure of DDCMIS in any set of controller, set of power supply, set of communication modules, set of RIO link then complete CHP conveying system should take safe shutdown. h. In case of Fire Alarm Panel Sensing Fire in any area of CHP, Emergency shutdown is activated from Controller End for complete system i. Draw out console containing Emergency Stop Push Button for all major drives shall be used for complete system shutdown in case of DDCMIS failure.			
5.00.00	Safety Labels: Safety Labels and Placement Guidelines to be provided Prior to operating the conveyor or any of the associated accessories or equipment, all safety markings, guards and warnings must be in place in accordance with governmental regulations and site specific requirements. All safety labels should be bilingual. Some of safety labels are indicated below:			
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CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20	एनटीपीसी NTPC
	To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards  To be located on conveyors where there are exposed moving parts which must be unguarded to facilitate function, i.e. rollers, pulleys, shafts, chains, etc.  LOCATE ON INSPECTION DOOR (S) General warning to personnel that a conveyor's moving parts, which operate unguarded by necessity of function, i.e. belts, rollers, terminal pulleys, etc., create hazards to be avoided; in particular, conveyors which stop and start by automatic control near operator work stations would use this label.  LOCATE AT ENTRANCE TO CONVEYOR WΔI KWAY To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards. 	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT PAGE 9 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20	एनटीपीसी NTPC	
	To be placed up to a maximum of 50' centers along the walkway side.  SPACE UP TO A MAXIMUM OF 50 FT CENTERS (WALKWAY SIDES) To be placed at entrances to enclosed areas which would expose personnel to operational or environmental hazards which should only be entered by trained and authorized personnel under specific conditions; Examples, lifting conveyors, transfer car aisleways, confined spaces, etc.   		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT	PAGE 10 OF 11

CLAUSE NO.	ANNEXURE- I TO SUB-SECTION A-20 		
6.00.00	 The above list is not exhaustive and suitable safety labels to be provided for all equipment and hazardous locations in line with international practice for material handling equipment. Training: After the design and installation are developed and supervised by qualified engineers familiar with recognized safety features and requirements, the next priority should be personnel training. Operating and maintenance personnel and their supervisors should be initially and then periodically retrained in safe operating procedures, recognizable hazards, precautions, and the maintenance of a safe work place. Accordingly, Contractor to provide the list of proper tools and tackles to operate and maintain the conveyor in an adequately safe condition. Employees should be made aware of, and forbidden to enter, hazardous areas. The training proposal by contractor must include safety training module for site personnel.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC.NO.: CS-4540-001A-2	ANNEXURE to SUB-SECTION-A-21 COAL, LIMESTONE & GYPSUM HANDLING PLANT	PAGE 11 OF 11

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A-PU-8	VI/A	A-12	5 of 12	4.00.00, b)	19) Any other area/building required to be protected with hydrant system.	19) Any other area/building in the scope of the Bidder and required to be protected with hydrant system.
A-PU-9	VI/A	A-12	6 of 12	4.00.00, c)	8) Apart from the above any other equipment/system which requires HVW spray protection.	8) Apart from the above any other equipment/system in the scope of the Bidder and which requires HVW spray protection.
A-PU-10	VI/A	A-12	6 of 12	4.00.00, d)	8) Any other equipment/system which requires MVW spray protection.	8) Any other equipment/system in the scope of the Bidder and which requires MVW spray protection.
A-PU-11	VI/A	A-12	7 of 12	4.00.00, g)	Nitrogen injection system for transformers located outside plant boundary: Automatic Nitrogen injection system for all transformers located outside plant boundary where water-based fire protection system not envisaged (of rating 10 MVA and above or in case of oil filled transformers with oil capacity of more than 2000 liters) as detailed out in relevant electrical chapters.	DELETED
A-PU-12	VI/A	A-12	7 of 12	4.00.00, h)	(e) Switchgear/MCC rooms/Battery Rooms/control rooms of make-up water pump house/AWRS pump house/any other pump house (as applicable) located outside plant boundary.	DELETED
A-PU-13	VI/A	A-12	9 of 12	4.00.00, h)	xiii) For fire detection of Switchgear/MCC rooms/Battery Rooms/control rooms of Makeup water/AWRS pump house/other pump house (as applicable) located outside plant boundary, local fire alarm panels shall be provided separately. The fire alarm panel shall be interconnected with panel of Nitrogen Injection system of transformers for annunciation.	DELETED
A-PU-14	VI/A	A-12	11 of 12	4.00.00, i)	i) Fire extinguishers shall be installed in all the buildings including make-up water pump house area, AWRS pump house area, as per TAC requirement.	i) Fire extinguishers shall be installed in all the buildings in the scope of the Bidder as per TAC requirement.

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A-PU-15	VI/B	A-18	1 of 15	1.01.00	A comprehensive fire detection and protection system covering all the equipments/system/buildings/areas of entire power plant including make-up water pump house, AWRS pump house under scope of the Bidder.	A comprehensive fire detection and protection system covering all the equipments/system/buildings/areas of entire power plant under scope of the Bidder.

Specification Reference				Existing	Read As
Sec/Part	Sub Sec	Page No.	Clause No.		
VI	SUB SECTION-A-02, STEAM GENERATOR & AUXILIARIES INCLUDING ESP	6 of 65	3.02.01	Water/steam walls shall be of membrane wall construction and shall be made of seamless cold drawn tubes. Furnace / evaporator shall be formed using spiral wound / inclined tubing or vertical plain / rifled tubing as per the proven practice of the manufacturer for boilers of similar capacity.	Water/steam walls shall be of membrane wall construction and shall be made of seamless cold drawn tubes. Furnace / evaporator shall be formed using spiral wound / inclined tubing or vertical plain / rifled tubing as per the proven practice of the manufacturer for boilers of similar capacity Irrespective of the type of water wall tubing offered for the evaporator, the design offered shall ensure that no readjustment of tube mass flow is required during entire operating regime of the Steam Generator for complete range of specified coals. In case such readjustment becomes necessary over a period of five years from the date of successful completion of initial operation of respective Steam Generator, the cost of carrying out such flow readjustment/modifications including cost towards rectifying any damages to the Steam Generator tubing resulting from the inappropriate mass flow in the tubes shall be borne by the Contractor. Contractor in his proposal shall indicate the approximate time required for such readjustment of tube mass flow and the period of unit shut down. The thermo-hydraulic design of the offered evaporator shall be stable under varying heat flux and mass flux conditions as well as other system disturbance that the evaporator may encounter during operation. The stability of the thermo-hydraulic design of the evaporator shall demonstrated by the contractor by conducting stability analysis (both static and dynamic) of the finalized evaporator design. As a part of the static stability, interalia, the outlet temperature profile for each tube at the intermediate header inlet (if applicable) and vertical wall outlet header be calculated. The variance of tube outlet temperature shall be validated by carrying out site demonstration for the first boiler during commissioning by affixing metal temperature thermocouples at each evaporator outlet tube (at intermediate header inlet, if applicable, and vertical wall outlet). These thermocouples shall be over and above the requirements for metal temperature thermocouples specified elsewhere. In case the temperature variance in the evaporator tubing temperature during such demonstration is found to exceed the design considerations necessary modifications to the evaporator flow circuits shall be done by the contractor to control the tube temperatures. The mechanical design of the evaporator shall be carried out considering its primary stresses due to internal pressure as well as secondary stresses due to loads like weight membrane panel, buckstays, ash, and other elements loaded on evaporator, differential stresses restrained thermal expansion between evaporator tubes and the evaporator support elements etc. The calculations in support of the same shall be submitted by the contractor.
			3.02.04	Not Used	Flame impingement on steam/water walls is not permitted. Suitable provisions, including the extent of combustion staging, shall be made to minimize the water wall corrosion. The bidder shall demonstrate that the average thinning of tubes in the burner zone due to corrosion, erosion etc. shall not be more than 0.1 mm/per year.

S. No.	Specification Reference					Existing	Read As
	Sl. No	Sec/Part	Sub Sec	Page No.	Clause No.		
A-WS-08	8	VI/A	-	INDEX	IIA-09	MAKE-UP WATER SYSTEM	Deleted
A-WS-09	9	VI/A	I	3 of 8	1.02.00	This enquiry concerns two (2) power generating units each having a rated output of 660 MW, including but not limited to: ----- Cooling Water System including, - Equipment Cooling water system including ACW pumps. - Circulating water system including CW pumps - Cooling towers for circulating water system - Aux water system including Raw water pumps □ Make- up water system - Make up water system including make-up water pumps & piping Plant Utilities including, -----	This enquiry concerns two (2) power generating units each having a rated output of 660 MW, including but not limited to: ----- Cooling Water System including, - Equipment Cooling water system including ACW pumps. - Circulating water system including CW pumps - Cooling towers for circulating water system - Aux water system including Raw water pumps Plant Utilities including, -----
A-WS-10	10	VI/A	I	11 of 36	4.17	MUW/Cross country Pipe System The Bidder/ its sub vendor.....completion of its application.	Deleted
A-WS-11	11	VI/A	I-A	257 to 258 of 411		ATTACHMENT - 3K (257 to 258 of 411)	Deleted
A-WS-12	12	VI/A	IIA-09	1 to 3 of 3	Entire Sub-section	MAKE-UP WATER SYSTEM	Sub-Section IIA-09 Deleted From Tender Document
A-WS-13	13	VI/A	IV	22 of 73	1.01.07.02 d (xiii)	Auxiliary Water System Pumps (Working Pump) (xiii) Make-up Water Pumps	Auxiliary Water System Pumps (Working Pump) (xiii) deleted
A-WS-14	14	VI/A	IV	38 of 73	1.03.13.03	Make-up Water Piping Bidder shall perform the field hydro testing of all erected piping system in accordance of provisions of IS-5822 and AWAA-M11 (latest edition).	Deleted
A-WS-15	15	VI/A	IV	43 of 73	1.03.19	Pumps (Equipment Cooling Water system, Auxiliary Water system, Make-up water system, Pre-treatment plant, DM Plant & Condensate Polishing Plant)	Pumps (Equipment Cooling Water system, Auxiliary Water system, Pre-treatment plant, DM Plant & Condensate Polishing Plant)
A-WS-16	16	VI/A	VI	1 of 27	1.00.00	MANDATORY SPARES FOR WATER SYSTEM AREA (CW, ACW, ECW, MUW, RAW WATER, CT , WTP AREA ETC.)	MANDATORY SPARES FOR WATER SYSTEM AREA (CW, ACW, ECW, RAW WATER, CT , WTP AREA ETC.)
A-WS-17	17	VI/A	VI	3 of 27	1.00.00 (8)	ARV's for CW, MuW system & Raw water system	ARV's for CW system & Raw water system
A-WS-18	18	VI/A	VI	3 of 27	1.00.00 (9)	Lubrication Water Pumps (CW/Raw Water/MuW as applicable)	Lubrication Water Pumps (CW/Raw Water as applicable)
A-WS-19	19	VI/A	VI	8 of 27	1.00.00 (18)	Auxiliary Water Pumps & MuW Pump	Auxiliary Water Pumps
A-WS-20	20	VI/B	-	-	A -10	MAKE UP WATER SYSTEM	Deleted
A-WS-21	21	VI/B	G-04	60 of 224	TABLE-2 C (8)	LIST OF EQUIPMENT'S CONSIDERED FOR STATION AUXILIARY POWER CONSUMPTION c) (8) Make up water pumps at river end	LIST OF EQUIPMENT'S CONSIDERED FOR STATION AUXILIARY POWER CONSUMPTION c) (8) deleted

A-WS-22	22	VI/B	G-04	176 of 224	10.3	Readings of Individual Pump during test (frequency of readings – 15 minutes) MuW/RW (PT & ASH)/ ECW/DMCW/ ACW) PUMP #	Readings of Individual Pump during test (frequency of readings – 15 minutes) RW (PT & ASH)/ ECW/DMCW/ ACW) PUMP #
A-WS-23	23	VI/B	G-07	54 & 55 of 75	3712 to 3762	Tentative MDL List SL No 3712 (xxxx-xxx-PVM-F-001) to 3762 (xxxx-xxx-PVM-Y-036)	Deleted
A-WS-24	24	VI/B	A-01	68 of 101	3.10.00	Make Up Water (MUW) System	Deleted
A-WS-25	25	VI/B	A-01	69 of 101	3.11.00	Common Technical Requirement for systems like CW System, MuW, ECW, WTP, Auxiliary Water pumps, etc	Common Technical Requirement for systems like CW System, ECW, WTP, Auxiliary Water pumps, etc
A-WS-26	26	VI/B	A-10	-	Entire Sub-section	MAKE UP WATER SYSTEM	Deleted
A-WS-27	27	VI/B	A-15	25 of 31	1.01.00	This specification covers general requirements..... commissioning of Makeup Water & Raw Water Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:	This specification covers general requirements..... commissioning of Raw Water Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:
A-WS-28	28	VI/B	A-15	31 of 31	1.00.0	Control philosophy for CW System, MuW, ECW and Auxiliary Water Pumps etc.	Control philosophy for CW System, ECW and Auxiliary Water Pumps etc.
A-WS-29	29	VI/B	A-15	31 of 31	2.00.00	Instrumentation for CW System, MuW, ECW and Auxiliary Water Pumps.	Instrumentation for CW System, ECW and Auxiliary Water Pumps.
A-WS-30	30	VI/E			SL No- 83	Scheme of Makeup Water System 4540-001-POM-A-061	Deleted
A-WS-31	31	VI/E			SL No- 63	Plant Water Scheme 4540-001-POM-A-037 Rev-A	Plant Water Scheme 4540-001-POM-A-037 Rev-B

Specification Reference					Existing	Read As																				
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.																						
B-19	PART-A	IIB-ELECTRICAL SYSTEM / EQUIPMENTS	4 OF 17	1.06.00	1.06.00 DC System Battery and Battery Charger Lead acid plante type/ Nickel Cadmium batteries and Float cum boost chargers for main plant, switchyard and all other areas in the scope of the contractor, as per system requirement. Following DC systems (Battery and Charger) shall be supplied to cater to various DC loads in the plant. The design and sizing criteria shall be as detailed out in the chapter B-0, Part-8 of Technical specifications. 220 V DC System for Main Plant 220 V or 110 V DC System for AWRS/Seepage Pump House 220 V or 110 V DC System for Ash silos 220 V or 110 V DC System for MUWPH 220 V DC System for CHP 220V DC System for External CHP 48 V DC System for Switchyard 220 V DC System for Switchyard 110V DC system for water system area Any other DC system as per system requirement It is preferable to supply dc system from one/ two manufacturers. One set of variable metallic resistor and shunt for each battery rating & location suitable for carrying out the discharge test on the batteries under Contractor's scope shall also be supplied.	1.06.00 DC System Battery and Battery Charger Lead acid plante type/ Nickel Cadmium batteries and Float cum boost chargers for main plant, switchyard and all other areas in the scope of the contractor, as per system requirement. Following DC systems (Battery and Charger) shall be supplied to cater to various DC loads in the plant. The design and sizing criteria shall be as detailed out in the chapter B-0, Part-8 of Technical specifications. 220 V DC System for Main Plant 220 V or 110 V DC System for Ash silos 220 V DC System for CHP 48 V DC System for Switchyard 220 V DC System for Switchyard 110V DC system for water system area Any other DC system as per system requirement It is preferable to supply dc system from one/ two manufacturers. One set of variable metallic resistor and shunt for each battery rating & location suitable for carrying out the discharge test on the batteries under Contractor's scope shall also be supplied.																				
B-20	Amendment-1			B-13	3. Requirement of employer's load of 2 MVA on each colony feeder and 5 MVA on each ext. CHP feeder to be considered for ST sizing and associated systems.	3. Requirement of employer's load of 2 MVA on each colony feeder, 5 MVA on each ext. CHP feeder, 1.5 MVA on each MUW trf feeder and 1 MVA on each AWRS feeder to be considered for ST sizing and associated systems.																				
B-21	PART-A	IIB-ELECTRICAL SYSTEM / EQUIPMENTS	9 OF 17	1.16.02 (IV)	IV. 33kV Transmission Line: 33 kV Transmission Line of 28 Km length (approx.) with (2nos) Single Circuit towers (narrow based lattice towers with fully galvanised structure) from TTPS plant boundary to Make Up water pump house . The route is along the Make up water pipe corridor.	DELETED																				
B-22	PART-A	IIB-ELECTRICAL SYSTEM / EQUIPMENTS	9 OF 17	1.16.05	1.16.05 33Kv Trannssmission line:	DELETED																				
B-23	PART-A	IIB-ELECTRICAL SYSTEM / EQUIPMENTS	9 OF 17	1.21.00	OVERHEAD LINES: Transmission line to AWRS Pumphouse: Two number 11kV or 33kV single circuit transmission line on poles for supplying power from plant to AWRS pumphouse The overhead lines for AWRS Pump house shall generally be laid along the AWRS route. However, exact routing shall be decided during detailed engineering. Scope of work includes route survey for line, civil works, design, supply, erection and commissioning of poles.	DELETED																				
					Complete DC system,..... Bidder may supply additional DC systems at offsite load centers as per system requirement:	Complete DC system,..... Bidder may supply additional DC systems at offsite load centers as per system requirement:																				
					<table><tr><td>Area</td><td>DC Voltage</td><td>Load</td><td>Minimum Battery Rating</td><td>Bank</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table>	Area	DC Voltage	Load	Minimum Battery Rating	Bank						<table><tr><td>Area</td><td>DC Voltage</td><td>Load</td><td>Minimum Battery Rating</td><td>Bank</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table>	Area	DC Voltage	Load	Minimum Battery Rating	Bank					
Area	DC Voltage	Load	Minimum Battery Rating	Bank																						
Area	DC Voltage	Load	Minimum Battery Rating	Bank																						

B-24	PART-B	B0- GENERAL ELECTRICAL SPECIFICATION	11 OF 15	3.08.00	<table><tr><td>Unit</td><td>220 V</td><td>Total DC load of the unit at an acceptable voltage for at least 30 minutes</td><td>As per system requirement</td></tr><tr><td>CHP and external CHP</td><td>220 V</td><td>total CHP DC load at an acceptable voltage for at least 30 minutes and DC lighting for at least one hour</td><td>150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge (KPH) type batteries</td></tr><tr><td>AWRS/Seepage water system, Ash silos/ /Makeup water PH etc</td><td>220 V/ 110 V</td><td>supply total DC load of the associated area at an acceptable voltage for at least 30 minutes</td><td>150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge</td></tr></table>	Unit	220 V	Total DC load of the unit at an acceptable voltage for at least 30 minutes	As per system requirement	CHP and external CHP	220 V	total CHP DC load at an acceptable voltage for at least 30 minutes and DC lighting for at least one hour	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge (KPH) type batteries	AWRS/Seepage water system, Ash silos/ /Makeup water PH etc	220 V/ 110 V	supply total DC load of the associated area at an acceptable voltage for at least 30 minutes	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge	<table><tr><td>switchyard</td><td>220 V batteries</td><td>(a) Emergency lighting in Switchyard control room for a period of 1 hour plus (b) All continuous DC loads of relay & control panels/PLCC panels for a duration of 3 hours plus (c) Interlocking coils of isolators/earth switches shall be considered including requirement of three future line bays for a duration of 3 hours plus (d) loads in worst of the following conditions (i) simultaneous operation of the maximum number of breakers & associated equipments in case of bus fault in the switchyard. (ii) Operation of Breaker failure relay (LBB relay)</td><td>(KPH) type batteries 625AH lead acid Plante type/410 AH Ni-Cd (KPH type)</td></tr><tr><td>PLCC System for Switchyard</td><td>48 V</td><td>supply total DC load of the PLCC system at an acceptable voltage for at least 3 hours</td><td>425AH lead acid Plante type/390 AH Ni-Cd (KPL type)</td></tr></table>	switchyard	220 V batteries	(a) Emergency lighting in Switchyard control room for a period of 1 hour plus (b) All continuous DC loads of relay & control panels/PLCC panels for a duration of 3 hours plus (c) Interlocking coils of isolators/earth switches shall be considered including requirement of three future line bays for a duration of 3 hours plus (d) loads in worst of the following conditions (i) simultaneous operation of the maximum number of breakers & associated equipments in case of bus fault in the switchyard. (ii) Operation of Breaker failure relay (LBB relay)	(KPH) type batteries 625AH lead acid Plante type/410 AH Ni-Cd (KPH type)	PLCC System for Switchyard	48 V	supply total DC load of the PLCC system at an acceptable voltage for at least 3 hours	425AH lead acid Plante type/390 AH Ni-Cd (KPL type)
					Unit	220 V	Total DC load of the unit at an acceptable voltage for at least 30 minutes	As per system requirement																		
CHP and external CHP	220 V	total CHP DC load at an acceptable voltage for at least 30 minutes and DC lighting for at least one hour	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge (KPH) type batteries																							
AWRS/Seepage water system, Ash silos/ /Makeup water PH etc	220 V/ 110 V	supply total DC load of the associated area at an acceptable voltage for at least 30 minutes	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge																							
switchyard	220 V batteries	(a) Emergency lighting in Switchyard control room for a period of 1 hour plus (b) All continuous DC loads of relay & control panels/PLCC panels for a duration of 3 hours plus (c) Interlocking coils of isolators/earth switches shall be considered including requirement of three future line bays for a duration of 3 hours plus (d) loads in worst of the following conditions (i) simultaneous operation of the maximum number of breakers & associated equipments in case of bus fault in the switchyard. (ii) Operation of Breaker failure relay (LBB relay)	(KPH) type batteries 625AH lead acid Plante type/410 AH Ni-Cd (KPH type)																							
PLCC System for Switchyard	48 V	supply total DC load of the PLCC system at an acceptable voltage for at least 3 hours	425AH lead acid Plante type/390 AH Ni-Cd (KPL type)																							
DC Health Monitoring Systems for Main Plant (220 V) and switchyard (220V and 48V) shall be provided to monitor the condition of each battery cell of 220V battery banks on-line on 24x7 basis. With DC Health Monitoring System it shall be possible to measure & analyze the individual cell and battery parameters so that any damage to battery shall be prevented by proactive maintenance.																										

B-25	VI/ Part-A	Section-IB ELECTRICAL SYSTEM / EQUIPMENTS	7 of 17	1.16.00	The scope of work is for the Design, supply, erection, testing and commissioning of 400kV SF6 Gas Insulated switchyard including AIS portion, 33kV Transmission line as shown in Single Line diagram associated with Talcher TPP Stage-III (2X660MW).....	The scope of work is for the Design, supply, erection, testing and commissioning of 400kV SF6 Gas Insulated switchyard including AIS portion as shown in Single Line diagram associated with Talcher TPP Stage-III (2X660MW).....

B-26	VI/ Part-A	Sub-Section-III , TERMINAL POINTS & EXCLUSIONS AND OWNER'S INPUT	2 of 3	4.02.00	ELECTRICAL a) Supply erection and commissioning of PLCC, HF cable. b) 400KV transmission lines	ELECTRICAL a) Supply erection and commissioning of PLCC, HF cable. b) 400KV transmission lines c) 11kV O/H line to AWRS, d) 33KV O/H line to MUW Pump house, e) Electrical system and equipments for AWRS pump house, MUW pump house and ext. CHP
B-27	VI/ Part-A	Section-I-A Provenness	Page no 33 of 37	5.16	33kv Transmission Line :	Deleted . Not Applicable
B-28	VI/Part-B	B-17 Switchyard	29 of 60 to 60 of 60	12.00.00 to 24.05.05	33KV Syetem : General Information	Deleted. Not Applicable
B-29	VI/Part-B	B0- GENERAL ELECTRICAL SPECIFICATION	3 of 15	2.03.00	Loads of AWRS/Seepage water System located outside the plant boundary are in Bidder's scope and shall be suitably fed from 11kV Miscellaneous Switchgear. The basic scheme is shown in the Single Line diagram. The voltage of lines to AWRS and shall be based on system requirement considering starting of AWRS Motors under most onerous conditions AWRS Motors shall have voltage level as per criteria specified elsewhere in the specification. Further distribution for seepage pump house shall be at suitable voltage level meeting system requirement.	Deleted. Not Applicable
B-30	VI/Part-E	Tender Drawings			drawing : 3D isometric (sl no. 92 as per index) , 33kV Line conductor Formation & Clearances drg. No. REC/DDUGIY/33kv/03, (sl.no. 93 as per index), 33KV Lines Arrangement of conductors at Single Pole Support (0o to 10o deviation) drg no. REC/DDUGIY/33kv/03 (sl.no. 94 as per index)	Deleted. Not Applicable
B-31	VI/ Part-E	Tender Drawings		Electrical SLD TTPS-III EPC	Drg. No. 4540-001-POE-J-001	Replaced by Drg. No. 4540-999-POE-J-001
B-32	VI/ Part-A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	7 of 17	1.15.00	CONSTRUCTION POWER To meet the construction power requirement of the project,..... Complete construction power arrangement along with power drawl limits shall comply with respective DISCOM service rules. Supply, erection, testing and commissioning of overhead lines ring mains, single pole /double pole/ four pole structures with switches, fuse, lightning arrestors, LT transformers, 415V switchboards, power and control cables, DC Systems etc. as required for further distribution for meeting the construction power requirements, shall be in the bidder's scope. Start-up power shall be made available by Employer at 400 KV level through evacuation lines in the switchyard for plant commissioning purpose as per work schedule for initial operation of the equipments.	CONSTRUCTION POWER To meet the construction power requirement of the project,..... Complete construction power arrangement along with power drawl limits shall comply with respective DISCOM service rules. Some areas are under the scope of this contract but located outside the plant boundary (like area for laydown and pre assembly etc.). Bidder shall make separate arrangement of suitable capacity as necessary for meeting construction power requirement at such locations. Supply, erection, testing and commissioning of overhead lines ring mains, single pole /double pole/ four pole structures with switches, fuse, lightning arrestors, LT transformers, 415V switchboards, power and control cables, DC Systems etc. as required for further distribution for meeting the construction power requirements, shall be in the bidder's scope. Start-up power shall be made available by Employer at 400 KV level through evacuation lines in the switchyard for plant commissioning purpose as per work schedule for initial operation of the equipments.
B-33	VI/Part-A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	3 of 17	1.05.02	LV SWITCHGEARS AND LV BUSDUCTS The scope of work..... All Switchgears, Motor Control Centers (MCCs) & AC/DC distribution boards, etc. shall have at least twenty per cent (20%) or minimum two (whichever is higher) fully equipped switch fuse modules of each rating as spares, uniformly distributed over different vertical sections. In addition, all Switchgears, MCCs and AC distribution boards shall have as spares at least twenty per cent (20%) of starter modules/MCCB modules or at least one module (whichever is higher) of each rating range of the selection tables (Clause no.43.00.00.Section-VI, subsection-806) equipped for the rating of the largest auxiliary fed from that range. LT Switchgears in switchgear rooms.	LV SWITCHGEARS AND LV BUSDUCTS The scope of work..... All Switchgears, Motor Control Centers (MCCs) & AC/DC distribution boards, etc. shall have at least twenty per cent (20%) or minimum two (whichever is higher) fully equipped MCCB (less than 100 A) of each rating as spares, uniformly distributed over different vertical sections. In addition, all Switchgears, MCCs and AC distribution boards shall have as spares at least twenty per cent (20%) of starter modules/MCCB modules (100 A to 400 A)/ACB outgoing modules (DM & DAE-OG) or at least one module (whichever is higher) of each rating range of the selection tables (Clause no.43.00.00.Section-VI, subsection-806) equipped for the rating of the largest auxiliary fed from that range. LT Switchgears in switchgear rooms.

B-34

VI/Part A	Section-IIB ELECTRICAL SYSTEM / EQUIPMENTS	13 of 17	19.00.00 (4)	Addition of new clause	4. Shifting of existing LT transformer from old location of RWPH and PT plant of Stage-II to new RWPH and PT plant of Stage-III. Necessary Power and Control cable and cabling from existing power supply source to new location is also in Bidder's scope. This arrangement shall be utilized for feeding of Stage-III RWPH and PT plant until commissioning of Stage-III Auxiliary power Supply system. Bidder shall ensure readiness of LT switchgear associated with RWPH and PT plant of Stage-III in matching time frame.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-04	VI/A	IIC	5 of 18	2.02.00	The DDCMIS system During detailed engineering stage.	The DDCMIS system During detailed engineering stage. All equipment and systems being supplied in this package shall be monitored and controlled from DDCMIS under this package. Some of the equipments and systems (makeup water system and AWRS system) being procured by Employer in separate package shall also be monitored and controlled by DDCMIS under this package.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-05	VI/A	IIC	7 of 18	2.04.03, i	OWS: 6 Operator Workstations (OWS) per unit (1 SG, 1 TG, 3 BOP, 1 UID), 19 OWS for common (1 SAC, 4 WS in centralized offsite CR, 6 AHP in centralized offsite CR, 2 CHP, 2 FGD in centralized offsite CR, 2 FGD in FGD CR)	OWS: 6 Operator Workstations (OWS) per unit (1 SG, 1 TG, 3 BOP, 1 UID), 19 OWS for common (1 SAC, 4 WS in centralized offsite CR, 6 AHP (4 in centralized offsite CR, 1 in Ash Silo and 1 in AWRS), 2 CHP, 2 FGD in centralized offsite CR, 2 FGD in FGD CR, 2 for misc purpose)

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-06	VI/A	IIC	8 of 18	2.04.5		New S. No added 5. Between AWRS system / DCS , located in AWRS control room and AHP system / DCS for operation and monitoring of AWRS system from HMI of AHP system (Operation & monitoring of AWRS system should be available from OWS located in AWRS control room, even in case of non-availability of wireless link between AWRS system / DCS & AHP system / DCS.
C-07	VI/A	IIC	8 of 18	2.04.5	Wireless connectivity between, make up DDCMIS and Water system DDCMIS, CHP Stacker Reclaimer PLC and Station LAN is to be redundant. Other wireless links are non-redundant. The automation solution as per IEC 62443-2-4	Wireless connectivity between, make up DDCMIS and Water system DDCMIS, CHP Stacker Reclaimer PLC and Station LAN, AWRS HMI and AHP DDCMIS HMI is to be redundant. Other wireless links are non-redundant. The automation solution as per IEC 62443-2-4
C-08	VI/A	Annexure C to Sub Section IIC	6 of 24	A, 2.06.00	AWRS block (if applicable)	AWRS block
				2.07.00	Lime handling system stream-A block Lime handling system stream-A block	Lime handling system stream-A block Lime handling system stream- B block

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02

EPC Package for Talcher Thermal Power Project,
Stage-III (2x660 MW)

Amendment No. 02 to Technical
Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-09	VI/A	Annexure C to Sub Section IIC	7 of 24	A, 2.14.00		New Clause added Refer Appendix-I to this Subsection for IO and Drive count for Employers Makeup water system and AWRS that are to be monitored and controlled by Contractor's Control system.
C-10	VI/A	Annexure C to Sub Section IIC				Appendix-I to Annexure C to Subsection IIC has been attached as "C&I Annexure_Appendix-1 to Annexure C to IIC" to this amendment.
C-11	VI/A	Annexure C to Sub Section IIC	20 of 24	K	Vibration sensors shall be provided per measurement location.	Vibration sensors shall be provided per measurement location. For makeup water system (in Employer scope) and AWRS system (in Employers scope) 12 no. of Vibration sensor for each system are to be provided. Vibration monitor is to be provided on as required basis in Makeup water system CER and AWRS CER.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-12	VI/A	III	2 of 3	3.00.00	NOT USED	3.00.00 Control & Instrumentation 3.01.00 For Makeup water system and AWRS 3.01.01 TBs of employer's instruments and Local Junction boxes for signals which are being interfaced with the Contractor's control system. All required cables from these TBs to contractors control system shall be supplied, laid and terminated by the Contractor 3.01.02 For Employer's Fieldbus(FF/Profibus) based Devices:-- a. TBs of Fieldbus positioners and instruments. b TBs of Fieldbus based non-intrusive actuators for fieldbus cable. All required cables from these TBs to contractors control system shall be supplied, laid and terminated by the Contractor. 3.01.03 Employer shall provide one (1) number, 415 V, three phase 3-wire, 50 Hz feeder for UPS each at makeup water system and AWRS system. All required Cables from this feeder to Contractor UPS panel will be in contractors scope. 3.01.04 Employer shall provide two (2) number, 415 V, three phase 3-wire, 50 Hz feeder for 24 VDC system each at makeup water system and AWRS system. All required Cables from these feeder to Contractor 24VDC panel will be in contractors scope. 3.02.00 For other system: NIL

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-13	VI/A	IV	2 of 73	1.00.01 g)	PG test shall be performed by using process instruments envisaged for normal operation and control of unit. Any additional instrument/ item required for PG test shall also be supplied by the contractor. Instruments to be used for PG test shall be indicated in the respective P&IDs. Control system loop tuning required to limit the variation of parameters during performance guarantee testing shall be completed prior to PG Test / initial operation. Test result for PG test is envisaged to be computed in DDCMIS.	Instruments for PG test and instruments for process control of similar applications shall be of same make and model having same accuracy level. Instruments to be used for PG test shall be indicated in the respective P&IDs. PG test equipment being supplied, installed and commissioned for each unit, shall be retained by employer after completion of PG test. Control system loop tuning required to limit the variation of parameters during performance guarantee testing shall be completed prior to PG Test / initial operation. All PG test process parameters shall be made available in DDCMIS.
C-14	VI/A	IIC	17 of 18	21.00.00	2. Bidder is to provide..... The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for major equipment's of Boiler, Turbine, Generator, AHP, CHP. The individual equipment models shall finalized during detail engineering.	2. Bidder is to provide..... The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for the following equipments: Boiler, Turbine, Generator. Crusher House , Dry ash evacuation system, MDBFP, TDBFP, CW pumps, ID fan, FD fan, PA fan, Pulverizer, Condenser and Dearator The individual equipment models shall finalized during detail engineering.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 02	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 02 to Technical Specifications Section-VI

TABLE IB:

Table-IB- MAKE UP DDCMIS		
I/O types		
Function Block		Make-up Water Block
Function Block location		Make up Water system Control room
Brief Application /service/area		Make up Water system
Signal Type		
AI (Control)	AI (4-20mA)	10
	AI (4-20mA) Galvanic	30
AI (Field Bus)	AI (Field Bus)	70
AI (Information)	AI (4-20mA)	
	AI (4-20mA) Galvanic	
AO	AO (4-20mA)	10
	AO (4-20mA) Galvanic	
DI	DI (COC)	
	DI (NO/NC)	300
DO	DO (Contact)	10
	DO(24V DC)	120
Relays		10
Power Supply	24 V DC Power Supply	

TABLE IIB:

Table-IIB- MAKE UP DDCMIS		
Type of control	Function Block	Make-up Water Block
	Function Block location	Make up water system Control room
	Brief Application /service/area	Make up Water system
OLCS	HT	3
	LT	5
	VFD-O	
	MOD/MOV	
	MOD/MOV (Field bus)	11
	MOVI/MODI	
	AC-MOV1	
	AC-MOV2	
	DSOV	
	SSOV, SOV/O/L, SOV/C/L, SOV1	
	SOV2, SOV/O, SOV/C	7
	Elect Breakers (Non-Synch)	25
	Elect Breakers (Synch)	
CLCS	CLCS-M	
	CLCS-5 (VFD)	
Power Supply	24 V DC Power Supply	

TABLE IB:

Table-IB- AWRS (Part of AHP DDCMIS)		
I/O types		
Function Block		
Function Block location		AWRS CONTROL ROOM
Brief Application /service/area		AWRS
Signal Type		
AI (Control)	AI (4-20mA)	7
	AI (4-20mA) Galvanic	
AI (Field Bus)	AI (Field Bus)	15
AI (Information)	AI (4-20mA)	
	AI (4-20mA) Galvanic	5
AO	AO (4-20mA)	
	AO (4-20mA) Galvanic	
DI	DI (COC)	
	DI (NO/NC)	158
DO	DO (Contact)	
	DO(24V DC)	90
Relays		
Power Supply	24 V DC Power Supply	

TABLE IIB:

Table-IIB- AWRS (Part of AHP DDCMIS)		
Type of control	Function Block	
	Function Block location	AWRS Control room
	Brief Application /service/area	AWRS
OLCS	HT	3
	LT	4
	VFD-O	
	MOD/MOV	
	MOD/MOV (Field bus)	8
	MOVI/MODI	
	AC-MOV1	
	AC-MOV2	
	DSOV	
	SSOV, SOV/O/L, SOV/C/L, SOV1	
	SOV2, SOV/O, SOV/C	
	Elect Breakers (Non-Synch)	
	Elect Breakers (Synch)	10
CLCS	CLCS-M	
	CLCS-5 (VFD)	5
Power Supply	24 V DC Power Supply	

Notes:

1. Table IB - Quantity of Inputs/Outputs (Process I/Os as well as drive I/Os). The I/Os related to Drive I/Os mentioned in table IIB are already covered in counts of Table-IB.
2. Table IIB - Quantity of Drives controlled by Control System. Drive types & drive quantities have also been indicated for reference at Table-IIB. These quantities are to be used for estimating software blocks capacity in controllers.
3. The 10% I/O spare channels in each functional group for each type of input/output has been included in the Table-IB and are not to be reconsidered.

AMENDMENT - D2					
Specification Reference					Existing
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Read As
D2-1	VI/A	IID	2 of 13	1.00.00	In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline and external CHP corridor, dismantling of existing railway siding (both inside and outside plant boundary) is also in the scope of the bidder. Dismantling of all existing facilities and disposal of dismantled material is in the scope of the bidder. The bidder has to take care this aspect while bidding. Bidder shall be responsible for safe disposal of all such materials outside the plant boundary in environmentally friendly manner meeting all statutory requirements.....
					In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline inside plant boundary, dismantling of existing railway siding including OHE, Signaling System and S&T Building (inside plant boundary) is also in the scope of the bidder. Since construction drawings of existing underground structures/foundations are not available. A Ground Penetration Radar (GPR) study has been carried out some selected areas, wherever it was possible, for underground structures/foundations. Sub-surface survey has been carried out using Ground Penetrating Radar (GPR) comprising the 200 MHz & 500 MHz Antenna. Though the Ground penetrating radar (GPR) technology is yet to reach the level of maturity, and has its limitations, still GPR is now-a-days popularly used for the detection of subsurface structures and utilities. The details/report given by GPR agency is attached as Annexure-Q. The details provided are purely for information purpose, for preliminary assessment by the bidder, and is indicative within the limitations of the equipment deployed and the method adopted. Actual underground structure / foundation shape, size, depth, thickness etc. may vary from that shown in Annexure-Q. Accordingly, the bidder must use this report judiciously with due discretion. Bidder's scope of work would remain as defined / necessary for full completion of work. No additional claim from bidder for variation, from GPR report, of shape, size, depth thickness etc. of underground structures/ foundations shall be entertained. Dismantling of all existing facilities and disposal of dismantled material is in the scope of the bidder. The bidder has to take care this aspect while bidding. Bidder shall be responsible for safe disposal of all such materials outside the plant boundary in environmentally friendly manner meeting all statutory requirements. The liability for any payment w.r.t. removal / disposal of dismantled material including the applicable taxes/duties shall be that of the Bidder.
D2-2	VI/A	IID	4 of 13	1.00.00	6 d. Patrol/inspection road along Ash Slurry pipe corridor as shown in tender drawings.
D2-3	VI/A	IID	5 of 13	1.00.00	11. Civil, Structural, Architectural works for all buildings/ structures/ facilities for ash handling and ash water recirculation system along with switchgear building & control room including the following: if required as per system.
D2-4	VI/A	IID	5 of 13	1.00.00	11. c. Ash Water Recirculation Pump House complex including switchgear room, transformer yard, control room, battery room, Disaster management room, boundary wall etc.
D2-5	VI/A	IID	6 of 13	1.00.00	11. j. RCC pedestals for ash slurry disposal pipes lines upto mine voids including garlanding pedestal for mine voids
					11. j. RCC pedestals for ash slurry disposal pipes lines upto terminal point as per CI 1.03.00 of VI/A Sub Section-III

D2-6	VI/A	IID	6 of 13	1.00.00	11. k.RCC pedestals for supporting ash water recirculation pipe	11.k.RCC pedestals for supporting ash water recirculation pipe from terminal point as per CI 1.03.00 of VI/A Sub Section-III to ash water PH.
D2-7	VI/A	IID	6 of 13	1.00.00	11.p.Entire ash pipeline corridor road from plant boundary to mine voids including garlanding road on mine voids and connecting road for Ash Water Recirculation Pump House Complex.	11.p. Deleted
D2-8	VI/A	IID	7 of 13	1.00.00	19. Makeup water System All Civil, structural & architectural works..... and paving around all the facilities.	19. Deleted
D2-9	VI/A	IID	8 of 13	1.00.00	30.Civil, structural, architectural works for SOLAR PV plant on 'A-Row' elevation for main power house and roof top of building/facilities in the bidder's scope.	30.Civil, structural, architectural works for SOLAR PV plant on roof top of building/facilities in the bidder's scope.
D2-10	VI/A	IID	9 & 10 of 13	1.00.00	34.Railway Siding NTPC has undertaken..... If any on the same basis.	34. Deleted
D2-11	VI/B	D-1-5	65 of 127	5.18.00	CW SYSTEM, RAW WATER SYSTEM AND MAKE-UP WATER SYSTEM CIVIL WORKS	CW SYSTEM AND RAW WATER SYSTEM CIVIL WORKS
D2-12	VI/B	D-1-5	65 of 127	5.18.01	Circulating Water Pump House (CWPH), Raw Water Pump House (RWPH) and Make-up water Pump House (MUWPH)	Circulating Water Pump House (CWPH) AND Raw Water Pump House (RWPH)
D2-13	VI/B	D-1-5	66 of 127	5.18.01.02	The Make-up water pump house (MUWPH) shall the stoplog and trash rack area.	Deleted
D2-14	VI/B	D-1-5	66 of 127	5.18.01.04	Design requirement for CWPH, RWPH and MUWPH	Design requirement for CWPH and RWPH
D2-15	VI/B	D-1-5	70 of 127	5.18.01.06	Para 5 MUWPH Inlet Channel The channel shall..... thickness shall be 250 mm.	Deleted
D2-16	VI/B	D-1-5	71 of 127	5.18.01.08	Stop-logs and Trash Racks for CWPH, RWPH and MUWPH	Stop-logs and Trash Racks for CWPH and RWPH
D2-17	VI/B	D-1-5	73 of 127	5.18.01.10	Switch Gear / Control Room/ Remote IO room for CWPH, RWPH and MUWPH It shall be single storied building, framed RCC structure with beams, columns, floor and roof. It shall have non-load bearing brick wall cladding. It shall house the switch gear and MCC of respective Pump house & associated cable trenches. The architectural features shall be as specified elsewhere in the specification. Bio Toilet shall be opted for make up water facility area outside the plant boundary. Specifications of same shall be as mentioned elsewhere in technical specifications.	Switch Gear / Control Room/ Remote IO room for CWPH and RWPH It shall be single storied building, framed RCC structure with beams, columns, floor and roof. It shall have non-load bearing brick wall cladding. It shall house the switch gear and MCC of respective Pump house & associated cable trenches. The architectural features shall be as specified elsewhere in the specification.
D2-18	VI/B	D-1-5	73 to 82 of 127	5.18.02.00 Sub Clause 5.18.02.01 to 5.18.02.15	MUWPH Piping Works	Deleted

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

D2-19	VI/B	D-1-5	82 to 83 of 127	5.18.03 Sub Clause 5.18.03.01 to 5.18.03.04	Clean-Up And Restoration Of Work Areas	Deleted
D2-20	VI/B	D-1-5	83 to 84 of 127	5.18.04 Sub Clause 5.18.04.01 to 5.18.04.03	Cutting And Removal Of Paving/ Water Bound Macadam Road	Deleted
D2-21	VI/B	D-1-5	84 to 85 of 127	5.18.05	Structural Steel Bridges For Make-Up Water Pipes Crossing At Irrigation Canal/Nallah/ Samal Barrage Reservoir Submergence Area	Deleted
D2-22	VI/B	D-1-5	85 to 86 of 127	5.18.06	Make-Up Water Pipe Crossings At National Highway / State Highway / Railway	Deleted

D2-23	VI/B	D-1-5	35 of 127	5.05.01	The civil works for Ash handling system (both wet and dry) shall comprise of bottom ash and fly ash handling systems, which includes Combined Ash slurry pump house and their related sumps/tanks, Ash water pump house, Bottom Ash (BA) slurry transportation pump pit and their related sumps/tanks (In case of SCC system), Transport/instrument Air Compressor house, Conveying air compressor house, Switchgear /Control/RIO rooms, Ash Water Recirculation System (AWRS) pump house complex and their related sumps/tanks, supporting structures and foundations for Bottom ash hopper, Buffer hoppers/Collector tanks, bottom ash overflow tank, Settling tanks and Surge tanks, Seal water tank, Ash Classifier, Bagging plant Complex, Silo Utility Building complex with Fly & Bottom Ash Silos, including development of silo area (i.e. paving, fencing/boundary-wall, access roads, office block and watchman cabin), miscellaneous equipment foundations, trenches, pipe racks, pedestals/thrust blocks for BA / AWR pipe supports (both inside and outside the plant boundary) including bridges/ culverts for road/rail/drain/nallah as required.	The civil works for Ash handling system (both wet and dry) shall comprise of bottom ash and fly ash handling systems, which includes Combined Ash slurry pump house and their related sumps/tanks, Ash water pump house, Bottom Ash (BA) slurry transportation pump pit and their related sumps/tanks (In case of SCC system), Transport/instrument Air Compressor house, Conveying air compressor house, Switchgear /Control/RIO rooms, supporting structures and foundations for Bottom ash hopper, Buffer hoppers/Collector tanks, bottom ash overflow tank, Settling tanks and Surge tanks, Seal water tank, Ash Classifier, Bagging plant Complex, Silo Utility Building complex with Fly & Bottom Ash Silos, including development of silo area (i.e. paving, fencing/boundary-wall, access roads, office block and watchman cabin), miscellaneous equipment foundations, trenches, pipe racks, pedestals/thrust blocks for BA / AWR pipe supports including bridges/ culverts for road/rail/drain/nallah as required. For the ballast-less rail track under silo area complex a 4.0m wide area (2.0 m either side of centre line of railway track) shall be left unpaved along the rail track in complete silo area complex same shall be constructed by railway siding agency. RCC peripheral drains, crossing rail track shall be covered with permanent RCC slab (minimum 150 mm thk.) & construction of these RCC drains such that it will not create any hindrance in construction of rail track. Top of paving level in balance silo area complex shall be governed by the top level of rail track in silo area complex. Steel gates of minimum 6.0m width for entry & exit of railway wagons in silo area complex shall be provided in boundary wall/ fencing of silo area complex. For the hindrance free movement of railway rack on the rail track under Silo following shall be provided however necessary approval shall be taken from the railway authority by successful bidder. *Horizontal clearance: A minimum clearance of 3.5m shall be maintained between centre line of the Railway track to face of the crossing structure. *Vertical clearance: A minimum vertical clearance of 8.5m shall be maintained between Rail top level and bottom of structure.
D2-24	VI/B	D-1-5	35 of 127	5.05.02	Transport air compressor houses, Conveying air compressor houses, Ash slurry Pump House shall have steel shed building with side sheeting and Silo utility building, & Ash Water Recirculation pump houses shall have RCC framed structure, with RCC columns and profiled metal deck sheet roofing (filled with RCC) supported on steel purlins & truss / girders. Other buildings like MCC /switchgear rooms, control room, Disaster management room etc. shall have RCC framed structure with cast-in-situ RCC roof slabs. Bagging plant Complex building shall be closed steel shed. All RCC buildings shall have brick cladding. Crane girders or monorails shall be provided as per requirement and the same shall be of structural steel construction.	Transport air compressor houses, Conveying air compressor houses, Ash slurry Pump House shall have steel shed building with side sheeting and Silo utility building shall have RCC framed structure, with RCC columns and profiled metal deck sheet roofing (filled with RCC) supported on steel purlins & truss / girders. Other buildings like MCC /switchgear rooms, control room etc. shall have RCC framed structure with cast-in-situ RCC roof slabs. Bagging plant Complex building shall be closed steel shed. All RCC buildings shall have brick cladding. Crane girders or monorails shall be provided as per requirement and the same shall be of structural steel construction.

D2-25	VI/B	D-1-5	36 of 127	5.05.04	The finished floor level (FFL) of Ash Water Recirculation (AWR) pump house complex shall be 500 mm above FGL. However, in order to facilitate approach/connection to the road on top of mine void with AWR pump house complex, if required FGL may be fixed at higher level than 1.5 m above HFL. AWR System shall include Ash water recirculation pump house complex near mine void along with related sumps/tanks, MCC/Switchgear building, maintenance room, control room, disaster management room (single storey room of approx. size 15 m x 7.5 m and 1.5m wide verandah along the larger dimension), transformer yard, miscellaneous equipment foundations, trenches inside roads/RCC paving and area drainage etc. The peripheral drain inside the complex of suitable capacity & slope shall be suitably connected to the natural drain available outside the complex. The AWRPH complex shall be confined with boundary wall and a security gate. The complex shall be suitably connected to the road to plant and road on mine voids. Since the complex is situated outside the plant boundary, an Independent sewerage system including soak pit/ inspection chamber shall be provided.	Deleted
D2-26	VI/B	D-1-5	36 of 127	5.05.06	For AWR system, the pedestals/thrust blocks for pipe supports from mine voids to AWR sump & AWRPH to ash water PH including bridges/ culverts for road/rail/drain/nallah etc, shall be provided as per the system requirement. The pedestals for AWR pipes may be combined with the pedestals for Bottom ash pipes in the corridor common for pipes. Pipe supports shall be provided for bottom ash slurry pipes, ash slurry pipes, AWR pipes, dust suppression pipes, dry fly ash(FA) pipes including RCC thrust blocks and any other supports required to complete the system. Over-ground pipes shall be supported on RCC pedestals except for FA pipes which shall be on elevated steel trestles. Unless noted otherwise, the top of concrete pedestals shall be minimum 500 mm above surrounding ground level/paving level. Pipes shall be suitably anchored with RCC pedestals to resist lateral and vertical movements as per system requirement. B.A. slurry disposal pipe line pedestals and thrust block/culverts including garlanding of bottom ash slurry mine voids. If the layout requires the pipes to cross the road on	For AWR system, the pedestals/thrust blocks for pipe supports from terminal point as per CI 1.03.00 of VI/A Sub Section-III to ash water PH including bridges/ culverts for road/rail/drain/nallah etc, shall be provided as per the system requirement. The pedestals for AWR pipes may be combined with the pedestals for Bottom ash pipes in the corridor common for pipes. Pipe supports shall be provided for bottom ash slurry pipes, ash slurry pipes, AWR pipes, dust suppression pipes, dry fly ash(FA) pipes including RCC thrust blocks and any other supports required to complete the system. Over-ground pipes shall be supported on RCC pedestals except for FA pipes which shall be on elevated steel trestles. Unless noted otherwise, the top of concrete pedestals shall be minimum 500 mm above surrounding ground level/paving level. Pipes shall be suitably anchored with RCC pedestals to resist lateral and vertical movements as per system requirement. B.A. slurry disposal pipe line pedestals and thrust block/culverts from terminal point as per CI 1.03.00 of VI/A Sub Section-III to ash water PH.

					top of mine voids, all ash pipes shall be laid in hume pipes of suitable diameter (NP-3 class) encased in RCC(minimum 200 mm thick) forming a hump on the road. The road shall be modified such that the slope of road along the length, at hump section, shall not be steeper than 1:20.	
D2-27	VI/B	D-1-5	36 & 37 of 127	5.05.07	Single lane maintenance / Inspection road top shall be increased.	Deleted
D2-28	VI/B	D-1-5	37 of 127	5.05.10	Survey inside and outside plant boundary, required for finalization of layout for maintenance road, FA transportation pipe trestles, pipe pedestals up to mine voids including mine voids, is in the bidder's scope. The survey shall include the longitudinal section of the entire corridor	Deleted
D2-29	VI/B	D-1-5	38 of 127	5.05.15	g. Ash water recirculation building shall have Bio toilet as mentioned else where in the specification.	Deleted
D2-30	VI/E	Tender Drawings			4540-001-POC-A-009 4540-001-POC-A-010 4540-001-POC-A-010 (AutoCAD) 4540-001-POC-A-011 4540-001-POC-A-012 4540-001-POC-A-013 4540-001-POC-A-014	Deleted
D2-31	VI/B	D-1-12(P)			Annexure-P	Annexure-P(R2)
D2-32	VI/B	D-1-7	1 of 12 to 12 of 12	FULL CHAPTER	Foundation System and Geotechnical Data	Refer revised D-1-7
D2-33	VI/B	D-1-12(C)			Annexure-C	Refer revised Annexure-C
D2-34	VI/A	IID	1 of 13	1.00.00	3. Site clearance including cutting of trees of girth less than 30 centimeters.	3. Site clearance including cutting of trees of girth less than 30 centimeters. Cutting of trees of girth more than 30 cm shall be done by the Owner, however, removal and disposal of roots, trees of girth less than 30 cm and other vegetation is in Bidder's scope.
D2-35	VI/E	Tender Drawings			4540-999-POC-F-001	Revised
D2-36	VI/E	Tender Drawings			4540-001-POC-A-007	4540-001-POC-A-007 Rev-C
D2-37	VI/A		3 of 13	1.00.00	5. Construction of Raw Water Reservoir and dismantling, removal, disposal of waste material of existing reservoirs and levelling to FGL.	5.Construction of New Raw Water Reservoir and all associated facilities including supply and laying of Make up water pipe from the terminal point as per CI 3.00.00 of VI/A Sub Section-III inside the plant boundary to raw water reservoir inlet structure and as indicated in the Tender Drawing No. Drg No. 4540-001-POC-A-007 Rev-C The interconnection of Stage -III reservoir inlet pipe with existing MUW pipeline of Stage-II & I shall be under Bidder's scope and dismantling, removal, disposal of waste material of existing reservoirs and levelling to FGL.

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Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

D2-38	VI/A	III	2 of 3	3.00.00	NOT USED	Terminal point for Stage -III Inlet Make up water pipe line- The terminal point of Inlet Make-up water pipe shall be at a distance of 8m from the plant boundary as indicated in the Tender Drawing No. Drg No. 4540-001-POC-A-007 Rev-C

AMENDMENT - D2					
Specification Reference					Existing
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Read As
D2-39	VI/A	I-A	8 OF 136	CLAUSE 4.3	4.3.1 The Bidder / its sub-vendor should have designed/got designed, constructed and commissioned at least one (1) number of Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill of capacity not less than 30000 Cu.M/Hr and which should have been in successful operation for at least one (1) year. 4.3.2 Bidder / its Sub Vendor who fulfills the requirements in Clause 4.3.1 above with fill type other than splash/modular/trickle type fill, can also participate provided Bidder associates/collaborates with a cooling tower designer who has independently designed a Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill, of capacity not less than 30000 Cu.M/ Hr and which should have been in successful operation for at least one (1) year. In such a case, the Bidder/its Sub vendor should furnish a letter of technical support jointly executed by it and its Cooling Tower Designer for the satisfactory performance of Cooling Towers as per the format enclosed in the bidding document. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor. 4.3.3 In case the reference cooling tower was designed by a party other than the Bidder himself /its sub vendor, the Bidder/ its sub vendor shall employ a cooling tower designer who has independently designed a Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill, of capacity not less than 30000 Cu.M/ Hr and which should have been in successful operation for at least one(1) year. In such a case, the Bidder/its Sub vendor should furnish a letter of technical support jointly executed by it and its Cooling Tower Designer for the satisfactory performance of Cooling Towers as per the format enclosed in the bidding document. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Annexure (Q) GPR Report			
TALCHER TPP STAGE-III (2X660 MW) SG ISLAND PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B DOC NO. CS-4540-001A-2	SUB-SECTION-D-1-12 (C) CIVIL WORKS BORE HOLE DATA	PAGE	

Details of facilities to be dismantled - Annexure-P(R2)

Sl. No.	Name of facility	Total No. of Units	Plinth Area per Unit {Sq.m.}	Total Plinth Area {Sq.m.}	Type of Super-structure	Type of Sub-structure	Storey Configuration	Scope of Dismantling	Facilities envisaged under TTPS Stage-III	Type & Present Location of facility
1	E-type & F-type Qrts in BHEL sector	39	150	5850	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	PT Plant	Residential facilities in Township area
2	4R3/4 - Temp Sector	1	620	620	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
3	3R21/22 - Sector 2	1	350	350	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
4	2R 121 -136 - Sector 2	4	150	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard CR & Canteen	
5	2R 49-68 - Sector 2	5	190	950	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Bay	
6	2R 69-108 - Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - tranformer Yard & FO Handling area	
7	2RA 109-139- Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
8	F type - Sector 1	7	170	1190	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
9	1R type - Sector 2	16	220	3520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	FO handling area, Aux. Boiler, CT & Switchyard	
10	2RB type - Setor 3	4	140	560	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Admin Building area	
11	C 3/4 - Sector 1	1	220	220	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
12	C9-12 - Sector 3	2	220	440	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Admin Building area	
13	D type 9-13/21-32 - Sector 3	5	300	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Switchyard	
14	2R 7 2RA - Sector 4	15	200	3000	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Construction Office & Workshop	
15	3R 1-16 Sector 2	8	350	2800	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Hall & FO handling area	
16	3R 17-21/ 62-65	4	350	1400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
17	NC 1-4 Temp sector	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
18	ND 1-8 Temp sector	8	200	1600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
19	E 139-186 Temp sector	8	150	1200	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Track Hopper + Ash Silo	
20	F 1-56 Sector 4	7	300	2100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	BOP Batching Plant area	
21	Club Auditorium	1	698	698	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	Non-residential facilities in Township area
22	Club dining hall	1	556	556	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - ESP	
23	Stadium gallery	1	1170	1170	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Main Plant area - Boiler	
24	POLICE OUTPOST	1	128	128	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
25	Outpost front shop	1	49	49	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
26	Medicine store	1	32	32	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
27	ATM (SBI)	1	15	15	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
28	Cable tv room	1	46	46	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
29	Mangla mandir	1	75	75	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
30	Kalayani Mandap	1	82	82	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
31	shopping centre	1	600	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
32	Sai mandir	1	90	90	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Ash Silo	
33	Durga Mandap	1	575	575	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
34	CISF Barrack - quarter guard	1	520	520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
35	CISF Barrack Morcha	1	16	16	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
36	Primery school	1	2348	2348	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	FGD area	
37	DAV TT HIGH SCHOOL	1	1410	1410	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
38	BHEL Market	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	PT Plant	
39	LITTLE ANGEL SCHOOL	1	250	250	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
40	DAV TT HIGH SCHOOL	1	1053	1053	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
41	BANK BUILDING	1	742	742	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	AWRS & Ash classification	
42	T/S Civil Office	1	100	100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	CWPH	
43	T/S Civil Office Store	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	CWPH	
44	BADMINTON HALL	1	406	406	Structural Steel with sheet cladding	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - Boiler	
45	OAT Stage	1	298	298	Structural Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
46	OLD EWA Building	1	221	221	Structural Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
47	OLD UPL Building	1	106	106	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Chmney	
48	WATER TANK & PUMP HOUSE	1	200	200	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Triple storey	Sub-structure	Chimney	
49	T/S ELECTRICAL OFFICE	1	664	664	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
50	CISF BARRACK	1	3328	3328	Structural Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
51	GAS GOWDOWN	1	122	122	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
52	SAI MANDIR SHED	1	133	133	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Ash Silo	
53	RC	1	2880	2880	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
54	Security barrack	1	1084	1084	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
55	DAV TT H.SCHOOL C.STAND	1	365	365	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area -ID Fan	
56	GRIDCO OFFICE	1	347	347	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
57	Ash Brick manufacturing Plant	2	750	1500	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
58	Vehicle Parking Sheds	1	400	400	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area	
59	Store Sheds	28	640	17920	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Ash handling, TAC,CAC & ESP	
60	Under ground Diesel tank	1	100	100		Under ground RCC sump		Sub-structure	Main Plant - ID fan area	
61	Watch Towers	7	20	140	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Main Plant & CHP area	
62	Admin Building	1	2998	2998	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -CPU area	
63	C&M office Building	1	378	378	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -TAC	
64	Old Admin BUILDING	1	1622	1622	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
65	Safety building	1	103	103	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
66	Weigh Bridge Room	1	40	40	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -TAC	
67	DG room	1	53	53	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
68	plant tea stall	1	86	86	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - Boiler	
69	Stage-I Raw water reservoir	1	21000	21000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - CH, coal stock pile & Gypsum area	
70	Heavy Machinery shed	1	320	320	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area - CH	
71	Waste water sump & Pumphouse	1	100	100	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	TP-1 & Inplant Railway siding	
72	Waste storage shed	1	180	180	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area	
73	Stage-II Raw water reservoir	1	20000	20000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - coal stock pile, truck tippler, TP-9 & Dozer shed	

74	Stage-II Raw Water Pumphouse	1	200	200	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	TP-8	Facilities in Plant area
75	Stage-II PT Plant clarifiers	2	1100	2200	RCC Over-ground 30m dia	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
76	Stage-II PT Sludge sump & Pumphouse	1	80	80	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
77	Stage-II PT Plant Building including clarified/Filtered water Pumphouse, sump, Chemical House etc..	1	700	700	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	Pipe conveyor	
78	AAQMS Room	1	20	20	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Super-structure & Sub-structure	CSSP	
79	Cylinder Shed	1	70	70	Structurel Steel	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CSSP	
80	Coal Slurry Settling pit	1	1200	1200		brick masonry under-ground pit		Super-structure & Sub-structure	Coal stock Pile	
81	Dozer shed	1	500	500	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	
82	Coal yard shed	1	1000	1000	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	BOP Laydown area	
83	TP-14	1	180	180	Structurel Steel shed with side cladding	RCC foundation with PCC mudmat	Triple storey	Super-structure & Sub-structure	Coal stock Pile	
84	Ground Conveyor 16A/B - 2m wide 600m long	1	1200	1200	Ground conveyor along with stacker-Reclaimer support rails			Super-structure & Sub-structure	Coal stock Pile	
85	Conveyor 17 - overground - 5m wide 275m long	1	1375	1375	Overhead structural steel conveyor gallery	RCC foundation with PCC mudmat		Super-structure & Sub-structure	BOP Laydown area	
86	Conveyor 17 - underground - 5m wide 80m long	1	400	400		Under-ground RCC tunnel		Super-structure & Sub-structure	BOP Laydown area	
87	Site Store sheds	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	
88	ETP Building with associated equipments	1	NA	NA	RCC and Brick	RCC	-	Sub-structure and Super Structure	Coal stock Pile	
89	Coal conveyor#16,17,R1,R2,TP#14&10B,stacker cum Reclaimer,stacker,R2 shed	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		
90	Heavy Machinery Shed	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		
91	Ash Water Reservoir	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		
92	Existing Track Hopper Shed	NA	NA	NA	RCC, Steel Structure	RCC	-	Super Structure		
93	Existing Railway siding inside plant Boundary including Pway, OHE, S&T, S&T Building	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure		

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D-1-7	FOUNDATION SYSTEM AND GEOTECHNICAL DATA			
7.00.00	Soil Data Owner has carried out detailed geotechnical investigation at the project site. Bearing capacity for design of foundations and Bore logs data are given at Annexure - C of this specification. The geotechnical investigation report comprising of Boreholes, Laboratory tests, Chemical analysis, etc. in respect of the sub-strata prevailing at site will be made available for the Bidder's study at the Employer's office, if required. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder. The geotechnical investigation report will be made available for the Bidder's study at the Owner's office, if required. In case, bidder feels that the available data is inadequate, he may carry out his own geotechnical investigation. Further, if any change in layout or area not covered as per enclosed borelog data, Contractor shall carry out geotechnical investigation in the area at no cost to owner. The scheme for geotechnical investigation shall be approved by owner before execution. Geotechnical investigation work may be got executed by the contractor through the suggested agencies as mentioned in Clause No. 7.08.00 or any other agency having adequate experience for carrying out such works and approved by engineering department of the owner. However, no time extension shall be given on account of soil investigation carried out by the Bidder. The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundation and allowable bearing pressure for various structures/ facilities and other soil parameters. The report shall be submitted for Owner's approval prior to commencement of design of foundation. Bidder may refer enclosed topographical survey drawing and general layout plan along with borelogs for variation in existing/ natural ground level (NGL) and finished ground level (FGL). As per borelog data, near proposed Admin building, fire station, permanent store, Workshop building and gate complex area, carried out by owner ash/coal deposit is found. Wherever ash/coal deposit/brick-bats etc. is found the same shall be treated as filled up soil. Further, as per available borelog data of the above mentioned area, NGL is varying from RL(+) 64.9 m to RL(+) 67.0m and FGL is RL(+) 69.0 i.e. there may be filled up layer up to 2.0m to 4.1m of ash/coal deposit. As per borelog data, water table is varying from 0.0m to 4.5m at the time of field investigation and may fluctuate with season.			
7.00.01	The furnished borelog details are specific to the co-ordinates where the boreholes have been carried out and are provided for bidder's information only. Soil profile in the proposed area may vary with respect to the borelogs enclosed for bidder's information. Bidder has to consider all such variations in his estimation, over the extent of the work to be carried out. The Bidder should note that nothing extra whatsoever on account of variation between soil data collected by Owner and that found by the Bidder during geotechnical investigation by him or during execution of works, shall be Payable.			
7.01.00	Tank Foundations a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil, if any. b) Entire loose/ soft soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III.			
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7.02.00	c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers, etc to achieve a relative density of not less than 80%. d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications. Foundation System The requirements for the foundation system to be adopted are as given in subsequent clauses. Depending upon the depth of competent strata/stratum, type of structures, functional requirement of facility, extent of cutting / filling, suitable open or pile shall be adopted with approval of owner.			
	7.02.01	General Requirements a) All structures/equipment shall be supported on suitable open foundations (isolated, combined, raft) or pile foundations depending on type of structures/facilities, sub-strata, topography etc. b) The roads, ground floor slabs, trenches, pipe pedestals (except thrust blocks), channels/drains and staircase foundation with foundation loading intensity less than 4 T / M2 may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil. c) No other foundation (other than as mentioned in (b) above and (g) below) shall rest on the filled up ground / soil. d) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards. e) The water table for design purpose shall be considered at Finished Ground Level. f) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building. g) Foundation for equipments on ground floor For equipments of static weight upto 1.5 T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab shall be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 4T/m2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications. For equipment's of static weight between 1.5 T and 20 T, the equipment may be supported on compacted sand filling from Natural Ground Level (NGL) or excavation level of nearby footing whichever is deeper with the load intensity below the equipment limited to 4T/m2. The minimum depth of foundation is 1.0m below FFL. Other requirements of sand compaction below the foundation shall be adhered, as specified elsewhere in the specifications. For equipment of static weight more than 20 T, the equipment foundation shall be taken to the founding level or shall be built up with PCC from the level as mentioned in the Table 1. The pedestal of equipment foundation or the foundation Block shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment pedestal for the full depth of the floor slab.		
7.02.02	Open Foundations In case open foundations are adopted, following shall be adhered to. a) The minimum width of foundation shall be 1.0 m.			
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7.03.00	b) Minimum depth of foundation shall be 1.0m below Ground Level. c) It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum. d) Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC (1:4:8) up to designed foundation level. e) Wherever the intended bearing stratum is weathered rock, but the actual strata encountered during excavation consists of both overburden soil and weathered rock at founding level, under such cases, the overburden upto the weathered rock level including 0.5 m into the weathered rock shall be removed and built up through PCC (1:3:6) upto the designed founding level. Thus, maintaining the same founding level for all the footings of a structure. f) The last layer of about 300 mm before reaching the founding level shall be excavated carefully by such equipment so that soil / rock at the required level will be left in its natural condition. g) Wherever the new facilities (excluding roads, ground floor slabs, trenches, pipe pedestals, channels/drain and staircase foundation) are to be constructed after dismantling existing facilities; it is to be ensured that the new foundations shall be taken at least 1m below the existing founding depth of the dismantled structures in case of soil and 0.6m below the existing founding depth of dismantled structures in case of rock.															
	PILE FOUNDATIONS – In case piles are adopted, following shall be adhered to:															
	i) The pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Self erecting Crawler mounted Rotary Hydraulic Rigs. However, conventional tripod rig may be allowed in inaccessible areas subject to site specific conditions. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer. If required, temporary or permanent MS liner may be provided for piling.															
	ii) The minimum diameter of pile shall be 600mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be least of the two values i.e. as per the values furnished in following table and pile capacity achieved in pile load tests:															
	<table><tr><td>Pile</td><td>Dia. (mm)</td><td>Vertical compression capacity (T)</td></tr><tr><td rowspan="4">Bored cast-in-situ pile</td><td>600</td><td>140</td></tr><tr><td>760</td><td>250</td></tr><tr><td>1000</td><td>350</td></tr><tr><td>1200</td><td>450</td></tr></table>				Pile	Dia. (mm)	Vertical compression capacity (T)	Bored cast-in-situ pile	600	140	760	250	1000	350	1200	450
	Pile	Dia. (mm)	Vertical compression capacity (T)													
	Bored cast-in-situ pile	600	140													
		760	250													
		1000	350													
		1200	450													
Pile shall be socketed into weathered rock. A socketing length of Five meter into rock shall be ensured. The uplift and lateral load capacity shall be respectively restricted to 35% and 5% of the allowable load capacity in vertical compression. However, the pile capacities to be adopted shall be the least of the estimated design values and that obtained from the initial pile load tests.																

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	iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m. iv) The contractor shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, pile load test arrangement, locations of initial test piles etc.) for Engineer's approval. v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval. vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under. Vertical Lateral Minimum of 2 Nos. in each mode. Uplift vii) The initial pile load test shall be conducted with test load three times the estimated pile capacity. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part). viii) Load test shall be conducted at pile cut of level (COL). If the water table is above the COL the test pit shall be kept dry through out the test period by suitable de-watering methods. Alternatively, the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter. ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under: i) Vertical : 0.5% of the total number of piles provided. ii) Lateral : 0.5% of the total number of piles provided. x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer. xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required. xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm.			
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	xiii) The test load on initial and routine test piles shall be applied by means of reaction from anchor piles / rock anchors alone or kentledge with concrete blocks alone or combination of anchor piles / rock anchors and kentledge with concrete blocks. xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM. xv) High Strain Dynamic Load Test may be carried out for routine vertical load test of working piles. However, at least three numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.03.00 (ix) shall be total of static routine vertical load test and high strain dynamic load tests. The procedure to carry out the test shall be submitted to the Engineer. The test and equipment shall conform to ASTM D4945-00. The test shall be conducted by an experienced independent test agency approved by the owner. Field data shall be submitted to the site engineer and shall include force velocity curves, pile capacity, simulated static load test curve, net and total pile displacement, pile integrity. A (Case pile wave analysis) CAPWAP or equivalent software analysis shall be conducted on the field data for correct capacity estimation and to evaluate end bearing and skin friction components of the pile. xvi) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions. xvii) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles. xviii) Reinforcement for job piles shall be designed as following: (a) Compression + bending piles: For these piles, the allowable safe pile capacities in compression and bending shall be considered. (b) Tension + bending piles: For these piles, the actual pile forces to be considered. However, maximum 3 types of combinations for varying percentage of tension capacity + bending case may be designed & adopted by contractor for the entire scope of work under this package.			
7.04.00	Special Requirements			
7.04.01	Details of treatment for foundations / underground structures required to counteract soil / water chemical environment, cement type, grade of concrete, type of reinforcement, cover to			
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	reinforcement and protective coating to foundations, etc. shall be as mentioned in Annexure-1 of this specification			
7.05.00	Excavation, Filling and Dewatering			
7.05.01	For excavation works, comprehensive dewatering with well point or deep wells arrangement, if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth.			
7.05.02	Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or any loose pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.			
7.05.03	<u>Backfilling in Power House & Boiler Area</u> Backfilling around foundations, trenches, sumps, pits, plinths, etc. shall be carried out with sand in layers not exceeding 300 mm compacted thickness and each layer shall be compacted to minimum 80% of relative density. <u>Backfilling in other area</u> Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each layer shall be compacted to 90% of standard proctor density for cohesive soils and to 80% of relative density for non cohesive soils. Rock pieces having size less than 150 mm and interstices filled with soil may be used for backfilling around foundation, plinths etc. and shall be compacted to minimum of 85% of original stack of material after filling the interstices.			
7.05.04	Founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.			
7.05.05	CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.			
7.05.06	The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding of material or article from any bank or side of such excavation which is more than one and a half meter above the footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.			
7.06.00	EXCAVATION IN ROCK Excavation in rock shall be carried out by mechanical means and if blasting is required for founding of some of the structures under this package, control blasting only shall be carried out.			
7.06.01	Controlled blasting shall be done by a specialised agency duly approved by Engineer. All controlled blasting shall be done by using time delay detonators (i.e. excel type).			
7.06.02	a) Contractor shall engage an agency expert in blasting such as, NIRM (National Institute of Rock Mechanics), CMPDIL, Central Institute of Mining and Fuel Research Dhanbad, Dept. of Mining of Govt. Institutions etc. to design detailed blasting scheme and get the same approved from Engineer before carrying out the blasting operation. All blasting shall be done as per the approved blasting scheme & initial			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO:CS-4540-001-2	SUB-SECTION-D-1-7 CIVIL WORKS FOUNDATION SYSTEM	PAGE 6 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
			Isolated and combined footings including raft for 25mm permissible settlement in case of soil and 12mm in case of rocky strata	Isolated and combined footings for 40mm permissible settlement in case of soil and 12mm in case of rocky strata	Rafts (width > 6m) for 75mm permissible settlement in case of soil and 12mm in case of rocky strata
			Width upto 6.0m		
	In case of foundation stratum is soil				
	1.0m below NGL	-	5	7	
	2.0m below NGL	-	8	12	
	3.0m below NGL	10	15	18	
	4.0m and below NGL	14	20	24	
	In case of founding stratum is rock				
	0.6m embedment into rock	35.0	35.0	35.0	
	1.0m embedment into rock	40.0	40.0	40.0	
	2.0m embedment into rock	50.0	50.0	50.0	
	4.0m embedment into rock	55.0	55.0	55.0	
	5.0m and more embedment into rock	60.0	60.0	60.0	
	For FGL refer GLP (General layout plan) For NGL of the proposed area GLP along with enclosed topographical survey drawing and borelog data may be referred. In case any loose/soft pockets is encountered at founding level, the same shall be removed completely upto the hard strata and filled up with PCC (1:4:8). For the new facilities to be constructed after dismantling existing facilities; founding level of new facilities shall be taken at least 1.0m below the existing founding depth of the dismantled structures in case of soil and 0.6m below the existing founding depth of the dismantled structures in case of rock.				
	b)	For open foundations, the total permissible settlement shall be governed by IS: 1904 / IS: 13063 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:			
		Isolated & Raft (Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil		25 mm	
		Isolated & Strip (other than Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil		40 mm	
		Raft (other than Main power house, TG Area Footings, Boiler, Mill, Bunker Footings & Fans) resting on soil		75 mm	
		Foundations in Weathered rock / rock		12 mm	
	In case the total permissible settlement is to be restricted to less than as above specified from functional requirements, then the net allowable bearing pressure shall be reduced after review in consultation with Engineer.				
c)	Special Requirements:				

TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO:CS-4540-001-2	SUB-SECTION-D-1-7 CIVIL WORKS FOUNDATION SYSTEM	PAGE 8 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			एन टी पी सी NTPC																				
	i) Chemicals in ground water and subsoil, as observed during investigation are: <table><tr><th>Chemical</th><th>Sulphates</th><th>Chlorides</th><th>pH</th></tr><tr><td>Ground Water</td><td>288-341mg/l</td><td>20-95 mg/l</td><td>7.2-8.5</td></tr><tr><td>Sub-soil</td><td>0.09-0.13 %</td><td>0.01-0.04 %</td><td>7.1-7.8</td></tr></table> ii) The sulphate content of the soil is slightly more than the specified limit. Therefore, strata at the site may be treated in Class-II as described in IS: 456. iii) In view of the above, the following shall be adopted. <table><tr><td>Cement Type</td><td>As per IS 456 Table 4</td></tr><tr><td>Concrete Grade</td><td>As specified elsewhere in the specifications</td></tr><tr><td>Type of Reinforcement</td><td>As specified elsewhere in the specifications</td></tr><tr><td>Cover to Reinforcement</td><td>As specified elsewhere in the specifications</td></tr></table>				Chemical	Sulphates	Chlorides	pH	Ground Water	288-341mg/l	20-95 mg/l	7.2-8.5	Sub-soil	0.09-0.13 %	0.01-0.04 %	7.1-7.8	Cement Type	As per IS 456 Table 4	Concrete Grade	As specified elsewhere in the specifications	Type of Reinforcement	As specified elsewhere in the specifications	Cover to Reinforcement	As specified elsewhere in the specifications
Chemical	Sulphates	Chlorides	pH																					
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Type of Reinforcement	As specified elsewhere in the specifications																							
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO:CS-4540-001-2	SUB-SECTION-D-1-7 CIVIL WORKS FOUNDATION SYSTEM	PAGE 9 OF 9																				

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
E-QA-04	SECTION - VI /PART – B	E-13 MAKE UP WATER SYSTEM			COMPLETE CHAPTER	TO BE DELETED.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

Specification Reference					Existing	Read As
Sl. No	Sec/Part	Sub Sec	Page No.	Clause No.		
G-04	VI/B	G-04/STANDARD PG TEST PROCEDURE	Page 9 of 224	3.4	Condensate flow nozzle (ASME PTC 6) will be installed by vendor Prior to initial operations. Conden-sate flow data will be available in DCS during performance test. All other online process instruments will be used for conducting TG Performance test. Average value of test data of the specified test peri-od will be collected from DCS for evaluation purpose. Offline instrument will not be used during performance test. Vendor to ensure calibration validity of all in-struments used for PG Test.	Condensate flow nozzle (ASME PTC 6) will be installed by vendor Prior to initial operations. Conden-sate flow data will be available ~~in DCS~~ during performance test. All other online process instruments will be used for conducting TG Performance test. Average value of test data of the specified test peri-od will be collected ~~from DCS~~ for evaluation purpose. ~~Offline instrument will not be used during performance test.~~ Vendor to ensure calibration validity of all in-struments used for PG Test.....
G-05	VI/B	G-04/STANDARD PG TEST PROCEDURE	Page 15 of 224	4.8	Frequency of Readings a) The most important measure-ment, that is the primary flow, shall be read at interval of as defined in DCS. b) Other important measurements, primary pressures, temperatures and secondary flows shall be read at interval as defined in DCS. c) Storage level changes, second-ary pressures and temperatures, shall be read at interval as defined in DCS. d) The generator output shall be collected from online energy meter	Frequency of Readings a) The most important measure-ment, that is the primary flow, shall be read at interval of as defined in ~~DCS~~ the applicable code. b) Other important measurements, primary pressures, temperatures and secondary flows shall be read at interval as defined in ~~DCS~~ the applicable code. c) Storage level changes, second-ary pressures and temperatures, shall be read at interval as defined in ~~DCS~~ the applicable code. d) The generator output shall be collected from online energy meter
G-06	VI/B	G-04/STANDARD PG TEST PROCEDURE	Page 39 of 224	8	For condenser calculations, one hour data will be considered from minimum test duration of two hour period during steady state condition. Frequency of test data will be as specified in DCS.	For condenser calculations, one hour data will be considered from minimum test duration of two hour period during steady state condition. Frequency of test data will be as specified in ~~DCS~~ the applicable code.
G-07	VI/A	IV	Page 7 of 73	1.01.02(xi)	Guarantee For increase in Station auxiliary power consumption: Limiting Value Not more than 16500 KW	Guarantee For increase in Station auxiliary power consumption: Limiting Value Not more than 14350 KW

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
G-08	VI/B	G-07	75 Pages	MDL	-	Drawings/Documents listed herein, for the scope deleted as per Amendment No. 2, are to be considered as Not Applicable.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

SL. NO.	SPECIFICATION REFERENCE				Existing	Read as								
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.										
A-MH-60	VI/B	A-01	89 of 101	4.01.02 (M) (amendment A-MH-46)	(i) Pumping distance to be considered for arriving of Ash Slurry Pump head is 12.5 K.M. (ii) Pumping distance to be considered for arriving of AWRS Pump head is 11.75 K.M. Static lift to be considered for Pontoon/Barge mounted Pumps- Not applicable Static lift to be considered for Ash Slurry Pump – Not applicable.	(i) Pumping distance to be considered for arriving of Ash Slurry Pump head is 12.5 K.M. (ii) Pumping distance to be considered for arriving of AWRS Pump head - Not applicable Static lift to be considered for Pontoon/Barge mounted Pumps- Not applicable Static lift to be considered for Ash Slurry Pump – 65 (meter)								
A-MH-61	VI/B	A-01	101 of 101	4.04.15	Dust extraction system Type: Dry type dust extraction system Location: Truck un-loading points, Junction Towers (limestone/ gypsum discharge & receipt points), limestone crusher house (including belt feeder & vibrating screening feeder) and limestone/ gypsum storage Shed/Silo.	Dust extraction system Type: Dry type dust extraction system Location: Truck un-loading points, Junction Towers (limestone), limestone crusher house (including belt feeder & vibrating screening feeder) and limestone storage Shed/Silo.								
A-MH-62	VI/B	A-01	91 of 101	4.02.02	All conveyors (except boom conveyor of S/R) shall be designed for 110% of rated capacity. The boom conveyor of S/R shall be designed for 125% of rated capacity. Rated capacity (corresponding to CHP capacity) shall be guaranteed capacity for 100% duty equipment. For 50% duty equipment rated capacity shall be guaranteed capacity. For purpose of guaranteed power consumption rated capacity shall be considered in either case.	All conveyors (except boom conveyor of S/R) shall be designed for 110% of rated capacity. The boom conveyor of S/R shall be designed for 125% of rated capacity. Rated capacity (corresponding to CHP capacity) shall be guaranteed capacity for 100% duty equipment & 75% duty equipment . For 55% duty equipment design capacity shall be guaranteed capacity. For purpose of guaranteed power consumption rated capacity shall be considered in either case.								
A-MH-63	VI/B	A-01	98 of 101	4.04.07	SI	Equipment	Duty requirement	Design capacity as % of duty requirement		SI	Equipment	Duty requirement	Design capacity as % of duty requirement	
					1	Crushers	2x100%	2x110%		1	Crushers	2x100%	110%	
					2	Vibrating Feeders, Vibrating screen feeders	1x100%, 2x100%	1x110%, 2x110%		2	Vibrating screen feeders	2x100%	110%	
										3	Vibrating feeders	1x100%	110%	

Doc. No.: CS-4540-001A-2-TECH-AMDT. 03	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 03 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

A-MH-64	VI/B	A-01	93 of 101	4.02.06	SI	Equipment	Duty requirement	Design capacity as % of duty requirement		SI	Equipment	Duty requirement	Design capacity as % of duty requirement	
					1	Crushers	2x50%	110%		1	Crushers	2x55%	110%	
					2	Vibrating feeders	2x50%	110%		2	Vibrating feeders	2x55%	110%	
					3	Paddle feeders	2x50%	150%		3	Paddle feeders	2x75%	110%	
					4	Belt Feeder for Crusher House	2x50%	110%		4	Belt Feeder for Crusher House	2x55%	110%	
					5	Stacker-reclaimer	1x100%	110% for stacking & 125% for reclaiming		5	Stacker-reclaimer	1x100%	110% for stacking & 125% for reclaiming	
A-MH-65	VI/B	IIA-14	4 of 5	2.03.00	Minimum four (4) Nos. sump pumps in gypsum storage shed complete with motors, local control panel, level switches, individual discharge piping with fittings and valves ash disposal slurry sump.					Minimum four (4) Nos. sump pumps in gypsum storage shed complete with motors, local control panel, level switches, individual discharge piping with fittings and valves up to ash disposal slurry sump.				
A-MH-66	VI/B	A-01	95 of 101	4.02.12 (Amendment A-MH-12)	Bidder to maximize the coal stockyard storage capacity by utilizing the available space. However, stockyard capacity in any case shall not be less than 1,50,000 million tonne in the stockpile considering 800 T/cum bulk density for coal.					Bidder to maximize the coal stockyard storage capacity by utilizing the available space. However, stockyard capacity in any case shall not be less than 1,50,000 MT in the stockpile considering 800 T/cum bulk density for coal.				
A-MH-67	VI/A	IIA-14	1 of 5	1.01.01	Limestone will be received to power plant through road by trucks. Limestone received through..... Limestone by truck tipplers. Two (2) numbers Box Feeders/ Bulk-material Receiving Unit/ Surface feeder each of 150 TPH Capacity, for unloading..... before Limestone crusher house. Limestone shall be 100% for conveying.					Limestone will be received to power plant through road by trucks. Limestone received through..... Limestone by truck tipplers. Two (2) numbers Box Feeders/ Bulk-material Receiving Unit/ Surface feeder each of 200 TPH Capacity, for unloading..... before Limestone crusher house.				

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EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
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A-MH-68	VI/B	A-20	36 of 101	4.25.00 (c)	Capacity: 60 Ton Unloading Cycle:3-4 minutes Max. Tilting angle: 55 Main Structure: Steel IS 2062/IS 1570 Hydraulic cylinder Tubes: Honed/Roller Burnished of seamless with internal surface finish less than 0.4 micron Hydraulic Cylinder piston rod: C45/EN8 Seal & guide ring: PTFE	Capacity: 60 Ton Max. Tilting angle: 55 Main Structure: Steel IS 2062/IS 1570 Hydraulic cylinder Tubes: Honed/Roller Burnished of seamless with internal surface finish less than 0.4 micron Hydraulic Cylinder piston rod: C45/EN8 Seal & guide ring: PTFE
A-MH-69	VI/A	Mandatory Spares	6 of 23	Chapter-04 Coal Handling Plant	H) SAMPLER (Coal & Lime) I) CRUSHER (Coal & Lime)	H) SAMPLER (Coal) I) CRUSHER (Coal)
A-MH-70	VI/A	Mandatory Spares	15 of 23	Chapter-04 Coal Handling Plant	Y. BUCKET ELEVATOR Z. Surface Feeder/BRU-Bulk Reception Unit ZA. Truck Tippler	Y. BUCKET ELEVATOR (for LHP) Z. Surface Feeder/BRU-Bulk Reception Unit (for LHP) ZA. Truck Tippler (for LHP)
A-MH-71	VI/A	Mandatory Spares	14 of 15	Chapter-09- LIMESTONE GYPSUM HANDLING PLANT	BUCKET ELEVATOR 1 Buckets 2 Belt for bucket elevator 3 Linkages	Deleted
A-MH-72	VI/A	Mandatory Spares	2 of 23	Chapter-04 Coal Handling Plant	8. Cable reel drive (i) to (xii)	Not applicable
A-MH-73	VI/A	Mandatory Spares	1 of 23	Chapter-04 Coal Handling Plant	A) Mandatory Spares for Paddle Feeder 3. Gear box (including Paddle wheel, Travel drive, cable reel drive / Drag chain) i) Complete assembly 4 (vi) Hydraulic Motor (for Traverse Drive) 5(vi) Tension roller of paddle feeder trolley	A) Mandatory Spares for Paddle Feeder 3. Gear box (of drives wherever applicable including Paddle wheel, Travel drive, Energy chain) i) Complete assembly 4 (vi) Hydraulic Motor/ Geared Motor (for Traverse Drive) 5(vi) Tension roller of paddle feeder trolley (if applicable)

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Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

A-MH-74	VI/A	Mandatory Spares	10 of 23	Chapter-04 Coal Handling Plant	R) Mandatory Spares for STACKER/RECLAIMER 5..1- Hydraulic pump & hydraulic motor drive for luffing system 5.2- Hydraulic pump & hydraulic motor drive for slew mechanism 11- Gear Box of bucket wheel 12- Plummer blocks and bearings of (CRD) 22- Plummer block with bearing for cable reel drums 18- Chain & chain sprockets 27- Energy Chain	R) Mandatory Spares for STACKER/RECLAIMER 5..1- Hydraulic pump for luffing system 5.2- Not applicable 11- Not applicable 12- Plummer blocks and bearings of (CRD) 22- Deleted 18- Chain & chain sprockets (if applicable) 27- Energy Chain (if applicable)
A-MH-75	VI/A	IV/Functional Guarantees	23 of 73	1.01.07.02(g)	Coal Handling plant, Limestone handling plant, Gypsum handling plant Total power consumption for all the equipments including auxiliaries with single stream operation at its guaranteed capacity for: i. Coal flow path IA (Direct stream), as per clause no 1.03.07.03.1 (i) and one no. stacker reclaimer, one no of yard conveyor (maximum of stacking / reclaiming modes) and four (4) nos. paddle feeders.	Coal Handling plant, Limestone handling plant, Gypsum handling plant Total power consumption for all the equipments including auxiliaries with single stream operation at its guaranteed capacity for: i. Coal flow path IA (Direct stream excluding Paddle feeders), as per clause no 1.03.7.02.1 (i) and one no. stacker reclaimer, one no of yard conveyor (maximum of stacking / reclaiming modes) and four (4) nos. paddle feeders.
A-MH-76	VI/A	IV/Functional Guarantees	32 of 73	1.03.7.02.1	GUARANTEES The Contractor shall furnish a declaration in the manner prescribed and included in the relevant Attachment of Section-VII for the following guaranteed parameters which shall attract levy of liquidated damages for shortfall in Performance.	GUARANTEES The Contractor shall furnish a declaration in the manner prescribed and included in the relevant Attachment of Section-VII for the following guaranteed parameters.
A-MH-77	VI/Part E			Tender Drws.	4540-001-POM-A-040 (option-01), Rev-C 4540-001-POM-A-040 (option-02), Rev-C	4540-001-POM-A-040 (option-01), Rev-D 4540-001-POM-A-040 (option-02), Rev-D

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A-MH-78	VI/Part-A		238/411 to 245/411 259/411 To 271/411 277/411 To 286/411	Attachm ent 3K	SUB-QUALIFYING REQUIREMENTS FOR THE MILL REJECT HANDLING SYSTEM SUB-QUALIFYING REQUIREMENTS FOR ASH HANDLING SYSTEM SUB-QUALIFYING REQUIREMENTS FOR COAL HANDLING SYSTEM	Annexure for Attachment 3K-MH
A-MH-79	VI, PART-B	SUB SECTI ON-A- 20	2 of 101	3.01.0. (b)(Ame nded A- MH-14)	 “As received” limestone shall be fed on the double stream conveyors from where the same shall be conveyed upto the crushers. The crushed limestone shall be conveyed by conveyors/ Bucket elevators up to the limestone storage shed/Silo. From the limestone storage shed/Silo paddle feeders/vibro-feeders will extract/ reclaim crushed limestone and feed the same onto conveying system up to the limestone day silos.	 “As received” limestone shall be fed on the single stream conveyors from where the same shall be conveyed upto the crushers. The crushed limestone shall be conveyed by conveyors/ Bucket elevators up to the limestone storage shed/Silo. From the limestone storage shed/Silo paddle feeders/vibro-feeders will extract/ reclaim crushed limestone and feed the same onto conveying system up to the limestone day silos.

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A-MH-80	VI/A	IIA-14	5 of 5	4.00.01	All electrical actuators used in this package like for Flap gates, Scoop coupling, Pump house, Dust extraction etc. shall be non- intrusive, fieldbus based integral actuators meeting requirements specified in Electrical actuators, Part-B, Section-VI.	All electrical actuators used in this package shall necessarily be of non-intrusive field bus based integral actuators like Flap Gates, RPG, Dampers, Valves meeting requirements specified in Electrical Actuator referred in C&I section Part –B , section-VI of the specification, except for skid mounted / operated through only PLC/ local control panel systems like scoop coupling, tripper, paddle feeder, LSU where it is not possible to have above non-intrusive type actuators, the Contractor shall provide Electrical Actuators as per Standard practice.
A-MH-81	VI/A	III	18 of 18 Terminal Point & exclusion & owners' input	1.03.00 (Amendment A-MH-48)	Terminal Point for Ash slurry disposal piping and AWRS piping shall be 5 m inside plant boundary. Ash slurry piping & AWRS after 5 m from plant boundary towards Mine Void shall be excluded from the Bidders' scope.	Terminal Point for Ash slurry disposal piping and AWRS piping shall be 5 m inside plant boundary. Ash slurry piping & AWRS after 5 m from plant boundary towards Mine Void shall be excluded from the Bidders' scope. Decanted water shall be pumped from owners' pumping system located at Mine Void end. There shall be two nos. working AWRS Pump of 1200 m³/hr flow rate each, as envisaged. Hence, maximum recovery water received inside plant shall be 2400 m³/hr.

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A-MH-82	VI, PART-B	SUB SECTION-A-20	82 of 101	4.01.00	Overall, operation of the following equipment of Coal, Biomass, Limestone & Gypsum Handling Plant shall be controlled from CHP DDCMIS located at main CHP control room. Conveyors, feeders, flap gates, R & P gates, crushers, hydraulic scoop couplings. The operation of the Employers' Cross-country conveyor shall be finalized during detail engineering. Complete Dust Suppression system, service water system, ...	Overall, operation of the following equipment of Coal, Biomass, Limestone & Gypsum Handling Plant shall be controlled from CHP DDCMIS located at main CHP control room. The operation of the Employers' Cross-country conveyor shall be finalized during detail engineering. Conveyors, feeders, flap gates, R & P gates, crushers, hydraulic scoop couplings. Complete Dust Suppression system, service water system, ...

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Specification Reference							
Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Page No.	Clause No.	Existing	Read As	
A-SG-47	SECTION-VI, PART-A	SUB-SECTION IV, FUNCTIONAL GUARANTEES	2 OF 73	1.00.01	1. For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conductance of Performance test, the test results shall be calculated automatically by the server/software provided by the contractor. The correction curves shall be fed/inbuilt in the PG test program/software. Provision of manual entry of offline data which cannot be captured online (such as Relative humidity, Atmospheric pressure etc.) and necessary for calculation of PG Test result shall also be provided. The contractor shall submit the detailed test evaluation report of Performance test results to Employer promptly but not later than 7 days from the date of conductance of Performance test.	1. For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conductance of Performance test, the test results shall be calculated automatically by the server/software provided by the contractor. The correction curves shall be fed/inbuilt in the PG test program/software. Provision of manual entry of offline data which cannot be captured online (such as Relative humidity, Atmospheric pressure, Coal analysis, Unburnt carbon in fly ash and bottom ash, Bottom ash / fly ash collection at various hoppers, Flue gas analysis (grid result) etc.) and necessary for calculation of PG Test result shall also be provided. The contractor shall submit the detailed test evaluation report of Performance test results to Employer promptly but not later than 7 days from the date of conductance of Performance test.	
A-SG-48	Section-VI, Part-A	II A-01	26 OF 28	5.00.00	5.00.00. Provision for CO2 to Methanol in Talcher 2 x 660 MW Project in order to make the plant more efficient and environmentally friendly, provisions shall be provided for capturing carbon di-oxide from the flue gas generated from the plant. Provisions shall be provided in the flue gas duct i.e. from common duct after FGD system for tapping the desired flue gas quantity (2000 TPH) so as to capture 200 TPH of carbon di-oxide. Provisions shall be given in both the units. The tap-off duct portion shall be provided with necessary isolation gates and damper for isolation and control purposes. Further, all the loads on account of such extraction shall be accounted in the duct design with suitable strengthening as may be required.	5.00.00. Provision for CO2 to Methanol in Talcher 2 x 660 MW Project in order to make the plant more efficient and environmentally friendly, provisions shall be provided for capturing carbon di-oxide from the flue gas generated from the plant. Provisions shall be provided in the flue gas duct i.e. from common duct after FGD system for tapping the desired flue gas quantity (2000 TPH) so as to capture 200 TPH of carbon di-oxide. Provisions shall be given in both the units. The tap-off duct portion shall be provided with necessary isolation gates and damper for isolation and control purposes in each tap-off. These Gates are to be made of Carbon steel with C276 cladding of sheet of minimum thickness 16 mm along with 2x100 % Seal Air fans. Also, seals to be made of Alloy C-276 or better material. Blanking plates shall also be provided in each tap-off duct after isolation gates. Further, all the loads on account of such extraction shall be accounted in the duct design with suitable strengthening as may be required.	
A-SG-49	Section - VI Part-B	Sub sec A-02	Page No 16 of 65	9.01.03 (4) ii	The maximum air-in-leakage to flue gas after 3000 hours continuous operation of the Steam Generator with coal shall be guaranteed and demonstrated. The Contractor shall also demonstrate that the drift in air heater leakage (percentage change in air-leakage) does not exceed 1%, one year after demonstration of above guaranteed air-leakage. Within this period of operation till all air heater leakage demonstrations are completed there will be no need for any shut down for seal replacements or any internal adjustments. The seal design/construction shall be such that the above requirements are satisfied.	The maximum air-in-leakage to flue gas after 3000 hours continuous operation of the Steam Generator with coal shall be guaranteed and demonstrated along with the Boiler PG test. The Contractor shall also demonstrate that the drift in air heater leakage (percentage change in air-in-leakage) does not exceed 1%, one year after demonstration of above guaranteed air-in-leakage. Within this period of operation till all air heater leakage demonstrations are completed there will be no need for any shut down for seal replacements or any internal adjustments. The seal design/construction shall be such that the above requirements are satisfied.	
A-SG-50	Sec VI Part-A	Sub Sec- IIB Project Information	8 of 15	Table 1-A	Ultimate Analysis	No corresponding input constituent values for HCL/HF	For FGD design and guarantee condition- HCL (ppm)-wet-45 and HF (ppm)-wet- 12 may be considered respectively.
A-SG-51	Section - VI part - B	Sub sec A-02	Page No 16 of 65	9.01.03 (4) ii, iv	Seals shall have life not less than 2 years (with leakages not exceeding guaranteed limits). The seal should be of flexible soft thin material and hardness should be less than that of sector plate / seal plate.	Seals shall have life not less than 2 years (with leakages not exceeding guaranteed limits). The seal should be of flexible soft thin material and hardness should be less than that of sector plate / seal plate. Alternatively, the bidder can also select the seal material based on its standard practice and proven design only for similar applications so as to ensure that these offered seals meet the above guaranteed life. The bidder will provide the basis for the selected material & seals type along with proven references.	
A-SG-52	Section - VI part - B	Sub sec A-02	Page No 16 of 65	9.01.09 (i)	Leakage control system. This shall also online maintain the seal gap/radial seal clearance based on pre-set temperature and thereby ensure leakage control at various loads.	Leakage control system. This shall also online maintain the seal gap/radial seal clearance based on pre-set temperature and thereby ensure leakage control at various loads. The bidder at its discretion can also optimize the above clearances, over & above the methodology as given above, by also measuring the actual gap between seals and seating surface. However, in such case suitable calibration and checks to be ensured during commissioning for synchronism in above two approaches. In any case, all the guarantees as specified are to be ensured by the bidder.	
A-SG-53	Section-VI Part-B	Sub Sec A-02	Page No 3 of 65	1.05.00	(i) To match the desired plant operating capabilities, the Steam Generator shall also be designed for cyclic/two shift operation. Expected numbers of Steam Generator start-ups during 25 years of design life are as follows: Type of Starts Number of Starts a. Hot start (after 8 hours of unit shut down) 4550 b. Warm start (after 36 hours of unit shut down) 930 c. Cold start (after 72 hours of unit shut down) 455	(i) To match the desired plant operating capabilities, the Steam Generator shall also be designed for cyclic/two shift operation. Expected numbers of Steam Generator start-ups during 25 years of design life are as follows: Type of Starts Number of Starts a. Hot start (after 8 hours of unit shut down) 4000 b. Warm start (after 36 hours of unit shut down) 1000 c. Cold start (after 72 hours of unit shut down) 150 To make unit capable of continuous two shifting operation, the number of hot start ups shall be increased from 4000 numbers to 6700 numbers without changing cold and warm start up as well as daily N1 (minimum 13400 cycles in total design life) and N2 (minimum 6700 cycles in total design life) requirements as defined Sub section -G-01 operating capability of Plant, Part-B, Section VI.	

Specification Reference					Existing	Read As
Sl. No	Sec/Part	Sub Sec	Page No.	Clause No.		
A-TG-16	VI/B	G-01 OPERATING CAPABILITY OF PLANT	Page 2 of 4	1.03.00	The plant shall be suitable for load cycling which implies that it should be designed to operate continuously under two shift mode.....any other grid disturbances. The design of the plant equipments and control system would permit participation of the plant in automatic load frequency control.	The plant shall be suitable for load cycling which implies that it should be designed to operate continuously under two shift mode.....any other grid disturbances. The design of the plant equipments and control system would permit participation of the plant in automatic load frequency control. To make unit capable of continuous two shifting operation, the number of hot start ups shall be increased from 4000 numbers specified elsewhere to 6700 numbers without changing cold and warm start up as well as daily N1 (minimum 13400 cycles in total design life) and N2 (minimum 6700 cycles in total design life) requirements as defined above.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

1	Section- VI	G-03	2 of 15	1.01.03	A) Control Equipment room (only for placing control and power system panels) for each of the following areas shall be provided for near to their respective area/MCC/SWGR. However, HMIPIS for operation & monitoring of these control systems shall be placed as defined in Appendix-III to Sub-section-IIC of Part A for assignment of operator locations. - Ash Handling system - FOPPH system - RAW water pump house - Water System B) Control room for placing panels as well as HMI shall be provided for following areas: - FGD System (In addition LVS, Control desk and workstation shall also be provided at centralized offsite control room in control tower) - CHP System - External CHP CR at Mine end NOTE: FGD Control room may be a part of ESP Control Building.	A) Control Equipment room (only for placing control and power system panels) for each of the following areas shall be provided for near to their respective area/MCC/SWGR. However, HMIPIS for operation & monitoring of these control systems shall be placed as defined in Appendix-III to Sub-section-IIC of Part A for assignment of operator locations. - Ash Handling system - FOPPH system - RAW water pump house - Water System B) Control room for placing panels as well as HMI shall be provided for following areas: - FGD System (In addition LVS, Control desk and workstation shall also be provided at centralized offsite control room in control tower) - CHP System NOTE: FGD Control room may be a part of ESP Control Building.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
G-OS	VI/B	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Page 9 of 224	3.4	Provisions for Performance Test Condensate flow nozzle (ASME PTC 6) will be installed by vendor Prior to initial operations. Condensate flow data will be available in DCS during performance test. All other online process instruments will be used for conducting TG Performance test. Average value of test data of the specified test period will be collected from DCS for evaluation purpose. Offline instrument will not be used during performance test. Vendor to ensure calibration validity of all instruments used for PG Test. Calibration certificates of test instruments shall be submitted to NTPC at least 15 days before the conductance of performance test. Instrument Calibration to be carried out in a NABL accredited Laboratory.	Provisions for Performance Test Condensate flow nozzle (ASME PTC 6) will be installed by vendor Prior to initial operations. Condensate flow data will be available during performance test. Average value of test data of the specified test period will be collected for evaluation purpose. Vendor to ensure calibration validity of all instruments used for PG Test. Calibration certificates of test instruments shall be submitted to NTPC at least 15 days before the conductance of performance test. Instrument Calibration to be carried out in a NABL accredited Laboratory.

Doc. No.: CS-4540-001A-2-TECH-AMDT. 03	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 03 to Technical Specifications Section-VI

S. No.	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
B.35	SEC VI/ PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	4 of 17	1.13.00	~~Electrical Actuators~~ Electric actuators with integral starters along with associated accessories etc. shall be supplied on as required basis for Valves / Dampers to meet the functional and the other specification requirements. However actuators related to CHP area shall be non-integral type with starters	DELETED
B-36	VI-Part-B	B-0	8 OF 15	3.06.02 (d)	For protection of motors below 30kW, MPCB(only Short-circuit release) and Intelligent motor controller(IMC) with current sensing module shall be provided and for motors from 30kW and below 90kW, MCCB and Intelligent motor controller(IMC) with current & voltage sensing module shall be provided. Motor feeders below 90kW (upto 160kW for CHP conveyor motors) shall be contactor controlled. The motor feeders for 90kW & above shall be Air Circuit Breaker controlled. Contactors shall be of 250% of motor FLC for fan and compressor application and 200% of motor FLC for other application. MOTOR FEEDERS BELOW 90KW SHALL BE CONTACTOR CONTROLLED. THE MOTOR FEEDERS FOR 90KW & ABOVE SHALL BE AIR CIRCUIT BREAKER	For protection of motors below 30kW, MPCB(only Short-circuit release) and Intelligent motor controller(IMC) with current sensing module shall be provided and for motors from 30kW and below 90kW, MCCB and Intelligent motor controller(IMC) with current & voltage sensing module shall be provided. Motor feeders below 90kW (upto 160kW for CHP/LHP/GHP conveyor motors) shall be contactor controlled. The motor feeders for 90kW & above shall be Air Circuit Breaker controlled. Contactors shall be of 250% of motor FLC for fan and compressor application and 200% of motor FLC for other application. MOTOR FEEDERS BELOW 90KW SHALL BE CONTACTOR CONTROLLED. THE MOTOR FEEDERS FOR 90KW & ABOVE SHALL BE AIR CIRCUIT BREAKER CONTROLLED

B-37	SECTION – VI, PART-A	SUB-SECTION-IIB	12 OF 17	1.18.03.(c)	CHP ELECTRICAL BUILDINGS Following Switchgear locations are envisaged for CHP 1. One(1) no. switchgear building near track hopper area to house CHP TH service switchgear , MLDBs & Welding DBs, TR panels for ILMS/SM etc. MCC location considered near Track hopper. 2. One (1) No. Switchgear cum CHP control building near Crusher house to accommodate CHP CH service switchgear, 220V DC charger panels, DCDB, MLDBs, Welding DBs, TR panels for ILMS/SM etc. and 3.3KV CHP Switchgear. One separate battery room shall be provided for accommodating 220V DC battery.	DELETED
B-38	SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	22 OF 23	II ELECTRICAL (U)	U) VIBRATING SCREENING FEEDER	DELETED
B-39	SUB-SECTION-VI, PART-A, Mandatory Spares	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	18 of 23, 19 of 23	II ELECTRICAL I)	Mandatory Spares for STACKER/RECLAIMER Electrical 1 Motor (other than those covered in B)(1) above) 19 Slew Drive Motor	S.No.1, 6, 7, 19 deleted
B-40	SUB-SECTION-VI, PART-A, Mandatory Spares	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	16 of 23	II Electrical	-	S.NO. B added same as follows CONVEYORS(Including Boom conveyor/intermediate conveyor of stacker reclaimer/belt feeder) 1 Number of each type and rating covered other than motors covered in Mechanical mandatory chapters

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

B-41	SUB-SECTION-VI, PART-A, Mandatory Spares	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	16 of 23	II Electrical	A).2 Cable reel drive motor complete	deleted

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Amendment No. 03 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-3

SL. NO.	SPECIFICATION REFERENCE				EXISTING	READ AS
	SEC/ PART	SUB SEC.	PAGE NO.	CLAUSE NO.		
C-15	VI/A	IIC	17 of 18	21.00.00	2. Bidder is to provide..... The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for the following equipments: Boiler, Turbine, Generator. Crusher House , Dry ash evacuation system, MDBFP, TDBFP, CW pumps, ID fan, FD fan, PA fan, Pulverizer, Condenser and Dearator The individual equipment models shall finalized during detail engineering.	2. Bidder is to provide..... The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for the following equipments: Boiler (walk through and acquaintance model), Turbine (HP module, IP Module, LP Module, Journal & Thrust bearing, pedestal), Generator. Crusher, Dry ash evacuation system (walk through and acquaintance model), MDBFP, TDBFP, CW pumps, ID fan, FD fan, PA fan, Pulverizer, Condenser and Deaerator. The individual equipment models shall finalized during detail engineering. The duration of individual training model can be different. However, the total duration of training models combined for all the above mentioned equipments shall be for 20 hours. The training model for each of the above equipments shall have Full HD video and audio in two languages English and Hindi.
C-16	VI/A	Annexure C to subsection IIC	7 of 24	A 2.15.00		New Clause added The I/O counts for Employer's Biomass handling system to be monitored & controlled by Contractor's CHP DDCMIS are as : DI : 120 nos DO : 64 nos AI: 32 nos AO: 16 nos

Doc. No.: CS-4540-001A-2-TECH-AMDT. 03	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Amendment No. 03 to Technical Specifications Section-VI

Specification Reference					Existing	Read As
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.		
D3-1	VI/B	D-1-9	7 of 32	9.08.01	COLOUR COATED AND OTHER SHEETING WORK Material a)Wall Cladding & Roofing Material Troughed permanently colour coated sheet of approved shade and colour shall be i)either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii)or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. iii)or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS: 1254.	COLOUR COATED AND OTHER SHEETING WORK Material a)Wall Cladding & Roofing Material Troughed permanently colour coated sheet of approved shade and colour shall be i)either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS250 as per IS 15961 / grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii)or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS350 as per IS 15961 / grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. iii)or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS550 as per IS 15961 / grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS: 1254.

D3-2	VI/B	D-1-9	9 of 32	9.08.06	Pre-Fabricated Insulated Metal Sandwich Panels For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets. Each sheet shall be i)either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii)or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 iii)or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254.	Pre-Fabricated Insulated Metal Sandwich Panels For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets. Each sheet shall be i)either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS250 as per IS 15961 / grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 ii)or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS350 as per IS 15961 / grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150 iii)or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade YS550 as per IS 15961 / grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150. Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254.
D3-3	VI/B	D-1-12(P)			Annexure-P, Annexure-P(Amendement-D1), Annexure-P(Amendement-D2)	Annexure-P(R3)

Details of facilities to be dismantled - Annexure-P(R3)

Sl. No.	Name of facility	Total No. of Units	Plinth Area per Unit {Sq.m.}	Total Plinth Area {Sq.m.}	Type of Super-structure	Type of Sub-structure	Storey Configuration	Scope of Dismantling	Facilities envisaged under TTPS Stage-III	Type & Present Location of facility
1	E-type & F-type Qrts in BHEL sector	39	150	5850	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	PT Plant	Residential facilities in Township area
2	4R3/4 - Temp Sector	1	620	620	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
3	3R21/22 - Sector 2	1	350	350	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
4	2R 121 -136 - Sector 2	4	150	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard CR & Canteen	
5	2R 49-68 - Sector 2	5	190	950	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Bay	
6	2R 69-108 - Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - tranformer Yard & FO Handling area	
7	2RA 109-139- Sector 2	10	150	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
8	F type - Sector 1	7	170	1190	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
9	1R type - Sector 2	16	220	3520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	FO handling area, Aux. Boiler, CT & Switchyard	
10	2RB type - Sctor 3	4	140	560	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Admin Building area	
11	C 3/4 - Sector 1	1	220	220	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
12	C9-12 - Sector 3	2	220	440	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Admin Building area	
13	D type 9-13/21-32 - Sector 3	5	300	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Switchyard	
14	2R 7 2RA - Sector 4	15	200	3000	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Construction Office & Workshop	
15	3R 1-16 Sector 2	8	350	2800	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - TG Hall & FO handling area	
16	3R 17-21/ 62-65	4	350	1400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
17	NC 1-4 Temp sector	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Inplant Railway siding	
18	ND 1-8 Temp sector	8	200	1600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Inplant Railway siding	
19	E 139-186 Temp sector	8	150	1200	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Track Hopper + Ash Silo	
20	F 1-56 Sector 4	7	300	2100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	BOP Batching Plant area	
21	Club Auditorium	1	698	698	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	Non-residential facilities in Township area
22	Club dining hall	1	556	556	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - ESP	
23	Stadium gallery	1	1170	1170	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double Storey	Sub-structure	Main Plant area - Boiler	
24	POLICE OUTPOST	1	128	128	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
25	Outpost front shop	1	49	49	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
26	Medicine store	1	32	32	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
27	ATM (SBI)	1	15	15	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - TG Bay	
28	Cable tv room	1	46	46	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
29	Mangla mandir	1	75	75	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
30	Kalayani Mandap	1	82	82	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
31	shopping centre	1	600	600	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
32	Sai mandir	1	90	90	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Ash Silo	
33	Durga Mandap	1	575	575	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant - Transformer Yard	
34	CISF Barrack - quarter guard	1	520	520	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
35	CISF Barrack Morcha	1	16	16	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Track Hopper	
36	Primery school	1	2348	2348	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	FGD area	
37	DAV TT HIGH SCHOOL	1	1410	1410	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
38	BHEL Market	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	PT Plant	
39	LITTLE ANGEL SCHOOL	1	250	250	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
40	DAV TT HIGH SCHOOL	1	1053	1053	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -ID Fan	
41	BANK BUILDING	1	742	742	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	AWRS & Ash classification	
42	T/S Civil Office	1	100	100	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Double storey	Sub-structure	CWPH	
43	T/S Civil Office Store	1	400	400	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	CWPH	
44	BADMINTON HALL	1	406	406	Structurel Steel with sheet cladding	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - Boiler	
45	OAT Stage	1	298	298	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
46	OLD EWA Building	1	221	221	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
47	OLD UPL Building	1	106	106	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Chmney	
48	WATER TANK & PUMP HOUSE	1	200	200	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Triple storey	Sub-structure	Chimney	
49	T/S ELECTRICAL OFFICE	1	664	664	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
50	CISF BARRACK	1	3328	3328	Structurel Steel with Brick in-fill panels	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
51	GAS GOWDOWN	1	122	122	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Sub-structure	Track Hopper	
52	SAI MANDIR SHED	1	133	133	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Ash Silo	
53	RC	1	2880	2880	RCC structure with Brick in-fill panels + Structural Steel roof	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Transformer Yard	
54	Security barrack	1	1084	1084	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area - ESP	
55	DAV TT H.SCHOOL C.STAND	1	365	365	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area -ID Fan	
56	GRIDCO OFFICE	1	347	347	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Chimney	
57	Ash Brick manufacturing Plant	2	750	1500	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Switchyard	
58	Vehicle Parking Sheds	1	400	400	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant area	
59	Store Sheds	28	640	17920	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Sub-structure	Main Plant - Ash handling, TAC,CAC & ESP	
60	Under ground Diesel tank	1	100	100		Under ground RCC sump		Sub-structure	Main Plant - ID fan area	
61	Watch Towers	7	20	140	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Triple storey	Sub-structure	Main Plant & CHP area	
62	Admin Building	1	2998	2998	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -CPU area	
63	C&M office Building	1	378	378	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area -TAC	
64	Old Admin BUILDING	1	1622	1622	RCC structure with Brick in-fill panels	RCC foundation with PCC mudmat	Double storey	Sub-structure	Main Plant area - Boiler	
65	Safety building	1	103	103	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
66	Weigh Bridge Room	1	40	40	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -TAC	
67	DG room	1	53	53	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area -CPU area	
68	plant tea stall	1	86	86	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Sub-structure	Main Plant area - Boiler	
69	Stage-I Raw water reservoir	1	21000	21000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - CH, coal stock pile & Gypsum area	
70	Heavy Machinery shed	1	320	320	Structural Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area - CH	
71	Waste water sump & Pumphouse	1	100	100	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	TP-1 & Inplant Railway siding	
72	Waste storage shed	1	180	180	Structurel Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CHP area	

73	Stage-II Raw water reservoir	1	20000	20000		CC lined under-ground reservoir		Super-structure & Sub-structure	CHP area - coal stock pile, truck tippler, TP-9 & Dozer shed	Facilities in Plant area
74	Stage-II Raw Water Pumphouse	1	200	200	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	TP-8	
75	Stage-II PT Plant clarifiers	2	1100	2200	RCC Over-ground 30m dia	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
76	Stage-II PT Sludge sump & Pumphouse	1	80	80	Structural Steel shed	Under ground RCC sump	Single Storey	Super-structure & Sub-structure	Pipe conveyor	
77	Stage-II PT Plant Building including clarified/Filtered water Pumphouse, sump, Chemical House etc..	1	700	700	RCC structure with Brick in-fill panels	Under ground RCC sump	Double storey	Super-structure & Sub-structure	Pipe conveyor	
78	AAQMS Room	1	20	20	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single storey	Super-structure & Sub-structure	CSSP	
79	Cylinder Shed	1	70	70	StructureI Steel	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	CSSP	
80	Coal Slurry Settling pit	1	1200	1200		brick masonry under-ground pit		Super-structure & Sub-structure	Coal stock Pile	
81	Dozer shed	1	500	500	StructureI Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	
82	Coal yard shed	1	1000	1000	StructureI Steel shed	RCC foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	BOP Laydown area	
83	TP-14	1	180	180	StructureI Steel shed with side cladding	RCC foundation with PCC mudmat	Triple storey	Super-structure & Sub-structure	Coal stock Pile	
84	Ground Conveyor 16A/B - 2m wide 600m long	1	1200	1200	Ground conveyor along with stacker-Reclaimer support rails			Super-structure & Sub-structure	Coal stock Pile	
85	Conveyor 17 - overground - 5m wide 275m long	1	1375	1375	Overhead structural steel conveyor gallery	RCC foundation with PCC mudmat		Super-structure & Sub-structure	BOP Laydown area	
86	Conveyor 17 - underground - 5m wide 80m long	1	400	400		Under-ground RCC tunnel		Super-structure & Sub-structure	BOP Laydown area	
87	Site Store sheds	1	1500	1500	Brick masonry load bearing walls	Brick masonry foundation with PCC mudmat	Single Storey	Super-structure & Sub-structure	Coal stock Pile	
88	ETP Building with associated equipments	1	NA	NA	RCC and Brick	RCC	-	Sub-structure and Super Structure	Coal stock Pile	
89	All Equipments and Structures of Coal conveyor#16,17,R1,R2,TP#14&10B,stacker cum Reclaimer,stacker,R2 shed, Penthouse	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure	CHP	
90	Ash Water Reservoir	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure	AWPH	
91	Existing Track Hopper Area : All the structures and equipments above ground level of Track Hopper area i.e Shed structural part , all associated mechanical equipment , ventilation system, Hoists, Cable Trestle, electrical equipments , light fittings etc.	NA	NA	NA	RCC, Steel Structure	RCC	-	Super Structure	CHP	
92	Existing Railway siding inside plant Boundary including Pway, OHE, S&T, S&T Building	NA	NA	NA	RCC, Steel Structure	RCC	-	Sub-structure and Super Structure	St-III Plant Area	
93	Compressor house near Track hopper : RCC Building and its equipments (if any)	NA	NA	NA	RCC Building	RCC		Sub-structure and Super Structure	CHP	
94	Conveyor 13 A&B: All the structures, RCC buildings, cable trestle and equipments above ground level upto TP 13	NA	NA	NA	RCC, Steel Structure	RCC		Sub-structure and Super Structure	CHP	
95	32 nos small sheds (Agency Office) near Raw water reservoir St-I	NA	NA	NA	RCC, Steel Structure, Tin	RCC/Brick Masonary		Sub-structure and Super Structure	Coal stock Pile	

Sl. No	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
A4-LAYOUT-2	Section- VI	PART-C	16 of 114	8.03.04 (iv)	Contractor shall prepare the model of all the facilities located within All input files of software used for design of Equipments / Piping like CAESAR2 files, input files for Pressure vessel design, datasheets etc., shall be handed over to NTPC as per NTPC specifications for handover of Engineering Information. Further, two Licenses of the used 3D Modelling Software (One forEngineering View and One for Site View) shall be provided along with compatible Hardware for possible review and study of the Model Files being submitted by the Bidder Time to time. Handover Plan: There shall be continuous handover of documents and data at various stages of the project including rules and trigger points for handover of data to NTPC shall be at 30%, 60% and 90 % of 3D model stage. Database backup shall be taken every month and handed over to NTPC.	Contractor shall prepare the model of all the facilities located within All input files of software used for design of Equipments / Piping like CAESAR2 files, input files for Pressure vessel design, datasheets etc., shall be handed over to NTPC as per NTPC specifications for handover of Engineering Information. Further, two Licenses of the used 3D Modelling Software (One forEngineering View and One for Site View) shall be provided along with compatible Hardware for possible review and study of the Model Files being submitted by the Bidder Time to time. <i>All software provided shall necessarily include cost for perpetual license(s) for use on all the machines and an Annual maintenance contract (AMC) which shall include software upgrades as & when released by the software agency for a period of three years after warranty/guarantee period .</i> Handover Plan: There shall be continuous handover of documents and data at various stages of the project including rules and trigger points for handover of data to NTPC shall be at 30%, 60% and 90 % of 3D model stage. Database backup shall be taken every month and handed over to NTPC.

Specification Reference						
Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Page No.	Clause No.	Existing	Read As
A-SG-54	Amendment no:01 - S.N.:A-SG-25, P-27/123 (CS-4540-001A-2-TECH-AMDT. 01), (Specifications Reference: A-05, Part-B, Cl.-5.06.11, Page - 10 / 28)				The complete absorber vessel (absorber oxidation tank, absorber tower & absorber outlet duct) shall be made of clad sheet of Titanium/ C276 / Alloy 59 (minimum 2 mm thickness) having minimum 7 mm thick carbon steel as base material.	The complete absorber vessel (absorber oxidation tank, absorber tower & absorber outlet duct upto absorber outlet flange) shall be made of clad sheet of ~~Titanium/~~ C276 / Alloy 59 (minimum 2 mm thickness) by explosion bonding or hot rolling , having minimum 7 mm thick carbon steel as base material.

S. No.	Specification Reference				Existing	Read As
	Sec/Part	Sub Sec	Page No.	Clause No.		
D4-1	SECTION-VI, PART-B	D-1-6	15 OF 24	6.03.15	The live storage capacity of each coal bunker shall be greater of the following: a)Total 10 hours coal requirement of the boiler for BMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. b)Total 10 hours coal requirement of the boiler for BMCR duty with design coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. c)Total 10 hours coal requirement of the boiler for TMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required to be in service for this duty condition as specified elsewhere.	The live storage capacity of each coal bunker shall be greater of the following: a)Total 10 hours biomass blended coal requirement of the boiler for BMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. b)Total 10 hours biomass blended coal requirement of the boiler for BMCR duty with design coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required in service for this duty condition as specified elsewhere. c)Total 10 hours biomass blended coal requirement of the boiler for TMCR duty with worst coal firing, equally distributed over the number of bunkers (i.e. the coal mills) required to be in service for this duty condition as specified elsewhere.
D4-2	SECTION-VI, PART-B	D-1-6	16 OF 24	6.03.16	For all capacity (volume) calculation and structural design (load calculation) unit weight of coal shall be assumed as 800 kg/cum. and 1100 kg/cum respectively.	For all capacity (volume) calculation and structural design (load calculation) unit weight of biomass blended coal shall be assumed as 760 kg/cum. and 1100 kg/cum respectively.

S. No.	Specification Reference				Specification Requirement	Bidder's Query	NTPC's Clarification
	Sec/Part	Sub Sec	Page No.	Clause No.			
1					Approach to Project Site	Present approach road is passing through a congested market & busy railway Crossing (electrified) area, which will restrict movement of oversized trucks, dumpers, trailers etc. during construction period. The only other possible approach to the project site is through Railway over Bridge (ROB), which is still under construction. In this context, kindly note that construction of a portion of this ROB is pending for past few years. We, therefore, request NTPC to take up suitably with the concerned authorities, so that access to site through the ROB can be made available to the EPC Contractor on or before the issuance of Notification of Award (NOA).	Approach road to the plant is available through a level crossing. For ease of movement, construction of balance work of Rail Over Bridge (ROB) is under construction by R&B department, Govt. of Odisha. In addition to this, Anugul Talcher State highway can also be used for transportation and approach to TTPS site directly. Further for approach to the designated laydown area in abandoned ash dyke, ROB is not required.
2					Rerouting of existing transmission lines passing through laydown area	Existing transmission lines are passing between the two ash dykes i.e. dyke no. B and C, with significant elevation difference, which will restrict the vehicular movement within the laydown area from dyke B to C. Thus, the laydown earmarked within the dyke C having substantial area will remain unutilized. We request NTPC to ensure rerouting of transmission lines prior to handover of laydown area to the EPC Contractor.	Rerouting of existing 132kV transmission line is not feasible and hence not envisaged. The transmission line is sufficiently above the existing ground level and sufficient headroom is available
3					Space constraint for construction of Main Plant facilities	Additional space will be required between proposed Main Plant facilities of Unit 1 and existing TPS Stage-II BOP facilities for carrying out pre-assembly work, crane movement for erection of Main Plant equipment, temporary storage etc. We, therefore, request NTPC to provide additional space to EPC Contractor by arranging to dismantle the adjacent TPS Stage-II BOP facilities like railway siding, store and ash water reservoir etc. before the issuance of NOA.	Dismantling of existing Railway Siding and Ash water reservoir is in the scope of EPC Package. Above ground structures of Stores would be dismantled by Owner. However, dismantling of below ground structures of stores i.e. foundations etc. is in the scope of EPC Package. Please refer Technical Specifications for detailing. Additionally, 75 acres of land is available for Laydown & Pre-assembly and an additional 10 acres are available for Batching Plant within plant boundary. EPC Contractor to plan accordingly.

4					TPS Stage-III AHP facilities overlapping with the existing power station	During our site visit, we were informed that existing power station will be fenced temporarily and dismantling of the existing facilities within the fenced area will be taken up by NTPC later. However, kindly note that construction clearance for Talcher TPS Stage-III AHP facilities like ash water pump house, ash pipelines etc. proposed within the existing power station area will be required from start of the project to enable the EPC Contractor to meet the AHP Package completion schedule. Hence, we request NTPC to ensure availability of front for the same on the date of NOA.	Bidder to refer area handover and dismantling schedule as detailed in Clause 5.00.00 of Sub-Section-III Section VI, Part-A and Sub-Section-IIID, Section VI, Part-A for area availability schedule and plan accordingly.
5					Limited Space availability for ESP, FGD and Carbon capture facilities	Total Space allotted for ESP, FGD and Carbon capture is not sufficient and cannot be accommodated within the given layout. We, therefore, request NTPC to relocate the Carbon capture facilities to a different location.	The space allocated for FGD & ESP in the layout is based on the earlier experiences of NTPC for the space requirement. In view of space constraint, single control room is planned for both the units near chimney. Separate space identified for lime and gypsum handling to address the issue of space constraint for FGD. For carbon capture 3000 Sq.M. area is identified near to chimney to meet the technical requirement. Further additional area of around 50,000 Sq.M. is also identified for Hydrogen & Methanol handling which will be made available progressively with dismantling of existing units. Considering above, bidder may plan their facilities within the space provided. Further, the bidder has flexibility to the extent that the width of the area of carbon capture may be reduced to minimum 40 m from existing 50 m shown in tender drawing while maintaining the total area of 3000 m2. Also, minor shifting of the area may be done to the extent that the distance from chimney may not increase by more than 20 m from the existing distance shown in GLP. Please refer Amendment A-SG-1

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Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

6					Delay in handover of area for CHP facilities	Existing facilities of Stage-II viz. Raw water reservoir-2 and PT plant are fouling with proposed CHP facilities for Stage-III and need to be retained till the completion of Stage-III Raw water reservoir and PT plant. This will have bearing on overall project schedule; we, therefore, request NTPC to provide alternative arrangement of water supply, so that EPC Contractor can dismantle the existing raw water reservoir-2 and PT plant from start of the project.	Bidder to refer area handover and dismantling schedule as detailed in Clause 5.00.00 of Sub-Section-III Section VI, Part-A and Sub-Section-IID, Section VI, Part-A for area availability schedule and plan accordingly.
7					CHP stockpile fouling with existing Stage-II ETP facility	Location of Coal stockpile and coal shed for proposed Stage-III are fouling with existing Stage-II ETP facility. We understand during our site visit that the same needs to be retained till completion of proposed Stage-III ETP. Please note that this may adversely impact the overall project schedule and we, therefore, request NTPC to arrange to dismantle the aforesaid ETP facility, so that the front can be made available to the EPC Contractor from start of the project.	Bidder to refer area handover and dismantling schedule as detailed in Clause 5.00.00 of Sub-Section-III Section VI, Part-A and Sub-Section-IID, Section VI, Part-A for area availability schedule and plan accordingly. Please refer Amendment D-1
8	VI/B	A-01	4 of 101	1.05.01 v)	Heat Input per burner(*) - 600 X105kCal/Hr (Maximum) (*) Minimum number of coal pulverisers to be provided for each steam generator shall not be less than Seven (7).	In the recently awarded package by NTPC, specification specifies for Heat input per burner as 75 Mkal/hr (maximum). Therefore, we request NTPC to issue the suitable amendment to the technical specifications.	Please refer amendment A-SG-08
9					Land availability	Availability of complete & encumbrance free land on date of award.	Complete encumbrance free land would be available. Bidder to refer area handover and dismantling schedule as detailed in Clause 5.00.00 of Sub-Section-III Section VI, Part-A and Sub-Section-IID, Section VI, Part-A for area availability schedule and plan accordingly.
10					Laydown area development	Development of Ash Dyke by NTPC to utilise the time prior to award of EPC package under separate enabling package.	Fencing of the laydown area and re-routing of 33kV line in the area marked for laydown is in Owner's scope. Construction of wire fencing in the proposed laydown area shall be completed within 4 months from NOA. Contractor can do the site preparation work parallelly. Please refer Clause 2.03.00 of Sub-Section-IID Section VI, Part-A. Scope of Work shall be as per the Technical Specifications.

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11	VI/A	IIA			Coal Shed	Suitable modification in the scope of coal shed	Scope as defined in the Technical Specifications shall be retained.

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
12	SECTION-VI, PART-A	SUB-SECTION-I-A PROVEN-NESS	PAGE 17 OF 36	4.23.2 (c)	The Bidder shall be required to furnish an undertaking jointly executed by the Bidder, its sub-vendor (if applicable) and the QSCRM for the successful performance of SCR system, as per the format enclosed with the bidding documents in which the QSCRM and the Bidder and its sub-vendor (if applicable) are jointly and severally liable to the Employer to perform contractual obligations including the technical guarantees for the complete SCR system. The Deed of Joint Undertaking (DJU) shall be submitted at the time of placement of order on the approved sub vendor. In case of award, QSCRM and Bidder's subvendor (if Applicable) shall each be required to furnish an on demand bank guarantee for INR 24 million (Twenty Four Million only) in addition to the contract performance security to be furnished by the bidder.	As per the scope under this package, EPC bidder has only provide SCR Ready system. So the requirement of DJU/DJU Performance BG for SCR Ready system is not applicable. Bidder request NTPC to issue suitable amendment.	Refer amendment A-SG-02 in this regard.
13	SECTION-VI, PART-A	SUB-SECTION-VI-Chapter 01	PAGE 23 OF 38	1.24.00	Spares for SCR System	As per the scope under this package, EPC bidder has only provide SCR Ready system. So the requirement of mandatory spares under this clause is not required. Bidder request NTPC to issue suitable amendment.	Refer amendment A-SG-01 in this regard.
14	SEC VI/ PART-A	II-A-15/ COAL HANDLING PLANT	PAGE 4 OF 7	1.16.00	Stockyard Management System shall be provided complying the requirements as per C&I Annexure to sub section A-20, Part-B.	C&I Annexure to sub section A-20 is not available in the specifications. Kindly issue suitable amendment.	Refer Amendment No C-1
15	Sec VI/A Sec VI/E	II-A-15/ COAL HANDLING PLANT CHP Flow diagram	PAGE 2 OF 7	1.00.01 (v) & (xiii)	As per specification, External CHP and Biomass handling system are excluded in Bidder's scope. Referring to Flow diagram enclosed in Tender drawings in Option-2, External CHP & Biomass handling systems are shown as part of Bidder's scope.	Kindly clarify the scope and issue suitable amendment, if required.	Bidder to refer revised Coal Flow diagram issued as Amendment (A-MH-1)
16	Sec VI/ Part-B	A-06	1 of 4	1.01.00	One number outdoor installation type, natural circulation, pressurized furnace, water tube boiler suitable for firing LDO and having steam-ing capacity of minimum 90 T/hr or of higher capacity if the requirement of auxiliary steam for pre-commissioning, commissioning and startup activities of Boiler and Turbine is greater than 90T/hr (Excluding steam requirement of Auxiliary boiler) with steam parameters at superheater outlet as optimized by the bidder maintaining a minimum 50 deg C superheat and minimum temperature of 315 deg C and 19 Ksc (a) taking care of various start up require-ments including cold, warm and hot start up conditions.	Auxiliary boiler will be in operation only during the start-up of the main boiler. Steam produced from Aux boiler will be used for the following purposes: 1.HFO heating & tracing 2.HFO atomization 3.De-aerator pegging 4.Turbine gland sealing 5.Feeding SCAPH etc. OTSC units operating at a (minimum) SH/RH outlet temperature of 568/596 °C respectively require auxiliary steam at (280-300) °C for turbine gland sealing. Hence, all the auxiliary boilers supplied by BIDDER for OTSC units are sized to deliver steam at 290°C. Therefore, an auxiliary boiler of 90 TPH (min.) capacity and Super heater outlet parameters of 19 ata & 290°C shall be offered. Kindly Confirm.	Following may be noted- HFO is not provisioned in the scope. The parameters as mentioned by the bidder are not in line with the specified parameters of SH/RH for Talcher-III. The steam parameters at the outlet of Auxiliary boiler are decided as per NTPC past operating experience. Bidder to comply specification requirements.
17	Sec VI/ Part-B	A-06	2 of 4	1.10.00	Ducting: The boiler shall be provided with The ducting section shall have flanged & bolted joints	Aux Boiler ducting shall be made up of welded joints as per standard industrial practice. Kindly concur.	The bidder's query doesn't bring out the constraints for the specified flanged & bolted joints which allow easy replacements. The specifications requirements are to be complied with.

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18	Sec VI/ Part-B	A-06	3 of 4	1.13.00	Aux Boiler Canopy: To offer protection to the Boiler against rainfall, a rain canopy shall be provided.	Canopy shall be provided on the floors & platforms where instrumentation/ equipment is present (like drum floor, burner floor), in line with BIDDER's standard practice. Kindly concur.	Bidder to ensure that all equipments & Instrumentations needs to be protected against rain-fall by providing suitable canopy. Refer amendment A-SG-03 in this regard.			
19	Sec VI/ Part-B	A-06	3 of 4	1.17.00	Equipment Handling Arrangement Where it is necessary to handle any item in excess of 55 kg. weight on the boiler for pur-pose of erection or maintenance, a suitable lifting beam arrangement is to be provided. For loads one ton and above on lifts exceeding three me-ters electric hoists shall be provided.	Since all the associated equipment are of smaller size, separate equipment handling system is not provided for Aux. Boiler as per our standard practice. Kindly concur.	Refer amendment A-SG-04 in this regard.			
20	Sec VI/ Part-B	A-06	4 of 4	1.20.00	Instrumentation & Control All necessary sensors, transmitters, switches & local instruments including flame scanners shall be provided by the Contractor for safe, efficient operation of the plant. The control, interlock & protection shall be implemented in Control System. For details, refer relevant Sub-section-of C &I, Section-VI.	Auxiliary boiler is a package boiler and shall be in service only during the start-up of the main boiler. Considering its intermittent operation, the instrumentation & controls have been minimized/ optimized and standardized ensuring safety of the aux. boiler. Hence, kindly confirm that the instrumentation & controls for aux. boiler shall be as per bidder's standard practice.	Bidder to comply with specification requirement.			
21	Sec VI/ Part-B	A-06	4 of 4	1.21.00	Valves For valves of Fuel Oil system for auxiliary boil-er, the Contractor shall comply with requirements stipulated for Fuel oil system for main boiler in relevant clauses of Sub-Section-A-03, Part-B, Section-VI.	For auxiliary boiler, considering its intermittent operation i.e. only during the start-up of main boiler, Gate and Globe valves shall be used for isolation and regulating purpose respectively in-line with earlier contracts executed by BID-DER. Kindly concur	Refer amendment A-SG-05 in this regard.			
	Sec VI/ Part-B	A-02	33 of 65	11.05.03	Valves shall conform to following requirements: <table border="1"><thead><tr><th>S.No.</th><th>Parame-ter</th><th>Requirement</th></tr></thead><tbody><tr><td>i)</td><td>Type of valves (for oil services)</td><td>Plug type (metallic seated), leak proof, fire safe as per the require-ment of API 6FA</td></tr></tbody></table>			S.No.	Parame-ter	Requirement
S.No.	Parame-ter	Requirement								
i)	Type of valves (for oil services)	Plug type (metallic seated), leak proof, fire safe as per the require-ment of API 6FA								
22	Sec VI/ Part-B	A-02	55 of 65	22.00.00	Type Test	Auxiliary boiler is a standard package boiler. Hence, we understand that type tests are not applicable. Kindly confirm.	Bidder's query context is not clear against the referred clause for type test. Type test is not mentioned for auxiliary boiler and Its auxiliaries wrt Mechanical equipments.			
23	Tech Part-1	II A-05	525 of 2672		Auxiliary Boiler	Shear UT (SA 577) for Plate Material of Shell and Dished Ends: We propose to procure plate material for Shell and Dished Ends without shear UT (SA 577) in view of following reasons. a) As the design conditions of Auxiliary Boiler are different as compared to Main Boiler, Shear UT (SA 577) that is applicable for Main Boiler need not be required in case of subject Auxiliary Boiler. b) None of Indian manufacturer is having in-house facility for shear UT to SA 577.	Aux. Boiler drum is a critical equipment. Hence the Raw Material healthiness to be ensured in all respect. Plate material for Shell and Dished Ends shall be checked with angular probe beam as per SA 577 which is more stringent than normal beam probe. Based on criticality same standard to be followed. Bidder to meet the specification requirements.			
	Tech Part-3		462/618							

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

24	SECTION – VI, PART-A	SUB-SECTION-I-A PROVENNESS	24 of 36	4.26.1 (e)	A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.26.1 above in India shall be considered qualified for such equipments, provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.26.1 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s). In case the Bidder or the proposed sub-vendor is not manufacturer of proven Agitators as per clause 4.26.1 (e) above but is a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry, the Bidder or the proposed sub-vendor can also manufacture Agitators, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Agitators in India with such manufacturer who meet the requirements stipulated at clause 4.26.1 (e) above for the Agitators. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.	For agitators other than absorber agitators, the provenness sought is for the application in "Wet Limestone based FGD application in Coal fired power plant". Though, customer has also allowed manufacturers of Agitators in other application to participate through collaboration or valid licensing agreement with manufacturer who meets the PQR in FGD application, but only one indigenous manufacturer is having such collaboration and meet the requirement. We request customer to allow manufacturers of agitators having experience of similar rating of agitators in Non-FGD applications without collaboration or valid licensing agreement with manufacturers who meet the PQR in FGD application. Further, we would like to inform that the agitators ,manufactured by these indigenous manufacturers, used in the other process industries like petrochemical, paper & pulp etc. are for more critical application using slurry of higher specific gravity. Please accept.	Bidder to comply with specification requirement.
		(f)	Agitators	Vertical/Horiz ont	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application	
25	SECTION-VI, PART-A	SUB-SECTION-I-A	30 OF 36	5.12.1.1	The Bidder/Sub-Vendor should have manufactured & supplied at least two numbers (one each at two different installations) of 16 MVA, 11KV or higher rating oil filled transformers which should have been in successful operation for a period of at least two (2) years.	The clause shall be altered as: The Bidder/ Sub-Vendor should have manufac-tured & supplied at least two numbers (one each at two different installations) of highest offered rating oil filled transformers which should have been in successful operation for a period of at least two (2) years. Min. 16 MVA transformer criteria is not required when order ratings are less than 16 MVA. Due to this clause good vendors get rejected.	Bidder to comply with specification Requirements. Sufficient number Of vendors are available.
26	SECTION-VI, PART-A	SUB-SECTION-I-A	31 OF 36	5.12.1.2	Bidder/Sub-Vendor should have his own facilities for conducting all routine and type tests as per IS: 2026 (except short circuit test).	The clause shall be altered as: Bidder/ Sub-Vendor should have his own facili-ties for conducting all routine and type tests as per IS: 2026 (except short circuit test and light-ening impulse test). Since impulse test is a type test thus same can be conducted at govt./ govt. accredited lab in line with short circuit test. Due to this clause good vendors get rejected.	Bidder to comply with specification Requirements. Sufficient number Of vendors are available.
27	SECTION-VI, PART-A	SUB-SECTION-I-A	31 OF 36	5.12.1.3	16 MVA, 11 KV or higher rated oil filled transformer manufac-tured by Bidder/Sub-Vendor should have been successfully short circuit tested.	The clause shall be altered as: The highest offered rating oil filled transformer manufactured by Bidder/ Sub-Vendor should have been successfully short circuit tested. Min. 16 MVA transformer criteria is not required when order ratings are less than 16 MVA. Due to this clause good vendors get rejected.	Bidder to comply with specification Requirements. Sufficient number Of vendors are available.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

28	Section-VI, Part-A	SUB-SECTION-I-A Provenness	9 of 36	4.8	The Bidder/its sub-vendor should have designed, supplied, erected and commissioned at least one (1) number water/waste water treatment plant having capacity of not less than 1000 Cu.m/hr., comprising of clarifiers/tube settlers/thickeners or a combination thereof including civil works. The plant should have been in successful operation for at least one (1) year	1.As per stated PQR for PT plant, Liquid effluent treatment plant (LETP) execution of civil works is made mandatory for qualifying the PQR. Since, the civil works of PT Plant is designed/executed by bidder, so the civil works criteria shall not be the part of PQR for WTP suppliers. In case, if Civil works is in the scope of WTP supplier then Criteria for Civil Works execution shall be a part of WTP supplier evaluation/PQR. 2. It is proposed that LETP PQR may not be kept same as that of PT plant as LETP capacity may not be as high as PTP. Hence by laying high capacity parameters in PQR, qualified vendors may get eliminated. Civil works criteria should also be removed from LETP PQR and 50% of the plant capacity should be specified to enhance bidder's participation.	Bidder to Refer Amendment No : A-WS-1
29	VI / A	I A	10 of 36	4.13	Mill Reject Handling System: Mill reject handling system offered by the Bidder shall be only from such manufacturer who has previous experience of manufacturing and supplying metallic belt conveyor type or chain flight conveyor type coal mill rejects handling systems of capacity 1.5 MTPH or higher for a pulverized coal-fired boiler unit which are in successful operation in at least one (1) plant for a period not less than one (1) year. The reference mill reject handling systems should be of the same type i.e. metallic belt conveyor system or chain flight conveyor sys-tem as is being offered by the Bidder/ its Sub-vendor	NTPC is requested to allow Bulk Material Handling System also as there are limited supplier in the market who meets mentioned requirement. Further, design aspects of conveyors for Bulk Material handlings are same as of Mill reject system PQR for Mill reject system can be modified as: Mill reject handling system offered by the bidder who has previous experience of manufacturing and supplying metallic belt conveyor type or chain flight conveyor type coal mill rejects handling systems or Bulk Material Handling System of capacity 1.5 MTPH or higher in thermal power plant / Other industries which are in successful operation in at least one (1) plant for a period not less than one (1) year. OR Bidder may also qualify based on the credential of principal meeting pre-qualifying requirements mentioned above. For this, bidder shall be required to furnish a 'letter of support from Collaborator/Licenser/Associates along with valid technical collaboration Licensing agreement and scope matrix for execution.	Bidder to follow Proneness Criteria for Mill Reject Handling System, as per the Technical Specification
30	VI / A	I A	11 of 36	4.15	Turbine Hall EOT crane: The Bidder/ its sub-vendor should have designed, manufactured, erected and commissioned EOT cranes of capacity 100T or more with minimum crane span of 28 meters, which is in successful operation in at least one (1) station for a minimum period of one (1) year	NTPC is requested to accept Gantry Crane credentials also against qualifying requirement, as design of gantry crane is same / more challenging (for leg designing) than EOT crane.	Bidder to note that Turbine hall EOT Crane requirement and application is over and above that of gantry crane. Hence Bidder proposal is not acceptable. Bidder to comply specification re-quirements.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
31	VI A	IA/ Provenness	12 of 36	4.19.1	The Bidder/ its Sub- vendor(s) should be supplier of ash handling system(s) and should have executed ash handling system(s) involving design, engineering, manufacture, supply, erection and commissioning for (a) (i) Wet Bottom Ash handling system comprising either a jet pump system in conjunction with water impounded Bottom Ash Hopper or a submerged Scraper Chain Conveyor system designed for the following conveying capacities for pulverized coal fired boilers: Jet Pump System : 50 tonnes/hour (dry ash basis) or more per jet pump. Submerged Scraper : 20 tonnes/hour (dry ash basis) Chain Conveyor System or more per Conveyor. OR (ii) Dry Bottom Ash Handling System involving mechanical conveying and crushing designed for at least 20 Tonnes/hour conveying capacity for pulverized coal fired boilers. The reference Bottom Ash Handling systems should be of the same type i.e. jet pump system or submerged scraper chain conveyor system or dry type mechanical conveying system as is being offered by the Bidder/ its Sub- vendor. (b) Pneumatic fly ash handling system for conveying fly ash from ESPs of a single pulverized coal fired boiler unit by either: (i) Pressure conveying system designed for 30 TPH or more conveying capacity. OR (ii) Vacuum conveying system designed for 30 TPH or more conveying capacity per vacuum extractor. The reference fly ash handling systems should be of the same type i.e. pressure system or vacuum system, as is being offered by the Bidder/ its Sub- vendor. An individual boiler unit having its own independent fly ash handling system up to wetting units/ dry dust collection buffer hoppers/intermediate Silos which includes, among others, independent fly ash handling equipment below ESP hoppers, independent ash conveying piping up to wetting units/ dry dust collection buffer hoppers can be considered as a plant for meeting the requirement above. And (c) Pneumatic Fly Ash Transportation System for transporting fly ash from pulverised coal fired boiler unit having capacity of not less than 20 TPH for a conveying distance of not less than 500 meter including fly ash storage silo. Further, a transportation system provided for an individual boiler unit having dedicated transportation vessels below dry dust collection buffer hoppers and dedicated piping from dry dust collection buffer hoppers/ intermediate Silos to storage silos, including storage silos can be considered as a plant for meeting the requirement above. (d) Complete ash slurry disposal system for handling not less than 40 tons of ash per hour for pulverised coal fired power stations which includes, among others, ash slurry pumps & piping system with associated controls.	As per referred clause we understand that de-packaging can be done while ordering AHP i.e. Bottom Ash system (4.19.1 (a)) can be ordered to vendor A, fly ash system (4.19.1 (b) & (c)) can be ordered to vendor B & Ash slurry disposal system((4.19.1 (d)) can be ordered to Vendor C. Request NTPC to confirm that bidder understanding is in order.	Bidder's understanding is in order.
32	VI A	IA/ Provenness	14 of 36	4.19.2	The Bidder/ its Sub- vendor who is a supplier of ash handling systems but does not meet the requirements under clause 4.19.1 in part or in full can also participate provided it has executed at least the following systems of ash handling plant involving design, engineering, manufacture, supply, erection and commissioning: a) Bottom ash handling system comprising either a jet pump system in conjunction with water impounded Bottom Ash Hopper or submerged scrapper chain conveyor system or dry bottom ash system. b) Fly Ash Handling System for conveying fly ash from ESPs in dry form (involving pneumatic conveying systems of vacuum or pressure type) or in wet (slurry) form. The systems mentioned at 4.19.2 (a) and 4.19.2 (b) above should have been in successful operation in at least one (1) plant for two (2) years and should have been installed for pulverized coal fired boiler units generating not less than 40 TPH of ash per boiler. And collaborates/ associates with party(ies) who meet(s) either the total requirement or the balance part under 4.19.1 (a) ,(b), (c) & (d) above which the Bidder/ its Sub- vendor itself is not able to meet. In such a case, the Bidder/its sub-vendor shall be required to furnish a'letter of support' from Collaborator/Associates for successful performance of the relevant system valid for a period of seven (7) years or up to the end of defect liability period of the contract whichever is later, as per the format enclosed with the bidding documents. The 'letter of support' should be submitted at the time of placement of order on the approved sub-vendor.	To be modified as below: The Bidder/ its Sub- vendor who is a supplier of ash han-dling systems but does not meet the requirements under clause 4.19.1 in part or in full can also participate provid-ed it has executed at least the following systems of ash handling plant involving design, engineering, manufac-ture, supply, erection and commissioning: a) Bottom ash handling system comprising either a jet pump system in conjunction with water impounded Bot-tom Ash Hopper or submerged scrapper chain conveyor system or dry bottom ash system. OR b) Fly Ash Handling System for conveying fly ash from ESPs in dry form (involving pneumatic conveying systems of vacuum or pressure type) or in wet (slurry) form. The systems mentioned at 4.19.2 (a) and/or 4.19.2 (b) above should have been in successful operation in at least one (1) plant for two (2) years and should have been installed for pulverized coal fired boiler units generating not less than 40 TPH of ash per boiler. And collaborates/ associates with party(ies) who meet(s) ei-ther the total requirement or the balance part under 4.19.1 (a) ,(b), (c) & (d) above which the Bidder/ its Sub- vendor itself is not able to meet. In such a case, the Bidder/its sub-vendor shall be required to furnish a'letter of support' from Collabора-tor/Associates for successful performance of the relevant system valid for a period of seven (7) years or up to the end of defect liability period of the contract whichever is later, as per the format enclosed with the bidding docu-ments. The 'letter of support' should be submitted at the time of placement of order on the approved sub-vendor	Bidder to follow Proneness Criteria for Ash Handling System, as per the Technical Specification
33	VI/A	IIA-01	1 of 28	1.01.00	The scope of work for the equipment and ac-cessories to be furnished in accordance with this Sub-section "Steam Generators and Auxilia-ries including ESP" and other sub-sections for "Selective Catalytic Reduction (SCR) System" / "Hybrid (SNCR+SCR) ready system...	SCR system engineering is technology specific and engineering of the complete SCR (SCR reactors System and Ammonia Unloading, Storage, Handling and Injection system) system will be specific to Bidders/QSCRM's technology. We understand, NTPC is aware of the implications (if any).	The specified scope w.r.t DeNOx (i.e. "Selective Catalytic Reduction (SCR) System" / "Hybrid (SNCR+SCR) ready system) is part of the Contract and the same has been reviewed. Bidder to comply the specifications requirements. NTPC has noted Bidder's content
	VI/A	IIA-01	1 of 28	1.03.01	Complete pre-commissioning work including tests of facilities such as line flushing, hydraulic testing of pressure parts, air and gas tightness tests of steam generator enclosure, duct work and ESP,SCR System...		
	VI/A	IIA-02A	1 of 3	1.00.00	The contractor's scope shall include design, engineering, of the complete system for two (02) number steam generators each of 660 MW capacity, as detailed in this specification however, further manufacturing, supply, erection and commissioning scope shall only be limited to the works required for SCR ready/Hybrid ready plant as per Annexure SG-04 attached with this chapter...		
	VI/A	IIA-02A	2 of 3	2.00.00	...The above is described towards only design, engineering, of the complete system while further manufacturing, supply, erection and commissioning scope shall only be limited to the works required for SCR ready/Hybrid ready plant as per annexure SG-04 as attached.		
	VI/A	IIA-02A, Annexure-SG-04	3 of 3	1	Bidder's scope for SCR/Hybrid System shall include design and engineering of the complete system as per Subsection-IIA-02/ IIA-02A of Part A of Technical Specification. However, further manufacturing, supply, erection and commissioning scope shall only be limited to the works required for SCR ready/Hybrid ready plant.		

34	VI/A	IIA-02A	1 of 3	1.00.00	...The system scope (SS) and details has been provided at Annexure-SS1 so as to make the bidder understand towards the design, engi-neering, of the complete system and hence en-able the contractor to furnish all necessary ap-plicable data/drawings/other inputs to enable the owner to procure the SCR reactors/Hybrid System and Ammonia/Urea Unloading, Storage, Handling and Injection system as per detailed out in the related sub-clauses.	Basic engineering data/ drawings/ information only will be shared for information. 1. P&IDs 2. GA of SCR Reactors, 3. GA of Ammonia unloading, storage & handling area. 4. Sizing data of various components Purchase/ procurement specifications will not be shared.	Kindly refer the complete specifications requirements w.r.t. the DeNOx (SCR/Hybrid) system scope and the mentioned submissions required as par of the same. Bidder to submit all data/information as specified in the Contract to enable the owner to procure the SCR reactors/Hybrid System & associated sub-systems as speci-fied. Kindly also refer the Annexure-SG-04 , Sub section-IIA-02A for complete clarity.
35	VI/A	IIA-02A	1 of 3	1.00.00, v.	Computation Fluid Dynamics (CFD)	The arrangement of flow straightener /rectifiers, flow mixers, ammonia injection nozzles/ grid etc. and their locations in the SCR inlet duct are based on physical flow model study as per QSCRM standard practice. CFD models may be used to validate physical model study. Since phys-ical flow model study is not specified and cannot be done for future SCR, CFD modelling studies also cannot be per-formed and not envisaged.	The simulations i.e. Computation Fluid Dynamics (CFD) as specified is based on the package scope of De-NOx ready system and to enable the owner to procure the same. Bidder to adhere to the specification's requirements.
	VI/B	Annexure SS1	10 of 22	6.00.00	CFD MODELLING		
	VI/B	Annexure SS1	5 of 22	4.02.04	...The suitability of the design of the flow straightener /rectifier shall be demonstrated through CFD modelling.		
	VI/B	Annexure SS1	9 of 22	5.01.00	CFD shall be utilized, among others, to finalize the ducting & flow patterns adequate for the system design.		
36	VI/A	IIA-02A, Annexure-SG-04	3 of 3	2, b).	Duct up to SCR Inlet Gate including SCR Inlet Gate	Typical SCR arrangement with Terminal Points as defined in specification are as per Figure 1. NTPC may note that, SCR inlet gate is at SCR reactor inlet at higher elevation and in this duct internals like flow straightener /rectifiers, flow mixers, ammonia injection nozzles/ grid etc. are to be located. Supplying this duct without internals is not possible and required. Hence bidder propose blanking plates in the ducting as SCR Terminal Points as shown in Figure 2. Accordingly, SCR inlet/outlet duct and gate/damper are excluded from scope.	Scope shall be as per "Typical SCR Sketch" as per Amendment A-SG-06 in this regard. Further, Bidder to ensure that there should be proper arrangement (Flange & Bolt) of connecting ducts for SCR wherever Blanking plate is being provided at TP. Bidder to make arrangement such that erction of duct and reactor can be done later without any problem.
				2, c).	SCR Outlet Gate along with the duct from SCR Outlet Gate to APH inlet.		
	VI/B	Annexure SS1	10 of 22	5.11.00	...Alternatively, Bidder can provide Biplane damper with sealing arrangement at SCR outlet duct as per its standard and proven practice...		
37	VI/A	IIA-02A, Annexure-SG-04	3 of 3	2, c).	Structures and foundations in Boiler/APH/ Other areas considering the loading of complete SCR/Hybrid system as per Subsection-IIA-02/IIA-02A. However, structures for SCR reactors above the APH shall not be supplied and constructed.	Structures and foundations in other areas like Ammonia unloading, storage & handling area are not envisaged. Only space requirement and location will be identified.	Refer the amendment A-SG-07 w.r.t.Ammonia unloading, storage, handling & injection area etc.
38	VI, B	IIIC -04	19	10.01.07	CO Analyser Range 0-1 PPM to 0 – 1000 PPM	Bidder proposed for revision in analyser range in line with earlier NTPC Specifications as below: CO Analyzer Range 0-1 PPM to 0-100 PPM The proposed range is adequate for ambient air measurement.	Bidders proposal is not acceptable. Bidder to meet the specification requirement.
39	SECTION – VI, PART-B	G-01	2 of 4	1.01.00 (n	Plant Life 25 years with Number of Starts : Hot : 4000, Warm : 1000, Cold : 150. The plant shall be suitable for load cycling which implies that it should be designed to operate con-tinuously under two shift mode (daily start stop with one shift off). The plant shall be capable of daily 2 load cycling from 100% to 50% & 1 load cycling below 50% TMCR	The requirements of 5150 number of starts along with daily start stop with one shift off & daily 3 load cycling are contra-dictory and not practical. 5150 starts in 25 means 206 starts in a year i.e. One startup in every 1.7 days. Moreover 5150 number of given starts translate into approx. 15 years of standstill / non-productive period of the machine. In addition daily start stop is equivalent to 9125 starts. NTPC to reconsider the practicability and clarify the design requirement.	Bidder should not mix the load cycling requirements with start/stops. Further, hot start ups will get covered under daily start stop. Two shift re-quirement was being speci-fied in past also. Bidder to comply specification req-uirements.
40	SECTION – VI, PART-B	G-07	6 of 8	51	Turbine Data Sheet	Technical data of Steam Turbine required for operation, maintenance and information purpose shall only be furnished. Data / information which are proprietary in nature, shall not be furnished in line with earlier projects.	The data/information sought are not proprietary in nature and these information are provided in past also. Bidder to comply specification re-quirements.
41	SECTION – VI, PART-A	IV	1 of 73	1.00.00 f)	The Contractor shall make the plant ready for the performance guarantee tests before start of Initial Operation. All CAT-1 Performance Guarantee tests shall be conducted along with initial operation	All the efforts will be made to make unit ready for perfor-mance guarantee test before start of Initial Operation, how-ever CAT-1 performance guarantee test shall be conducted after stabilization of Unit as per satisfaction of both parties.	Cat-I guarantee test shall be conducted along with initial operation. Bidder to also refer clause 1.00.01 f) of Sub sec-tion-IV, Section-VI of tech-nical specification. Bidder to comply specification require-ments.
	SECTION – VI, PART-A	IV	10 of 73	1.01.03.01 (2) Note	In case any of the above correction curves are not submitted along with price bid , no negative cor-rections shall be allowed on turbine Heat rate on this account .Positive corrections if required to be applied, the amount shall be decided by Employer. Further, no positive corrections shall be allowed on turbine output on this account. Negative corrections if required to be applied, the amount shall be decided by Employer.	Correction Curves shall be generated after approval of Heat Balance Diagrams and shall be submitted to NTPC for Approval and inclusion in TG-PG test procedure.	Bidder to comply specification requirements.

42	SECTION – VI, PART-A	IV	51 of 73	2.02.03	Corrections to the test results for steam turbine shall be applied as per the correction curves listed in this subsection. All the efforts shall be made to control the un-accounted for leakage to the minimum, when the system is properly isolated for a performance test. It shall be bidder's responsibility to arrest all the cycle leak-ages and valves passing before start of initial op-eration. It will be endeavor of the bidder to keep the unaccounted for leakages below 0.1% of the design throttle flow at that load. In case the value of unaccounted for leakage, is more than 0.1% of design throttle flow at that load, the suitable correction for make-up shall be provided as per approved correction curve.	During initial operation plant leakages are quite high and it not possible to bring leakage of plant within 0.1% of MS flow. In view of above this clause to be deleted.	The correction for make-up (Change in system water storage) is already envisaged in worst scenario in case un-accounted leakage exceeds 0.1% inspite of all possible efforts. Bidder to comply specification requirements.
	SECTION – VI, PART-A	IV	51 of 73	2.03.00	The Contractor shall prepare test re-ports in which the methods followed, instrument readings, graphs, observations, final results obtained online, etc., shall be recorded. Soft copies of each test report shall be submitted to Employer for Approval.	TG-PG test report shall be generated as per standard format and will be submitted within shortest possible as per agree-ment during MOM of TG-PG test.	Bidder to refer the clause 1.00.01/(i), sub-section IV, PART-A, SECTION - VI for PG Test report submission schedule. Bidder to comply specification requirements.
	SECTION – VI, PART-B	A-07	23 of 25	1.19.00	Final feed water temperature: To be optimized by the bidder but not less than 305 Deg C	Lower limit of 305 Deg C for Final feed water temperature is quite high considering optimization of thermal cycle. This value to be reduced to 300 Deg C or to be optimized by Bid-der being EPC contract.	Final feed water temperature is based on cycle optimisation and NTPC experience in past project. Bidder to comply specification requirements.
43	SECTION – VI, PART-B	G-04	9 of 224	3.4	The turbine generator performance test is carried out according to ASME PTC6-2004 or latest revision and technical specification. Uncertainty on the test results is not applicable on account of measuring instruments inaccuracy & Fluctuation of parameters during the conductance of test. Ageing correction is not applicable for TG Cycle Heat Rate & Output test. Test will be conducted during trial operations. No shutdown will be allowed on account of PG Test preparations.	Aging is a physical phenomenon and once steam enters into the cycle the aging of the components starts. Hence the aging period will be considered from the date of first synchroniza-tion to the conductance of PG test.	PG test shall be conducted along with initial operation. Hence, ageing correction is not applicable. Bidder to comply specification require-ments.
44	SECTION – VI, PART-B	G-04	13 of 224	4.2	PERMISSIBLE DEVIATION OF VARIABLES: Permissible deviation for the average of the test conditions from design or rated conditions	Allowed permissible deviation in parameters will be as per test code and correction curves shall be generated according-ly.	Bidder to note that permissi-ble deviations specified are as per ASME PTC 6 only.
45	SECTION – VI, PART-B	G-04	14 of 224	4.7	Duration of test run shall be two hours. One hour as minimum is necessary before the test run to confirm whether the plant is at satisfactory condi-tion for the test	Duration of test shall be two hours, out of which most stable 1 hour period shall be selected for calculation and reporting.	Bidder to comply specifica-tion requirement.
	SECTION – VI, PART-B	G-04	15 of 224	5.2	Turbine cycle Heat Rate for Typical Cycle will be calculated using the following equation. (Nomen-clature & Symbols are not mandatory for sample calculation)	Heat Rate calculation methodica will be furnished for ap-proval as per standard practice based on thermal cycle final-ized for project specific design	The indicated formula is for a typical sample calcula-tion and self-explanatory. Bidder understanding is correct.
	SECTION – VI, PART-B	A-07	1 of 25	1.03.01 a)	Adequate drainage facility and temp. sensing de-vices in casings, strainers housings, stop and con-trol valves, extraction lines etc and in drain lines at downstream of the isolating valve to detect any chocking and passing of high energy drains.	We don't recommend/envisage to provide Temp Elements/Temp Gauges in the downstream of all Angle Drain Valves in Turbine Drain Lines, based on following reasons. a) To know the drain valve passing, M/s BHEL is providing the Limit switches and Torque switches in the drain valves to monitor the drain valves position, change in which is indicative of drain leakage as well. b) M/s BHEL manufactured Angle Drain Valves are of high quality and leakage/passing proof provided that maintenance of these valves are done properly and in a scheduled time. These angle drain valves testing is complied as per API 598 standards and seat leakage is accepted as per MSS SP-61 standards. Also, there is no reporting of passing of BHEL Supplied Drain valves at any site by any NTPC. c) As a Turbine designer, we not providing any Temp. sensing devices in the drain lines in any of the NTPC & Non NTPC Supercritical Projects and also not recommended by Siemens	Refer amendment in this regard. (Amendment No : A-TG-6)
	SECTION-VI, PART-B	A-07	07 of 25	2.01.00 (c)	Tubes shall be welded type stainless steel as per ASTM-A-249-TP 316L...	As per Technical specification Section-VI, Part-A, Sub-section-IB, Annexure-III, page 6 of 15 of Raw Water Analysis, Chlo-rides content of Condenser CW is 35 ppm. COC of Cooling Tower is 5.0 (Section-VI, Part-B, Sub-section-A-01, clause no. 3.04.00, page 58 of 101). For above value of COC/Chlorides content, maximum chloride in Condenser CW shall be 35X5= 175 ppm. Up to 250 ppm chlorides level, Condenser Tube of ASTM-A-249-TP 304 is rec-ommended. ASTM-A-249-TP 316L tube recommended for chlo-ride ppm level of higher than 750 ppm. Therefore 316L grade tube material is not required. This is in line with Power Industry sector practice.	Bidder to note that chloride content will be more in clari-fied water. Bidder to comply specification requirements.
46	SECTION-VI, PART-A	I-A PROVENNESS	36 of 36	13	... In case the bidder wants to purchase it from Indigenous sources who does not meet the specified criteria then the bidder to make sure following requirements are met. However, bidder can offer only one pump from indigenous sources for this package...	For subject tender, there are total 4 nos. vacuum pump pack-ages offered per unit. NTPC is requested to clarify the mean-ing of "Bidder can offer only one pump from indigenous sources for this package". We understand that only one no. vacuum pump package is required for station (two units) from indigenous sources as per specified clause. Please con-firm.	Only 1 vacuum pump out of 8 vacuum pumps (in both units together) may be supplied from indigenous sources. Bidder to comply specification requirements.
47	SEC-TION - VI, Part-B	B-01 (Generator & Auxiliaries)	14 of 26	9.06.00	Online dissolve oxygen monitoring system: To be provided for stator water system which op-erates in low oxygen regime at neutral pH.	The stator water system operates at alkaline pH. As such, the online dissolved oxygen monitoring system is not required and hence not envisaged.	Bidder's proposal is not acceptable. Bidder to comply with specification.
	SECTION – VI, PART-B	B-02 (Motors)	1 of 4	5.00.00	Temperature Rise: Air Cooled motors: 70deg C by resistance method for both thermal class 130(B) & 155(F) insulation.	For DC seal oil pump motor, class of insulation shall be class H and the temp rise shall be limited to 95 deg C.	Bidder's proposal is not acceptable. Bidder to comply with specification.

48	VI / B / A-01	42 of 101	2.01.02 (v) & Note-7	Extent and duration of permissible variations in rated steam temperature shall be same as speci-fied for rated steam temperature upto 566 deg C in IEC-45 even though rated steam temperature exceeds 566 deg C	Bidder is offering proven turbine modules designed with temperature / pressure variations as per OEM guidelines. Request NTPC to issue suitable amendment as below: Allowable Temperature Variation as per OEM guideline shall be as under : + 4 °C duration not limited (*) + 10 °C for a maximum of 400 hrs / annum (*) + 24 °C for a maximum of 80 hrs / annum, single event lim-ited to 15 min (*) (*) subject to that average steam temperature over any 12 months of operation is not exceeded the rated temperature for Main Steam & Reheat Steam.	Bidder to ensure that steam parameters at boiler outlet are maintained. Bidder proposal is not acceptable. Bidder to comply specification require-ments.
	VI / A / IV	2 of 73	1.00.00 g)	PG test shall be performed by using process instruments envisaged for nor-mal operation and control of unit. Any ad-ditional instrument/ item required for PG test shall also be supplied by the contrac-tor. Instruments to be used for PG test shall be indicated in the respective P&IDs. Control system loop tuning required to limit the variation of parameters dur-ing performance guarantee testing shall be completed prior to PG Test / initial operation. Test result for PG test is envisaged to be computed in DDCMIS.	PG test instruments are with special accuracy class and shall be calibrated before start of actual PG test and will be installed in running unit. Logging of PG test instrument shall be stored in sepa-rate data logger calibrated for TG-PG test. It is not possible to compute PG test results in DDCMIS. Supplier propriety software shall be used for PG test data calculation as per existing practice. Separate report shall be furnished to NTPC. Request NTPC to consider above and issue suitable amendment.	Bidder's proposal is not acceptable. Bidder to comply with specification.
	VI / A / IV	2 of 73	1.00.00 (i-1)	For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conduct-ance of Performance test, the test re-sults shall be calculated automatically by the serv-er/software provided by the contractor. The correction curves shall be fed/inbuilt in the PG test program/software. Provision of manual entry of offline data which cannot be captured online (such as Relative humidity, Atmospheric pressure etc.) and necessary for calculation of PG Test result shall also be provided. Thecontractor shall submit the detailed test evaluation report of Performance test results to Employer promptly but not later than 7 days from the date of conductance of Per-formance test.	It is not possible to compute PG test results in DDCMIS. No software shall be provided for calculation of TG-PG test data. Supplier propriety software shall be used for PG test data calculation as per existing practice. Separate report shall be furnished. Request NTPC to consider above and issue suitable amend-ment.	Bidder's proposal is not acceptable. Bidder to comply with specification.
49	VI / A / IV	51 of 73	2.02.02	No shutdown shall be allowed for in-stallation of PG test instrument/ flow nozzle etc. Any advanced class instrument system such as those using electronic devices or mass flow technique shall be arranged by the contractor, if required. However, same shall be installed before start of initial operation of unit. For determination of primary flow to the turbine, a calibrated low Beta-ratio throat-tap nozzle assembly shall be installed permanently in condensate line prior to initial oper-ation, same shall be also used for process control. All the instruments including the flow nozzle shall be calibrated by the contractor before initial operation in a reputed international institute. All calibrations reports shall be made available prior to the start of initial opera-tion and calibration certificates in original submitted to Employer. All instruments including flow nozzles as necessary for conduct-ance of PG tests shall be installed prior to the start of initial operation.	PG test instruments are with special accuracy class and shall be calibrated before start of actual PG test and will be in-stalled in running unit. Flow Nozzle shall be installed just before start of TG-PG test to ensure flow measurement and its reading will be recorded in separate data logger. Request NTPC to consider above and issue suitable amend-ment.	Bidder's proposal is not acceptable. Bidder to comply with specification.
50	VI / B / A-07	7 of 25	1.19.00	Furnish thermal kit data for plant performance by DDCMIS and true copies of Performance Guarantee test reports for sets rated for 660 MW or above.	TG-PG test report shall be generated as per standard format and will be submitted. NTPC to confirm.	Bidder's proposal is not acceptable. Bidder to comply with specification.
51	VI / B / G-04	9 of 224	3.4	Condensate flow nozzle (ASME PTC 6) will be in-stalled by vendor Prior to initial operations. Con-densate flow data will be available in DCS during performance test. All other online process instru-ments will be used for conducting TG Performance test. Average value of test data of the specified test period will be collected from DCS for evalua-tion purpose. Offline instrument will not be used during perfor-mance test. Vendor to ensure calibration validity of all instruments used for PG Test.	Flow Nozzle shall be installed just before start of TG-PG test to ensure of flow measurement and its reading will be rec-orded in separate data logger. PG test instruments are with special accuracy class and shall be calibrated before start of actual PG test and will be installed in running unit. Logging of PG test instrument shall be stored in separate data logger calibrated for TG-PG test. It is not possible to compute PG test results in DDCMIS. Sup-plier propriety software shall be used for PG test data calcu-lation as per existing practice. Request NTPC to consider above and issue suitable amend-ment.	Bidder's proposal is not acceptable. Bidder to comply with specification.
	VI / B / G-04	15 of 224	4.8	Frequency of Readings a) The most important measurement, that is the primary flow, shall be read at interval of as de-fined in DCS. b) Other important measurements, primary pres-sures, temperatures and secondary flows shall be read at interval as defined in DCS. c) Storage level changes, secondary pressures and temperatures, shall be read at interval as defined in DCS. d) The generator output shall be collected from online energy meter	PG test instruments are with special accuracy class and shall be calibrated before start of actual PG test and will be in-stalled in running unit. Logging of PG test instrument shall be stored in sepa-rate data logger calibrated for TG-PG test. It is not possible to compute PG test results in DDCMIS. Sup-plier propriety software shall be used for PG test data calcu-lation as per existing practice. Separate report shall be furnished. Request NTPC to consider above and issue suitable amend-ment.	Bidder's proposal is not acceptable. Bidder to comply with specification.

51	Section VI/Part-A	VI/Mandatory Spares		General Query		(i)The Clauses which are not applicable as per bidder design shall not be offered, if same will found applicable during detailed engineering than bidder will supply the same. (ii)In case of repetitive requirement, bidder will supply the spares in the clause where maximum quantity is called for.	(i) Bidder to refer general note no. 3 of page 30 of 31 of Sub section VI/ Chapter-2 /Part-A. (ii) Bidder's understanding is not correct. All specified spares shall be supplied by the contractor.
	VI A	I-A	1 of 36		For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on the techno-commercial bid opening date of EPC package unless otherwise specified in the respective clauses	In the recent past, it has been observed that there is signifi-cant time gap between opening of Techno-commercial bid date and actual award date. Therefore, we request NTPC to modify the said clause as below, in line with earlier NTPC tenders: “For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on the date of considera-tion for approval but not later than six months after award date of EPC package unless otherwise specified in the re-spective clauses.”	Bidder's proposal is not acceptable. Bidder is requested to comply with the stipulation of technical specifications.
52	VI-A	I	Page 7 of 8	4.09.00	The Contractor shall be responsible to under-take some activities related to its Corporate Social Responsibility (CSR) in the immediate vicinity of the project. The Contractor shall un-dertake such activities after prior consultations with the Employer to ensure that the efforts of the Employer and Contractor are complement-ed. The vendor / contractor is expected to carry out the CSR activities as per the provision (Rules) under section 135 of the companies Act 2013 relating to CSR and other circulars /instructions of various government departments viz MoEF etc. The share of CSR expenditure to be incurred by the vendor / contractor for this project in the total CSR expenditure incurred by the ven-dor/contractor as a company will be in the same proportion as the turnover of the project concerned to the total company turnover. This will be certified by the chartered accountant once every fiscal year. Such activities will be undertaken by the con-tractor / vendor in consultation with the Em-ployer.	Please refer specification requirements regarding share of CSR expenditure to be incurred by the vendor / contractor for this project. This does not provide the level playing field to all the bidders. We request NTPC to indicate expenditure to be incurred for carrying out the CSR activities in the im-mediate vicinity of the project as stated.	CSR activities as per the provision (Rules) under section 135 of the companies Act 2013 relating to CSR and other circulars / instructions of various government departments viz MoEF etc. are to be carried out by the contractor, being statutory in nature.
53	VI-D & VII Book 3 of 3			27.00.00 & Appendix-6	Facilities to be provided by the Employer	We request NTPC to physically hand over the clear en-croachment free land immediately after award of Contract i.e. within one month of issuance of NOA. Employer shall be responsible for coordinating and resolv-ing all issues with Central & State Government, local bodies and local authority w.r.t land acquisition.	No major land acquisition issue is envisaged for the project. Further envisaged role of the contractor is only facilitation in resolution of the land acquisition issues related to the project. Bidder is requested to comply with the stipulations of tender documents.
54	VI-A	I		4.10.00	The contractor shall also jointly facilitate in res-olution of Land acquisition		
	VI	C	28.00.00	45 of 114	Training of Employer's Personnel	The number of man-months training shall be mutually agreed. All the expenditure towards travel (internal & external), boarding and lodging and living expenses of Em-ployer's personnel shall be borne by the Employer for all types of trainings. Any kind of training shall only be provid-ed by BHEL's personnel experts at BHEL works / project site only. However if training is not availed by employer during the contract period no rebate on this account shall be ad-missible in contract price. NTPC to confirm.	Bidder's proposal is not acceptable. Bidder is requested to comply with the stipulation of technical specifications.
	VI	F			Mandatory Spare List	Wherever, Bidder quotes lot price for a clause/system in the list of mandatory spares, the offered price will remain same regardless of the deletion / change of items / quantity cor-rections etc as applicable to the particular design/vendor selected during execution. This should not be a point of contention during execution of the order. NTPC to confirm the same.	Bidder's understanding is not correct. Bidder is requested to comply with the stipulation of technical specifications.
	VI-A	II-D	2.01.00	Page 4 of 5	LABOUR & STAFF COLONY	We request NTPC to provide Land for labour & staff colony within Plant boundary. Availability of above land within plant boundary shall help in smooth execution of the pro-ject.	Bidder is requested to comply with the stipulation of technical specifications.
55	VI-A	II-C	4.00.00 (h)	Page 18 of 32	Measuring Instruments (Primary and Secondary): Regarding CEMS	Annual Maintenance Contract (AMC) As per technical specification requirements, AMC to be pro-vided for certain C&I / Instruments beyond completion of the defect liability period. We understand that on successful completion of facilities and completion of defect liability period, NTPC will release the contractor's Bank Guarantees, applicable payments and close the contract. Therefore, providing AMC beyond defect liability period is not envis-aged.	Annual Maintenance Contract (AMC) starts after defect liability period.Bidder to comply specification requirement.

56	SECTION-VI,PART-A	SUBSECTION – 1A	2 of 36		3.1 The Bidder/ Sub vendor should have previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type and minimum equipment rating as stipulated below such that the respective equipment(s) are in successful operation in at least one (1) plant for a period not less than one (1) year .	Our understanding is that the reference date for one year experience is the date of submission of Sub-vendor approval request to NTPC. Please clarify that our understanding is correct.	Bidder’s understanding is not correct. For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on the techno-commercial bid opening date of EPC package unless otherwise specified in the respective clauses.
57	SECTION-VI,PART-A	SUBSECTION – 1A	36 of 36	14.1 (iii)	In such a case additional Testing and Quality requirement shall be tied-up for quality assurance checks before award.	Please clarify what are the additional testing and quality requirements to be tied-up.	This will be finalized during detail engineering stage in line with other Quality plans. Additional tests may include creep test, NDT etc.
	SECTION-VI,PART-A	SUBSECTION – 1A	36 of 36	14.1 (iv)	Apart from specific mandatory spares (identified for HP Bypass system), one additional HP Bypass valve set of such indigenous manufacture/source shall be supplied in addition to the requirement as per specification. Same shall be supplied along with the main equipments without any extra cost to the Employer.	Our understanding is that only one indigenous make HP Bypass valve (without actuator and controls) needs to be supplied as a spare apart from the mandatory spares of HP Bypass system from approved sources. Please clarify.	Bidder understanding is not cor-rect. Bidder to supply HPBP valve along with actuator and controls. Bidder to comply speci-fication requirements.
	SECTION-VI,PART-A	SUBSECTION – 1A	36 of 36	14.1 (vi)	In case of any failure of these HP Bypass system during unit operation/commissioning, then bidder shall replace the same from NTPC approved sources. Further, in such a case bidder shall keep provision (till additional warranty period) for insurance to compensate the Employer for consequential losses due to unit outage.	Since the criteria considered for evaluating the Provenness of HP Bypass system supplier is w.r.t HP Bypass valve, we understand that in the event of failure of HP Bypass valve, it shall be replaced with the HP Bypass valve from NTPC approved sources. Failure of HP Bypass Valve may please be elaborated.	Failure means any unit outage and/or generation loss due to HP bypass.
	SECTION-VI,PART-A	SUBSECTION – VI	11 of 31	Xxv	Valve seat for HPBYPASS VALVE, HPBYPASS SPRAY VALVES - 1 No. of each kind of valve	Our understanding is that 1 no. of seat for HP Bypass valve, 1 no. of seat for HP Bypass spray water injection valve and 1 no. of seat for HP Bypass spray water isolation valve for the valves of sub-vendor’s HP Bypass system shall be supplied. Please confirm.	Refer amendment in this regard. (Amendment No : A-TG-12)
58	SECTION-VI,PART-A	SUBSECTION – VI	11 of 31	Xxvii	Seal kit for Electrohydraulic actuators for HP bypass system - 2 sets of each.	Our understanding is that 1 set of seal kit will contain 1 no. seal kit for each kind of actuator. Please confirm.	Bidder’s understanding is correct
59	SECTION-VI,PART-A	SUBSECTION – VI	11 of 31	Xxviii	Interface Seal kit for HP/LP bypass servo/proportional valve and blocking unit – 2 sets	As per our understanding, 1 set consisting of 1 No interfacing seal kit between Actuator and Propor-tional valve assembly for each kind of valve are of-fered. Please confirm.	Bidder’s understanding is correct
60	Section VI/PART-A	SUBSECTION – VI /Chapter -02	23 of 31	4.00.00/A (3)	a. Electro-Hydraulic Converter/Servo unit/ proportional valve for HPBP b. Blocking unit for HPBP (as applicable) c. Position feedback transmitter for HPBP d. Positioner for HPBP- 1 Set	Our understanding of “1 set” is 1 number of each component of HP Bypass valve listed in this clause. Please confirm.	Bidder's understanding is not correct. 1 set shall include quantity of each items mentioned under referred clause for complete replacement in one stream of HP bypass system as applicable for the offered system.
	Section VI/PART-A	SUBSECTION – VI /Chapter -02	23 of 31	4.00.00/A (4)	High pressure hoses for HPBP – 2 complete sets	Our understanding is that one set will comprise of hoses required for one 660 MW unit. Please confirm.	Bidder understanding is correct. Bidder to comply specification requirements.
	Section VI/PART-A	SUBSECTION – VI /Chapter -02	24 of 31	4.00.00/B (F(i))	Solenoid valves in the HPBP - 10 % or 1 no. of each type and model whichever is more.	Our understanding is that 10% or 1 no whichever is more of each type of solenoid valve that are mounted on one HP Bypass valve assembly. Please confirm.	Bidder's understanding is not correct. Quantity envisaged is 10% of total quantity of each type of solenoids for complete HPBP system being supplied in this package
	SECTION-VI,PART-A	SUBSECTION – A-07	4 of 25	1.16.00 (a)	Seat tightness of the HP bypass valves shall be equivalent to block valve tightness conforming to MSS SP61.	There is no criteria for “Block valve tightness” in MSS SP 61 standard. Leakage rate as applicable for the valve size as per MSS SP 61 or alternatively Class V leakage rate as per ANSI FCI 70-2 standard will be followed. Please confirm.	Refer amendment in this regard. (Amendment No : A-TG-9)
61	SECTION-VI,PART-A,	SUBSECTION – A-07	5 of 25	1.16.00 (h)	All the piping, fittings, valves, oil tanks, strainers including body and element associated with oil system of HP bypass system shall be of stainless steel.	Stainless steel piping, fittings and oil tanks can be of-fered. Based on our previous experience Valves and strain-ers associated with oil system are not being offered with Stainless steel MOC by the suppliers. Hence, MOC as per supplier’s proven practice will be of-fered. Please confirm.	Bidder to comply specification requirements.
62	SECTION-VI,PART-A	SUBSECTION – A-07	5 of 25	1.16.00 (j)	HP Bypass should have the provision of removable valve seat arrangement for ease of maintenance.	All HP Bypass valve designs which meet provenness criteria may not have removable valve seat arrange-ment. Hence proven design of valve seat arrange-ment only will be offered. Please confirm.	In past for sub-critical units valves with removable type seat have been offered and supplied. Further, welded or removable seat is not related to proven-ness. Bidder to further refer amendment. (Amendment No : A-TG-10)
	SECTION-VI, PART-B	SUB-SECTION- IIIC-08	1 of 5	1.01.03	For special type of control valves such as combined pressure and temperature con-trol valves for Aux PRDS application, separa-tor drain control valves, refer to the corre-sponding mechanical sections.	Since there is a separate mechanical section for HP Bypass system, we understand that, this section is not applicable to HP Bypass system. Please confirm.	Bidder understanding is correct.

63	LIST OF ITEMS RE- QUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL SUB- SYSTEM: TG- Mech		6 of 19	16 & 17	Vendor list is provided for Electro-Hydraulic Actuators and Hydraulic Power Pack Unit	<u>HP Bypass system</u> : Electro-Hydraulic Actuators and Hydraulic Power Pack Unit will be from the list of vendors qualified/approved by the OEM of HP Bypass system to suit their systems. Hence these vendor lists are not being considered for HP Bypass system.	Bidder to comply specification requirements.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

SL. NO	SPECIFICATION REFERENCE				SPECIFICATION REQUIREMENT	COMMENTS / CLARIFICATIONS	NTPC's Clarification
	SEC/ PART	SUBSEC.	PAGE NO.	CLAUSE NO.			
64	VI-A	I	5 of 8	4.02.00	Regarding, coal & fuel oil, the contrac- tor.....than the quoted values.	We request NTPC to consider following changes in the clause: 1. Contractor shall quote the total maximum quantity of coal & fuel oil as required upto the achievement of "Full Load" for the first time, not upto completion of "initial Operation", in case of each unit which shall be issued by NTPC free of charges. 2. Further, coal and fuel oil as required from first full load till the successful completion of 'Initial Op-eration" for both the units shall also be provided free of any charge to the contractor by NTPC	Requirements as per Amendment No. G-03 to be complied with.

Doc. No.: CS-4540-001A-2-TECH-CLRF. 01	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Clarifications No. 01 to Technical Specifications Section-VI

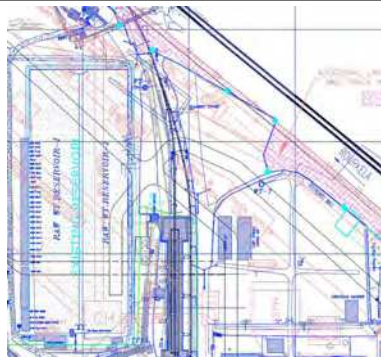
EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
65	Section-VI , Part-A	IIA-06	3 of 10	2.02.08	Portable turbine preservation system consisting of adequate numbers of air driers including, fans, motors, filters, heater drying wheel, connecting pipings, valves, fittings etc. for preservation against corrosion of turbine during idle periods shall be provided. One number system per station shall be provided.	Bidder understand that said clause is for main Steam turbine only. NTPC to confirm.	Bidder understanding is correct.
66	Section-VI , Part-A	VI-02	8 of 31	10	Electrohydraulic assembly for governing system of TDBFP's	Electrohydraulic assembly for governing system is not applicable for offered BFP drive turbine as per Bidder standard design.	Bidder to refer General note 3 in page-30 of 31 of Part-A/Sub-Section-VI, Chapter-02/Section-VI regarding not applicable item.
67	Section-VI , Part-A	VI-02	16 of 31	15.1	One set of emergency over speed governor assembly	We propose to use electronic over speed protection in line with latest practice followed in power industries. Hence 1 set of emergency over speed governor assembly will not be applicable.	Bidder to refer General note 3 in page-30 of 31 of Part-A/Sub-Section-VI, Chapter-02/Section-VI regarding not applicable item.
68	Section-VI , Part-B	A-07	14 of 25	6.05.04-a)	Stop Valves to be provided with removable stainless steel steam strainer for normal operation and one additional strainer element shall be provided for initial operation.	As per Bidder pre-commissioning/initial operation activities of Steam Blowing, the strainer is removed from the line and blanking fixture is used to isolate the steam turbine from steam supply . After steam blowing, the removed strainer is placed in the line again. Hence, we do not need any additional strainer for initial operation. Blanking device will be supplied by Bidder.	As per NTPC operating experience it is observed that after steam blowing loose dirt particle may enter in turbine and may choke the strainer, So additional strainer is specified for initial operation. Bidder to comply specification requirement.
69	SECTION-VI, PART-A.	A-06	6 of 10	6.01.00	One set of test kit for measuring oxygen content at deaerator outlet shall also be provided for the station.	Online oxygen mearing provision is being provided by Bidder. Hence, Offline test kit for measuring oxygen content at deaerator outlet is not required.	Oxygen content is important operational paramter. Hence one additional set of test kit for the station for measuring oxygen content at deaerator outlet is specified to ensure the oxygen content. Hence Bidder proposal is not acceptable. Bidder to comply specification requirement.
70	SECTION-VI, PART-B.	A-01	48 of 101	2.03.07	Maximum oxygen content shall be 0.005 cc/lit at deaerator outlet measured as per ASTM-D-888 reference method-A or Indigo carmine method at all operating condition.	All super critical units operated in oxygenated treatment mode and hence guarantee for maximum oxygen content in feed water system is not applicable for super critical sets.	Sometimes there may be requirement of AVT operation during unit running also. In case of oxygenated treatment mode oxygen content may be more but when unit will run in AVT mode this should be less than 0.005 cc/lit. So deaerator should be capable for maintaining maximum oxygen content of 0.005 cc/lit at deaerator outlet. Bidder to comply specification requirement.
71	SECTION-VI, PART-B.	A-07	11 of 25	5.02.00 (e),	Hardened 400 series stainless steel impingement plates for flashed drain inlet from HP heaters, BFP recirculation, boiler startup drains etc.	As per bidder's experience of super critical plants, Hardened 304 series stainless steel impingement plates are also suitable for this purpose. Customer is requested to amend the clause as " Hardened 400 series or 304 series stainless steel impingement plates"	Hardened 400 series stainless steel is better material for specified requirements. Bidder proposal is not acceptable. Bidder to comply specification requirement.
72	SECTION-VI, PART-B.	A-07	11 of 25	5.02.00 (f)	All water spray valves, splash plates, trays, vent condenser and other elements in contact with undeaerated water or non condensable gases shall be of SS-304	Elements in contact with undeaerated water or non-condensable gases shall be of SS304 material / SS304 lining material shall be provided This is in line with the Deaerators supplied for all 500 MW projects.	SS304 lining is not acceptable. Bidder to comply specification requirement.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

73	Drawing No-4540-001-POM-A-015B			Drawing No-4540-001-POM-A-015B	Centralized Nitrogen gas filling arrangement	N2 system will be based on following parameters. a) Operating pressure of system : 55 to 151 bar(a) b) 2-stage pressure reduction c) Min. pressure at which system is designed : 55 bar(a) d) MOC of N2 piping : CS Customer is requested to mention the number of Cylinders with capacity to be considered. Also We understand that the N2 will be filled into equipment one by one.	This shall be as per preservation requirement for the equipments(Dearator, Heater etc.) to be supplied by bidder. (a) to (c) will be discussed and finalised during detail engineering. (d) Materials will be as per bidders standard practice. N2 filling into the equipment will also be as per bidders standard practice.
74	SECTION-VI, PART-B	E-12	2 of 4	1.00.00 (1(a))	Performance Tests on each Boiler Feed Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure compliance with design requirements specified in the specification.	Performance Test of BFP: Performance test on BFP will be conducted at reduced speed and power and the results will be extrapolated to the specified conditions as per HIS, since it is not feasible to conduct full load, full speed tests at works.	Provision is already given for testing at reduced speed as per HIS guidelines. Refer Note-5, Chapter E-12.
75	SECTION-VI, PART-B	E-12	2 of 4	1.00.00 (1(a))	Measurement shall be carried out at 10%, 25%, 50%, 65%, 80%, 100% & 125% of Design Flow with loop water at design temperature. Performance Test at other specified Conditions shall be carried out on all Boiler Feed Pumps at their respective Speeds at design temperature.	Performance Test of BFP: Performance test measurement shall be carried out at 25%, 50%, 65%, 80%, 100% & 125% of design flow. Performance test measurement at 10% of design flow is not envisaged. Since, the BFP is a very high energy pump and hence running the pump nearer to closed valve condition is not recommended.	Pump performance at lower flow(10% & 25%) done to verify Pump internal conditions, in case of no flow & less flow conditions and for very short duration only. Hence, the present practise will continue. Bidder to meet the specification requirements.
76	SECTION-VI, PART-B	E-12	2 of 4	1.00.00 (3(a & b))	3 (a) Vibration on all Boiler Feed Pumps and Booster Pumps shall be measured in transverse, Horizontal and Vertical Direction at all measuring points. 3 (b) Noise Level on each Boiler Feed Pump and Booster Pump shall be measured at a distance of 1.5 meter above floor level in elevation and 1 mtr horizontally from the nearest surface of the equipment as per HIS. The measurement shall be taken at six points around the equipment for each flow condition.	Vibration & Noise Level tests on BFP & BP: Vibration & Noise Level readings taken during the shop tests for all pumps are for informative purpose only. These levels may be higher than the specified values in view of the presence of valves located in the test pit piping within close proximity of the pump due to layout constraints and the temporary foundation arrangement of the test set up.	Bidder understanding is correct.
77	API 612- 6th edition deviations			10.4	Unless otherwise specified, condensing turbines shall be provided with at least two grounding brushes on the same end of the shaft.	Only one number grounding brush will be provided in the bearing housing as per the standard design of bidder. NTPC to confirm.	Bidder's proposal is not acceptable. Bidder to comply specification requirement

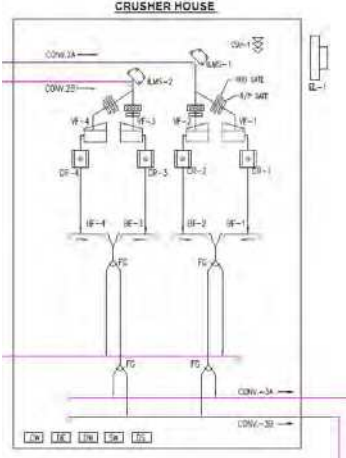
EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
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	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
78	SEC-VI/PART-B	D-1-5	99 of 120	5.23.06	RCC drains shall be provided in Coal stockyard area with precast RCC covers.	We understand that as per standard practice no RCC or PCC paving is required in coal stockpile area. Only levelling and grading of coal stockpile area is sufficient. Kindly confirm.	Confirmed
79	SEC-VI/PART-B	D-1-5	102 of 120	5.23.12	Stairs of MCC/control room, wagon tipplers/track hopper and underground TP's shall be of RCC construction.	We understand that no wagon tippler is envisaged in the scope of bidder. Kindly confirm.	Confirmed
80	SEC-VI/PART-B	D-1-5	37 OF 120	5.05.08	Bidder to take all statutory clearance from concerned authorities for crossing his pipe/trestles over road / rail / culverts / nallah etc. at his own cost and initiative, without any commercial implication to the owner. For any other additional works, bidder have to make their own assessment too of the quantity/ number of culverts, existing pipe pedestal crossings, nallah crossings etc., based on their site visit before quoting.	We request customer to keep approval from the statutory bodies in their scope.	Bidder to adhere to Technical Specifications
81	SEC-VI/PART-B	D-1-6	8 of 24	6.03.03	Design of steel structures shall be done by the working stress method. Design shall be as per provisions of IS:800:1984 and other relevant IS standards.	We understand that steel design shall be done in accordance with latest IS:800-2007 Working Stress Method. Kindly confirm.	Bidder to adhere to Technical Specifications
82	SEC-VI/PART-B	D-1-6	8 of 24	6.03.05	All structures close to railway line shall have clearances conforming to Railway norms.	We request customer to keep approval from the statutory bodies in their scope.	Bidder to adhere to Technical Specifications
83	SEC-VI/PART-B	D-1-6	22 of 24	6.04.01	Minimum thickness of tubular/ hollow steel sections conforming to IS 4923 shall be 4.0 mm, provided the ends of such steel sections are effectively sealed unless higher thickness is specified elsewhere for specific structure.	We request customer to allow tubular section thickness less than 4mm also based on the design requirements.	Bidder to adhere to Technical Specifications
84	SEC-VI/PART-B	D-1-8	10 OF 19	8.07.00	All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections	We request customer to allow site fabrication also.	Bidder to adhere to Technical Specifications
85	SEC-VI/PART-B	D-1-4	1 OF 4	4.03.01	Filling in reservoir area below the bed of reservoir and for the reservoir embankment shall also be done by the Bidder.	Some of the CHP facilities are coming on the existing raw water reservoir. Kindly furnish the depth of existing reservoir. If the depth is more, piling may come. If piling is envisaged, Kindly furnish permissible pile capacities.	Depth of reservoir is approx 4m(+/-1m). Geotechnical investigation of existing raw water reservoir has be carried out by the bidder.
86	SEC-VI/PART-E		4540-999-POC-F-002	TOPOGRAPHICAL SURVEY		Please refer attached snapshot. Contour levels are not marked for Limestone Handling, Gypsum handling areas and many portions of proposed Ash handling & Coal handling system area. Please provide us with existing contour levels for these areas, for correct assessment of foundation type & depth, filling, leveling & grading etc.	Contour levels for the area is not available. Bidder can visit site to make its own assessment.
87	VI/PART-E			4540-001-POM-A-028	Flow diagram of Fly ash handling system (Pressure system). In the flow diagram for fly ash handling system, Six (6) Nos. Buffer hoppers are shown. Stand-by buffer hoppers are not indicated	NTPC to confirm if stand-by buffer hoppers are not required.	Bidder to refer Revised Flow Diagram issued as Amendment. (Amendment No-A-MH-29)

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88	VI/PART-A	IIA-16	1 of 18	1.01.04 (c) 4540-001-POM-A-027 and A-028	A dry fly ash transportation and storage system including dry fly ash storage silos for road bulker <u>and rail wagon loading</u> In the flow diagram, One (1) Open truck unloading and One (1) closed tanker loading below each Silo is shown. Two (2) Nos. Spare connections with isolation valve for future use is indicated.	The fly ash unloading requirement specified in these two clauses are different. NTPC to confirm the actual requirement.	Bidder to refer Revised Flow Diagram issued as Amendment. (Amendment No-A-MH-29)
89	VI/PART-A	IIA-16	2 of 18		Combined ash slurry disposal system for Bottom ash, Economiser ash, Eco duct hopper (if applicable) ash, Air preheater ash, Duct hopper (if applicable) ash and ESP hopper ash up to the mine void	Bidder understands that ESP hopper ash disposal in wet form is intermittent	Bidder to comply stipulation of Technical specification w.r.t ESP ash evacuation as per clause No.
90	VI/PART-A	IIA-16	4 of 18	1.01.05,C),(iii) 4540-001-POM-A-025 and A-026	Two (2) numbers (1 working + 1 standby) economizer ash water pumps along with valves, pipes & fittings for both the units. These pumps shall be located in the ash water pump house. Three (3) numbers (2 working + standby) Eco/APH/SCR pumps	The number of working economiser pumps is different in these two clauses. NTPC to clarify.	Bidder to refer Amendment No (A-MH-22)
91	VI/PART-A	IIA-16	4 of 18	1.01.05,C) 4540-001-POM-A-025	Economizer/Economizer outlet duct (if applicable) /APH/ SCR (design only) / and Duct Hopper (If applicable) Ash Handling Systems Flow diagram of ash handling system	1) In this clause, scope of handling SCR ash is not clearly explained. NTPC to elaborate. 2) Based on the flow diagram, bidder understands that the Coarse ash slurry tank/trench should be designed to handle SCR ash also. NTPC to confirm	Bidders' understanding is correct.
92	VI/PART-A	IIA-16	6 of 18	1.01.06, A) 4540-001-POM-A-028	Six (6) nos. fly ash surge-cum-collection buffer hoppers (3 working + 3 Standby) complete with structural steel structures, platforms, stairs, aeration system, primary collector and secondary collector (if applicable) along with bag filter, target box etc for each unit. Flow diagram of Fly ash handling system	In the flow diagram, all 6 hoppers are indicated as working buffer hoppers. NTPC to clarify	Bidder to refer Amendment of the clause & respective Flow diagram. Amendment No : A-MH-24
93	VI/PART-A	IIA-16	7 of 18	1.01.06, B),(ii)	Twelve (12) nos. Mechanical vacuum pumps each unit. Seal water from the vacuum pumps shall be collected in the ESP area pit/sump.	The disposal of vacuum pump seal water from the pit is not clear. NTPC to clarify	Disposal of Vacuum pumps seal water to be collected to a dedicated Pit, from there disposal to be recycled through Settling & surge tank.
94	VI/PART-A	IIA-16	8 of 18	1.01.06,C),(vi)	Two (2) nos. aeration blowers along with drive motor for each unit, one (1) working and one (1) standby, for aeration of buffer hoppers, each complete with dedicated heaters, valves, insulated pipelines with sliding supports, supporting steel structure, aeration pads, silencer, filters and all other accessories as specified and as required.	Bidder understands that aeration blowers is envisaged only for buffer hopper.	Bidder to envisage aeration arrangement to cover total aeration requirement of the complete Ash Handling system and accordingly, bidder to provide aeration blowers.
95	VI/PART-A	IIA-16	13 of 18	1.02.01.02, (e) 4540-001-POM-A-025	The water requirement for disposal of fly ash in slurry form shall be met by one (1) number working and one (1) number standby fly ash water pumps. As per flow diagram, 2W+1S Fly ash water pumps is envisaged	The no. of pumps specified in these two clauses is different. NTPC to clarify.	Bidder to refer Amendment of the clause. Amendment No : A-MH-23
96	SEC-VI/PART-B	D-1-5(Civil WORKS)	103/120	5.23.15	Space frame structure for stock pile area shall cover the complete stock pile.	Since the span of coal stock pile is very high we understand that intermediate column inside shed can also be provided. Kindly confirm.	Intermediate columns are not allowed.

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97	SEC-VI/PART-B	D-1-5(Civil WORKS)	103/120	5.23.15	The structure shall have a suitable arrangement for fixing of solar panel over its surface.	We request to remove item of providing solar panel over shed .Since it will be very difficult to bend the solar panels according to shed profile and also providing solar panel will increase the weight of shed exhorbitatntly.	Technical specs to be followed.
98	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 23 OF 73	g) Coal Handling plant, Limestone handling plant, Gypsum handling plant	Total power consumption for all the equipment including auxiliaries with single stream operation at its guaranteed capacity for: i. Coal flow path IA (Direct stream), as per clause no 1.03.07.03.1 (i) and one no. stacker reclaimr, one no of yard conveyor (maximum of stacking / reclaiming modes) and four (4) nos. paddle feeders.	We understand only 2 Nos of Paddle feeders to be consid-ered for Power consumption, which are already included in the direct stream itself.	Four nos. Paddle Feeder to be considered as per requirement of technical specification. Bidder to comply.
99		4540-001-POM-A-040 (OPTION-01) Rev A		4540-001-POM-A-040 (OPTION-01) Rev A		We understand Rated/ Guaranteed / design of belt feeders in crusher house shall match with the Rated/ Guaranteed / Design capacities of Ring Granulator Crusher.	Bidders' understanding is correct.
100	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2	SUB-SECTION-IV FUNCTION-AL GUARAN-TEES	PAGE 33 OF 73	1.03.7.02.1 GUARANTEES (iii) Limestone unloading stream	Bidder shall also demonstrate the guaranteed tipping rate of Truck Tipplers	1.Tippling Rate is not defined in the specifications. Only Unloading Time of 3-4 min is defined which is practically not possible. This clause of tippling rate may pl. be deleted from NIT spec. Truck tippler will be provided meeting the outgoing conveyor requirement of 150 TPH Rated. Kindly give a line of confirmation for same. 2.Customer to also confirm the Truck Model, Type & No of Wheler Truck to be considered for truck tip-pler.	1. Tippling rate with each type of Trucks (as provided by the employer) and/or any combination of truck of net capacity 40 tonne and below shall be 160 TPH (minimum). 2. For Model of Truck Tippler, bidder to follow as provided in latest Lot FGD Projects.
101	TECHNICAL SPECIFICA-TIONS SECTION-VI, PART B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	Page 20 of 101	4.11.10	Potable water connections are to be provided in all transfer points, wagon tippler top (if applicable), crusher house, all tripper floors, and all con-trol rooms/MCC rooms and toilets etc. Water shall be drawn from the water storage tank by electric motor driven pumps and discharged via a pipe work system to the overhead drinking water stor-age PVC tanks of 250 litres capacities. The drink-ing water storage tanks shall have provision for maintenance & drain.	We understand 250 L of water tank only to be considered for TPs/ Building in CHP/LHP/GHP region for drinking wa-ter. Accordingly pump for the Potable water shall be sized considering 1 Hr (One Hour) of Operation for filling of these drinking water tanks.	Hour of operation for sizing shall be decided during detail engineering. Bidder may refer latest executed projects in this context.

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102	TECHNICAL SPECIFICATION SECTION-VI, PART A BID DOC.NO.:CS-4540-001A-2	SUB-SECTION-IIA-15 COAL HANDLING PLANT	PAGE 5 OF 7	1.31.00	d. Water Pump houses & water tanks for dust suppression/ extraction, service water, cooling water and potable water system.	We understand Tank at pump house will be of 0.5 Hour (Half Hour) storage capacities.	Tank capacity shall be decided during detail engineering.
103	TECHNICAL SPECIFICATIONS SECTION-VI, PART B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	Page 80 of 101	2.01.02 Dust Control System	d) Track Hopper Dust Suppression System (Plain water type) (3) No. of dust suppression nozzles that can be operated simultaneously on both side of Hopper : min. one zone or four (4) such zones (one zone means 20 mtr. Length of header on both sides)	We understand 4 Zones to be considered.	For better clarity , Bidder to refer Amendment of the Clause. Amendment No : A-MH-15

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
104	VI /PART B	A-08	4 OF 19	1.07.00	SPECIFICATION FOR PIPES & FITTINGS: Construction of Alloy steel fittings -Seamless	Construction of alloy steel TEE's may also be allowed from seamless forged components in line with spherical wye piece. NTPC to confirm	Bidder's Proposal is not acceptable. Bidder to consider seamless fittings as per Technical specification requirements.
105	VI /PART B	A-08	11 OF 19	1.12.00(2)	Bend thinning allowance shall be provided for all bends as per the recommendations of ASME B 31.1. However, bidder/contractor shall ensure that the minimum wall thickness at any point in the finished bend shall not be less than the calculated minimum straight pipe wall thickness.	Bend thickness for the various portion of the bends (Extrados, Intrados and straight) shall be as per ASME CI 102.4.5 and latest IBR regulation. NTPC to confirm	Bidder's Proposal is not acceptable. Bidder to follow the Technical specification requirements.
106	VI /PART B	A-08	14 OF 19	2.07.00	SPECIFIC REQUIREMENTS: HANGERS & SUPPORTS Each rod of a double rod hanger support shall be designed for the full hydro test load coming on the double rod hanger assembly.	Bidder understand that each rod of a double rod hanger support shall be designed for operating load coming on the double rod hanger assembly. NTPC to confirm.	Bidder's Proposal is not acceptable. Bidder to follow the Technical specification requirements.
107	Part III	SUB-SECTION –E-05	32 / 618	cl.1 – pipes	100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.	Hydro test of the complete system shall be done after erection at Site. Pipes are procured with suitable NDT (RT/UT). Hydro test not envisaged. NTPC to confirm.	Hydro test of the complete system shall be done after erection at Site. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.
108	Part III	SUB-SECTION–E-60	267 / 618 296 / 618	2 33	Seamless Pipes & Fittings	Bidder proposes to follow Bidder approved sources. NTPC to confirm.	Bidder to meet the specification requirements.
109	Part III	SUB-SECTION–E-60	339 / 618	4	PIPES-MS- (BLACK/ GI) AS PER IS:3589 >1000NB	Bidder proposes to follow Bidder approved sources. NTPC to confirm.	Bidder to meet the specification requirements.
110	Part III	SUB-SECTION–E-60	353 / 618	4	PIPES-MS- (BLACK/ GI) AS PER IS:1239 & IS:3589 UPTO 1000 NB	Bidder proposes to follow Bidder approved sources. NTPC to confirm.	Bidder to meet the specification requirements.

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
111	SECTION – VI, PART-B	SUB-SECTION-A-05(FGD)	2 of 28	1.03.08	In case of a power failure all items of equipment (e.g. minimum one agitator in absorber and limestone slurry tank, Process water pump & lube oil system of Booster Fan & Ball Mill) which may cause irreversible damage to the FGD System shall be connected to the emergency power supply system to be provided by the Contractor. Bidder shall furnish a list of all such Auxiliaries in their bid proposal.	Agitators are not required to be connected to Emergency power supply as per proven practice being followed by collaborator. Equipment needing emergency power connection shall be decided based on process requirement and the recommendations of the collaborator & OEM for different equipment. Please accept.	Bidder to comply the specifications requirements.
112	SECTION – VI, PART-B	SUB-SECTION-A-05(FGD)	22of 28	11.04.00 & 11.05.0	All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion. The material for the shaft (which is continuously in contact with slurry) and agitator blades of the Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades shall be made with Alloy 926 or better material & shaft can be rubber lined. This does not release the Contractor of the responsibility for selecting the correct materials.	Please also accept that for agitators in other tanks, agitator blades shall be made with carbon steel rubber lined as per collaborator proven experience.	Bidder to comply the specifications requirements.
113	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	113 OF 120	5.27.00	FIRE STATION BUILDING Salient Features The Fire Station Building shall be a RCC framed superstructure. The building shall be designed as per the latest guidelines of IS:456, IS 1893 & IS 13920(for seismic ductility requirement). Architectural Features It shall be of RCC Frame structure & Brick masonry. The building shall be provided with area 600 sq. m required to accommodate Fire tenders and fire per-sonnel including Dy./Asst. Commandant's (Fire) of-fice. The number of fire tenders shall be provided as per CISF norms. The number of fire tenders/equipment shall be pro-vided as given in elsewhere in speciation. One drill tower per station shall be provided. Facilities for the staff including Kitchen, Dining Hall, Rest Rooms, Stores, First Aid Room shall be provided as applicable.	Customer Civil specification calls for Fire Station Building along with supply of Fire tenders. However, the requirement of fire tender is not specified in the Mechanical specification SECTION-VI, PART-A, Sub-Section IIA - SCOPE OF SUPPLY & SERVICES, SUB SECTION-A-18 Fire Detection & Protection System. Nether the same is mentioned under TERMINAL POINTS & EXCLUSIONS chapter. Customer is requested to confirm the follow-ing: - 1. Requirement of Fire Tender – Quantity and type and applicable IS standard. Also furnish CISF specification as mentioned. 2. Requirement of Fire Jeep. 3. Requirement of Fire safety equipment. In case, the fire tenders are not applicable. Customer is requested to confirm the re-quirement of Fire Station Building along with drill tower.	Fire tender and fire station equipments are not envisaged in subject package.
114					GENERAL	In case the fire tenders are applicable for the project, please confirm the requirement of registration of these Fire tenders. Bidder understands temporary registration is in bidder's scope while permanent registration of these tenders is in customer's scope and excluded from bidder's scope. Pls. confirm,	Fire tender and fire station equipments are not envisaged in subject package.
115					GENERAL	In case of applicability of fire tenders, please confirms scope of insurance of these fire ten-ders. Bidder shall consider transit insurance and first year insurance only in their scope. Pls. confirm,	Fire tender and fire station equipments are not envisaged in subject package.
116					GENERAL	In case of applicability of fire tenders, please confirm the schedule of supply & handover of these fire tenders at Site.	Fire tender and fire station equipments are not envisaged in subject package.

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117	SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	15,16 OF 114	8.03.04 (a) (iv)	Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model..... Further, two Licenses of the used 3D Modelling Software (One for Engineer-ing View and One for Site View) shall be provided along with compatible Hardware for possible review and study of the Model Files being submitted by the Bidder Time to time.	Bidder understands that 2 nos. licenses of 3D Modelling Review software are to be supplied along with compatible Hardware for possible review and study of the Model Files. Please confirm.	Bidder understanding is not correct . The requirement of software is not only for viewing but also editing .Further, as per specification bidder has to also furnish model of this project in line specification requirement, so that the same can be viewed and edited for any future use of owner.
118	SECTION – VI, PART-A	SUB SECTION IIA-11	2 of 4	1.03.00 (1)	3X50% for TG and 2 X100% for SG Primary (DM) cooling water pumps of required capacity and head	We request option for common TG & SG circuit for each unit shall also be given. Accordingly, 3X50 % common DMCW pumps for each unit & 3X50% common PHEs for each unit may be provided as an option. Please	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
119	SECTION – VI, PART-A	SUB SECTION IIA-11	2 of 4	1.03.00 (3)	3X 50% for TG and 2 X 100% for SG Plate Heat Exchangers		
120	SECTION-VI, PART-B	SUB SECTION-A-01	56 of 101	3.02.00 (c)	CW Pumps Flow per Unit + 10% margin	It is proposed to provide separate cooling tower (IDCT) for cooling of ACW system common for both units. This will ensure time-ly completion of ACW and DMCW System before the Boiler Light-up milestone. It will also provide operational flexibility during normal operation as CW pumps will not be required to operate for running of ACW Sys-tem. Make up to this ACW IDCT may be envis-aged from PT-DM System. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
121	SECTION-VI, PART-B	SUB SECTION-A-01	57 of 101	3.03.00 (3-C)	Secondary water outlet temperature: Not more than the design hot water temperature at condenser outlet	Please note the heat load of ACW system and Heat load of condenser cooling system are added for design of cooling tower hence limiting the temperature rise of ACW does not serve any benefit. Further, please refer above query, wherein separate cooling tower is proposed for ACW System. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
122	SECTION-VI, PART-B	SUB SECTION-A-01	56 of 101	3.03.00 (1-b)	b. For SG ECW system- Design flow required for all SG auxiliaries + other Station Auxiliaries (Air compressors, Mill reject, Ash Handling compressors, FGD & SCR system, any other system envisaged by the bidder)	It is proposed to provide separate DMCW circuit for cooling of station aux's coolers (viz. Air compressors, Mill reject, Ash Handling compressors, FGD & SCR system) with 3x50% DMCW Pumps and 3x50 % PHEs for Station Aux's shall be provided. Alternatively, please provide an option to cool the station aux's from TG-ECW System also in addition to SG-ECW System. Please Confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
123	SECTION – VI, PART-B	SUB SECTION A-15	3 of 31	1.02.00 (14)	CFD modelling: The Contractor shall engage developer of CFD code (which is proposed to be used for CFD modeling) CFD model to establish validation of CFD results shall be carried out.	Physical sump model study for CW pump house is applicable as per specification. Any improvements/ rectification of CW sump etc is worked out based on physical sump model study only hence CFD analysis is not required. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
124	SECTION-VI, PART-B	SUB SECTION-A-01	58 of 101	3.03.00 (5)	Overhead ECW (DM water) tank (separate for TG ECW system and SG ECW system): 1 X 10 cum (min.) (at 60% of the tank height)	One number DMCW overhead tank of capacity 10 Cub. M. (at 60% of the tank height, common for TG & SG circuit) for each unit shall be provided in line with earlier executed projects of customer. Which means total 2 nos. DMCW overhead tanks (of capacity 10 Cub.M.) shall be provided for station. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.

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125	SECTION – VI, PART-F	CHAPTER -01	30 of 38	4.00.00 (B)	Mandatory spares for Plate Type Heat Exchangers: Gaskets - 1 Lot comprising 30% of total requirement of each type & size Fasteners - 1 Lot comprising 10% each type Plates - 1 Lot comprising 20% of each type	Please clarify the following: - 1. Different qty of mandatory spares of PHEs is indicated at two different clauses. Please confirm which is to be considered.	It is clarified that bidder to provide mandatory Spares for Plate Type Heat Exchangers of TG ECW & SG ECW in line with Clause No. 14) b) of Chapter-08,Part-A.
126	SECTION – VI, PART-B	CHAPTER-08	6 of 27	1.00.00 (14-b)	Mandatory spares for Plate Type Heat Exchangers: Plate Gaskets: 150 nos each for TG ECW & SG ECW Fasteners: 01 Set for each TG ECW & SG ECW Plates: 150 nos (main plates) + 2 nos of end plates for each TG ECW & SG ECW Note: One (1) set consists of quantity required for complete replacement for one (1) PHE of each type & size	2. We understand that the % of gaskets, fasteners and plates are for one no PHE. 3. Spares for fasteners includes only nuts and bolts required for the PHE (tie rods are not included under fasteners).	
127	SECTION – VI, PART-F	CHAPTER -02	3 of 31	16 (B)	ACW Pumps and DMCW Pumps motor with motor bearing: 1 no motor of each type and 1 Set brg of each type	Mandatory spares for ACW and DMCW motors are indicated at two different clauses. Please clarify which one to be considered.	It is clarified that bidder to provide mandatory Spares for ACW & DMCW motors in line with Clause No. 14) C) of Chapter-08,Part-A.
128	SECTION – VI, PART-F	CHAPTER -08	6 of 27	14 (C)	DMCW & ACW Pumps motor with motor bearing: 1 no motor including its bearing and 1 additional set bearings of each type & size		
129	SECTION-VI, PART-B	SUB SECTION-A-01	55 of 101	3.01.00 (e)	Total Head of the CW pump at rated flow: Sum of static lift from minimum water level in CW pump house sump up to the centerline elevation of hot water distribution header at Cooling Tower + 110% of friction drop in the entire CW system + pressure drop across Condenser with 2 mWC margin (minimum).	Please note high margins in the CW Pump head is not conducive for satisfactory CW system operation, as due to this CW Pump will not operate at the duty point. Customer may please note that there is already a margin of 1 MWC in the form of difference of min water level and max water level in the CW sump. Further, there is margin of 10% for friction loss, which is also approx 0.5 MWC. Therefore, enough margins are already available in the CW Pump head. Hence, Customer may please review the additional requirement of 2 MWC margin on the CWP head.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
130	-	-	-	-	CW System piping	As per feedback received from various NTPC and non-NTPC sites, provision of Debris filter in the CW line at the inlet of condenser is beneficial for CW system operation. Hence, it is requested to kindly add the Debris filter at the CW inlet line to condenser (total 4 nos. for station) in the scope of this tender and provide the technical specification for same.	Debris filter in CW line has not been envisaged in the specification. Bidder to comply the technical specification requirement.
131	SECTION- VI, PART - B	SUB SECTION- G-04	91 & 92 of 224	STANDARD PG TEST PROCEDURE - COLTCS	Cl no 1.0: The test of COLTCS shall be carried out at site immediately after commissioning & 2 weeks of trial operation of the system. The test shall be conducted with intermittent operation of COLTCS for 24 hours operation per day. Cl no 3 (Last para): The guarantee of Nos. of balls lost during 1000 hours of plant operation shall be deemed to be fulfilled in case of number of balls lost observed in total 6 weeks (42 days ,24 * 7, i.e.1000 hours) operation is within guarantee condition (B).	Please note normally the COLTCS runs for 8 hrs in a day of Plant operation and that the life of sponge rubber balls will not sustain for 3 weeks while continuously running COLTCS 24 hrs per day. In order to meet the PG test condition of 1000 hrs of plant operation, PG test shall be conducted by running COLTCS continuously for 24 hrs per day for 14 days (7 days for ball life + 7 additional days for ball recovery). This will achieve the required condition. Hence, the PG test of COLTCS shall be completed in 14 days instead of 42 days. Kindly confirm.	Bidder proposal is not acceptable. Bidder to comply specification requirement.

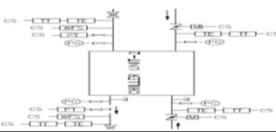
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132	SECTION – VI , PART-A	SUB-SECTION-A-12 PLANT UTILITIES	1 OF 12	1.00.00 b)	Centralized air-conditioning system for main plant TG building There shall be one (1) central chilled water type air-conditioning plant comprising of screw chilling units, chilled water pumps, condenser water pumps, AHUs, cooling towers, etc. to cater to the A/C re-quirement of the areas identified for main plant are-as like common control rooms, control equipment rooms, UPS/Battery charger rooms, static excitation control rooms (if applica-ble), SWAS room, water analysis lab, etc. of Unit # 1 and Unit # 2.	Following type of AC is being proposed for static excitation control rooms (if applicable), SWAS room, water analysis lab, etc. of Unit # 1 and Unit # 2 : 1) sStatic excitation control rooms (if applicable) – Since static excitation panel room is located towards A row side of power house, customer is requested to ac-cept dedicated Split AC/ Ductable split AC/ Package AC based on actual cooling requirement for static excitation control rooms (if applicable) as routing chilled wa-ter pipe towards A row of power house from Control tower (Location of AC plant) crossing the C-D-E-F bay is not feasible. 2) SWAS room, water analysis lab, etc. – if area like SWAS room, water analysis lab, etc. located such that it may not be feasible to route AC duct, Air conditioning of such areas may please accepted with dedicated FCU (fan coil unit) with at least one (1) no. unit, capacity same as each working unit Please confirm.	In view of high CFM requirements, dedicated AHUs have been envisaged for static excitation control rooms (if applicable). Routing of chilled water piping shall be finalized during detailed engineering. Bidder to comply with specification requirement.
133	SECTION-VI, PART-B	SUB SECTION-A-17 AIR CON-DITION-ING AND VENTILA-TION SYS-TEM	PAGE 1 OF 30	3.01.00 a)	Redundancy of various A/C system equipments shall be as follows: a) For Main Plant Areas [control room, control equipment room, UPS room, battery charger, static excitation control room (if applicable) SWAS room & water analysis lab] for Unit 1 & 2: i) Vapor compression type water chilling units: 3X50% ii) Chilled water pumps: 3X50% iii) Condenser water pumps: 3X50% iv) Cooling Towers: 3X50% v) AHUs: At least one (1) no. unit, capacity same as each working unit shall be provided as common standby.	F bay is not feasible. 2) SWAS room, water analysis lab, etc. – if area like SWAS room, water analysis lab, etc. located such that it may not be feasible to route AC duct, Air conditioning of such areas may please accepted with dedicated FCU (fan coil unit) with at least one (1) no. unit, capacity same as each working unit Please confirm.	Dedicated AHUs may be provided by the Bidder for SWAS Room, Water Analysis Lab, etc. to avoid A/C duct routing for long distance. Bidder to comply with specification requirement.
134	SECTION – VI , PART-A	SUB-SECTION-A-12 PLANT UTILITIES	1 OF 12	1.00.00 c)	Centralized air-conditioning system for Ash handling control room, ESP control room buildings and FGD control room building	Control room/VFD area of AHP, FGD and ESP of unit 1 and Unit 2 are generally far away from each other with small cooling re-quirement in AHP area (8 to 10 TR) and to pump the chilled water for such a small load is not feasible/workable/economical. This is-sue has been encountered in other NTPC projects also. In view of above, it is proposed to provide dedicated Air-cooled condensing unit with DX AHU/ Air cooled Package AC (based on design philosophy mentioned in tender speci-fication clause no. 3.13.01 17) SECTION-VI, PART-B, SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA, PAGE 78 OF 101 for Ash handling control	In Talcher-III, layout is compact and ESP control rooms, FGD control room(s) & AHP control room are in the vicinity of each other, accordingly one centralized A/C system have been envisaged for above buildings. Bidder to comply with specification requirement.
135	SECTION-VI, PART-B	SUB SECTION-A-17 AIR CON-DITION-ING AND VENTILA-TION SYS-TEM	PAGE 1 OF 30	3.01.00 b)	For ESP control rooms, FGD control room, AHP control room, etc. of Unit # 1 & 2: i) Vapour compression type water cooled chiller units: 3X50% ii) Chilled water pumps: 3X50%. iii) Condenser water pumps: 3X50%. iv) Cooling Towers: 3X50%. v) AHUs: 2x100% AHUs for each control room of ESP/FGD/AHP Building.	Since these are Green building, fresh air shall be provided as per ASHRAE 62.1 2010 for Green building. Please confirm.	Fresh air requirement as specified in referred guidelines is the minimum requirement. Bidder to comply with specification requirement.
136	SECTION-VI, PART-B	SUB-SECTION-A-01 EQUIP-MENT SIZ-ING CRITERIA	77 OF 101	3.13.01 4)	However, for areas like service building, administrative building, canteen, etc. quantity of fresh air shall be minimum 1.5 air changes per hour.	For Green building like service building, administrative building, canteen, lighting load shall be considered as per ECBC. Please confirm.	Bidder to comply with specification requirement.
137	SECTION – VI , PART-B	SUB-SECTION-A-01 EQUIP-MENT SIZ-ING CRITERIA	77 OF 101	3.13.01 5)	Lighting load shall be one (1) Watts/Sq. Feet or actual whichever is higher.	Requirement of VVVF in all chilled water pumps of green building are in contradiction with respect to VVVF drive for chilled wa-ter pump. We understand that only secondary chilled water	Bidder's understanding is correct that only secondary chilled water pumps shall be provided with VVVF and primary chilled water pumps shall be without VVVF.
138	SECTION – VI , PART-B	SUB-SECTION-A-01 EQUIP-MENT SIZ-ING CRITERIA	78 OF 101	3.13.01 19.1	Pumping System: Chilled water pumping system should be of variable flow type i.e. pumps should be VVVF driven.		

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139	SECTION-VI, PART-B	SUB SECTION-A-17 AIR CON-DITION-ING AND VENTILA-TION SYS-TEM	PAGE 1 OF 30	3.01.00 c)	c) Service Building: i) Screw type water chilling units: 2X50% ii) Primary Chilled water pumps: 2X50% iii) Secondary chilled water pumps (with VVVFD): 2X50% iv) Condenser water pumps: 2X50% v) Cooling Towers (with VVVFD Fan): 2X50% vi) AHUs (with VVVFD Fan): All working & no standby d) Administrative Building: i) Screw type water chilling units: 2X50% ii) Primary Chilled water pumps: 2X50% iii) Secondary chilled water pumps (with VVVFD): 2X50% iv) Condenser water pumps: 2X50% v) Cooling Towers (with VVVFD Fan): 2X50%	pumps of Service building and Admin. Building shall be provided with VVVFD. Primary Chilled water pump of Service build-ing, primary chilled water pump of Admin building shall be provided without VVVFD. Please confirm.	
140	SECTION-VI, PART-B	SUB-SECTION-A-01 EQUIP-MENT SIZ-ING CRITERIA	80 OF 101	3.13.02 3)	Fan envisaged for MCC & Switchgear rooms shall be provided with pre-filters and fine filters and for other areas shall be provided with pre-filter only	We understand that filters are not applicable for exhaust fans. Please confirm.	Bidder's understanding is correct that filters are not applicable for exhaust fans.
141	SECTION-VI, PART-B	SUB SECTION-A-17 AIR CON-DITION-ING AND VENTILA-TION SYS-TEM	PAGE 1 OF 30	3.01.00 d)	Administrative Building: i) Screw type water chilling units: 2X50% ii) Primary Chilled water pumps: 2X50% iii) Secondary chilled water pumps (with VVVFD): 2X50% iv) Condenser water pumps: 2X50% v) Cooling Towers (with VVVFD Fan): 2X50%	Nothing has been mentioned for configuration of AHU in Administrative building in referred clause. We understand that AHU for Administrative building shall be provided in line with Service building (AHUs with VVVFD Fan): All working & no standby). Please confirm.	Bidder's understanding is correct. Further, Bidder to refer amendment in this regard. Amendment No : A-PU-6
142	SECTION-VI, PART-B	SUB SEC-TION-A-17 AIR CON-DITION-ING AND VENTILA-TION SYS-TEM	PAGE 2 OF 30	4.02.00	Chilling Unit Type: Water-cooled type. (Chillers for main plant shall be with multiple compressors)	Individual Capacity of chiller estimated for this project is below 200 TR and only Blue Star is Indian manufacturer which can provide chiller with multiple compressors. In view of single vendor, chiller of main plant may please be accepted with single compressor also. Please confirm.	Bidder to refer amendment in this regard. Amendment No : A-PU-7
143	SECTION-VI, PART-B	SUB SECTION-A-17 AIR CON-DITIONING AND VENTILATION SYSTEM	PAGE 8 OF 30	5.02.02	Unitary Air Filtration The housing/ casing of air washer unit shall be dou-ble skin construction.	We understand that air washer referred in mentioned clause shall be read as UAF. Please confirm.	Bidder's understanding is correct.
144	SECTION-VI, PART-B	SUB SECTION-A-17	PAGE 10 OF 30	6.01.00	CENTRIFUGAL PUMPS a) Type : Horizontal Centrifugal, Axially split type casing pump End suction, top dis-charge horizontal cen-trifugal pump may be provided for modular air washer units & UAF unit.	We understand that casing of all pumps shall be Axially Split (Horizontal split casing). However, End suction, top discharge pumps is also acceptable for modular air washer units & UAF unit. Please confirm.	As specified type of centrifugal pumps shall be horizontal centrifugal, axially split type casing pump. Further, end suction, top dis-charge horizontal centrifugal pump may be provided for modular air washer units & UAF unit.
145	SECTION-VI, PART-B	SUB SECTION-A-17	PAGE 26 OF 30	5 b) of Annexure I	Pump casing shall have axially split type construc-tion as specified.		

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146	SECTION-VI, PART-B	SUB-SECTION-E-17 AC AND VENTILATION SYSTEM	Page 1 of 3	1.01.05	Performance test of assembled compressor and Chiller assembly shall be done to check for following : i) No load air run (free run) test of all types of compressor to check FAD (Free air delivery), Noise, Vibration & Temp. rise of bearing & body.	We understand that for Air conditioning system, FAD (Free air delivery) is not applicable for Chiller. Please confirm	Bidder's understanding is correct.
147	SECTION-VI, PART-B	SUB-SECTION-G-04 STANDARD PG TEST PROCEDURE	Page 60 of 224		TECHNICAL REQUIREMENTS TYPICAL STATION AUXILIARY POWER CONSUMPTION INCLUDES FOLLOWING SYSTEMS, • Service Air Compressor • Instrument Air Compressor • Air Conditioning System • Plant Water System • Ash Handling Plant • Coal Handling Plant • Mill Reject System • Fuel Oil System----- Any other auxiliaries envisaged in technical specification Duty factors will be applied for as per the clauses of Functional Guarantee's:	No duty factor has been mentioned in relevant clause of Functional Guarantee's for Air conditioning & ventilation system. Please provide the duty factor for Air conditioning & ventilation system.	Duty factor has been specified. Bidder to refer clause 1.01.07.02 b), Page-22 of 73, Sub-Section-IV (Functional Guarantees), Part-A of Technical Specification.
148	SECTION – VI, PART-E	LIST OF TENDER DRAWINGS	-	Tender drawing number 4540-001-POM-A-054, 4540-001-POM-A-055, 4540-001-POM-A-056 & 4540-001-POM-A-057	Requirement of TE with TT at inlet and outlet line (both chilled water side and condenser water side) for chiller of Main Plant. Service building. Admin building and ESP/FGD control room 	Chiller manufacturer are also providing TE with TT as part of chiller and in such case separate TE with TT is not required and details of TE and TT shall be as per manufacturer standard of chiller. Please confirm.	Bidder proposal is not acceptable. Bidder to comply specification requirement.
149	SECTION – VI, PART-B	SUB-SECTION-IIIC-04	28 OF 34	20.02.00	TEMPERATURE/ HUMIDITY INDICATOR Qty. : 15 nos. each of temperature & Humidity indicators (combined indicators for Humidity and temperature is also applicable).	We understand that Temperature cum humidity indicator with sensor shall be provided inside each AHU room/Package AC room to sense the Temperature and humidity in return air path of Air conditioning system. Hence Total number shall be equal to Total number of AHU rooms and Package AC rooms instead of 15 numbers. Please confirm.	Bidder's understanding is not correct. These Temperature cum humidity indicator are not for control and are not to be installed inside AHU room. For quantity of TS & RH in AHU room refer Part E of technical specification. Bidder to comply specification requirement
150	SECTION-VI, PART-B	D-1-7	6 of 12	7.03.00 xv)	High Strain Dynamic Load Test may be carried out for routine vertical load test of working piles. However, at least three numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.03.00 (ix) shall be total of static routine vertical load test and high strain dynamic load tests.	In case of pile foundation, High Strain Dynamic Load Test is technically not required as routine pile load test and low strain pile integrity test are to be done on job piles. Please confirm.	Bidder can opt for routine vertical load test instead of HSDT
151					Tender Drawing-Layout and details of Raw water reservoir	As per tender drawing no 4540-001-POC-A-007, the net usable capacity requirement is 127500 Cum and area allocated for earthen raw water reservoir as per GLP is 12.5 acre. Top of embankment and bed level is already fixed. The allocated area of 12.5 acre is not sufficient to accommodate the capacity of 127500 Cum. Please increase the area.	Land available is 12.5 acres. Capacity of 127500 cum has to be worked out during detailed engineering.

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152					Tender Drawing-Layout of Drains	As per layout drawings, four drain outfall points are given near Nandri nalla. During site visit, it is observed that there are existing culverts for storm water out fall. We understand that plant storm water drain will be connected to existing culverts. There is not any requirement for new culverts and strengthening of Nandri nalla at out fall locations.	Location of new outfall culvert will be at different location as indicated in layout drawing. New culverts will be required to drain out in Nandira nala.
153	SEC-VI / PART-B	A-01	39 of 101	1.05.22.01	For Borosilicate lining, the top flue liner above the roof slab shall be made of C276 (ASTM B575, UNS N10276) / Titanium (Grade 2 as per ASME SB265) of minimum 8 mm thickness with Borosilicate Glass Block Lining of minimum 38 mm thickness.	For Borosilicate lining, bidder proposes to provide the top flue liner above the roof slab made of mild steel or stainless steel of minimum 8 mm thickness covered with Borosilicate Glass Block Lining of minimum 38 mm thickness. Kindly confirm.	Bidder to comply the specifications requirements.
154	SEC-VI / PART-B	A-01	39 of 101	1.05.22.01	For Titanium/C-276 lining, the top flue liner above the roof slab shall be made of solid C276 (ASTM B575, UNS N10276) / Titanium (Grade 2 as per ASME SB265) of minimum 10 mm thickness.	For Titanium/C-276 lining, bidder proposes to provide the top flue liner above the roof slab made of 1.5 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 (ASTM B575, UNS N10276) alloy over 8 mm thick (minimum) mild steel base metal. Kindly confirm.	Bidder to comply the specifications requirements.
155	SEC-VI / PART-B	A-01	39 of 101	1.05.22.01	For Borosilicate lining, top portion of the flue can shall be fitted with stop bar of 8 mm thick capping of Titanium / C-276 sheet to avoid any damage in between flue can and borosilicate lining. The minimum length of the capping inside the chimney shall be at least equal to 1/4th diameter of flue liner.	For Borosilicate lining, Bidder proposes that external surface and top of chimney flue liner projecting over the chimney roof to be wrapped with 2 mm thick Titanium / C-276 sheet. Kindly confirm.	Bidder to comply the specifications requirements.
156	VI/A	IIA-06	08 OF 10	10.02.00	EOT CRANE FOR BOILER FEED PUMP If BFPs are provided in BC bay or are not accessible to TG hall EOT crane as per layout requirement, one (1) no of Electrically operated (Double Girder) travelling cranes for each unit with associated auxiliaries, along with electrical equipment, control & instrumentation as required and specified shall be provided in the BC bay for erection and maintenance of Boiler feed pump and their auxiliaries. The main hook capacity of each crane shall be 10% over and above the heaviest component/equipment to be handled (including lifting beam, if applicable, and slings etc.) or 25 Tonne whichever is higher. Further the EOT crane shall have necessary facilities such as lifting beam with swivelling arrangement (if applicable) and slings for erection as well as maintenance of the equipment.	As per bidders practice, erection of BFP/Drive Turbine will be done by external crane. EOT shall be provided in the BC bay for maintenance of Boiler feed pump and their auxiliaries with capacity as specified in the tender specification. Kindly confirm. Lifting beam and swivelling arrangement for BFP crane is not required hence not being considered. Kindly confirm.	Bidder understnading is not correct. BFP EOT crane may also be needed for erection/handling of BFP/drive turbine in future. Bidder to comply specification requirement. If applicable is already mentioned regarding lifting beam and swivelling arrangement in the reffered clause.
157	VI/A	IIA-19	01 OF 02	2.01.00	Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendors for the various equipment/areas. Some of the areas/equipment not covered by TG hall EOT crane are indicated below. For balance areas/equipment, not listed herein, the requirements of Technical Specification shall be followed. (a) Feed water heaters & deaerator. (b) Various pumps & Heat Exchangers. (c) Fans, motors, gear boxes etc., of Main Condenser, vacuum pumps, control fluid room etc. (d) Auxiliary cooling water pumps and DM cooling water pumps of ECW systems and Plate heat exchangers. (e) Central lube oil system room. (f) Any other equipment. The above requirement is indicative only; the requirement given in the respective chapter is to be adhered to.	a) As per bidders practice, Heaters are handled by TG Hall EOT in AB Bay & then dragged to their locations. As such, no separate EOT/Hoist is required. In addition, one time erection of De-aerator is done by mobile crane from CD Bay. As such, no separate EOT Crane /Hoist is required. f) There is no other major equipment. Hence, no other EOT/Hoist is being envisaged.	EOT crane is not envisaged for Feed water heaters & deaerator. However, applicable Hoists/Chain pully block for general maintenance purpose shall be provided. Bidder to please also refer Section VI Part-B Sub section A-24 Clause no 2.01.00 of page 6 of 6.

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158	VI/B	A-13	04 OF 08	2.01.00	Note (1) : For piping systems with operating temp>=500 deg. C first layer of insulation shall be at least 75mm of ceramic fiber insulation followed by subsequent layer of LBM..	As per market availability single layer of 75 mm thickness of Ceramic Fiber is not available. Hence Two Layers of ceramic fiber with combined thickness 75mm will be provided. Kindly confirm	Bidder to please refer the Clause 1.00.0 (b) (ii) in Pg 2 of 8 of Sub Section A 13 of Part B, where it has been mentioned as "Insulation mattress/section shall be supplied in thickness of 25, 40, 50, 60, 65 and 75 mm. Insulation of higher thickness shall be made up in multiple layers using mattress/slabs of thickness specified above."
159	VI/E	--	01 OF 08	--	List of Tender Drawings	Bidder understands that there are no TG Building layout drawings in the bid and bidder is free to decide TG Building size, floor levels and pitching. Kindly confirm	Bidder's understanding is correct.
160	VI/E	--	--	--	4540-999-POC-F-001 (GLP)	Bidder understands that Customer will dis-mantle existing piping coming in corridor proposed for new raw-water pump discharge piping. Bidder will use the same corridor for laying new raw water pipes. Kindly confirm	Dismantling is in EPC Scope of work. Bidder to also refer Amendment no. D1-4
161	VI/A	II-A-24	2 of 17	Annexure-I S. No.	Vertical Turret Lathe- Main motor spec. 42 Kw, 40 HP, 415 V, 3 Phase. AC.	Customer to note that there is contradiction in motor rating, we have considered main motor rating as 40 HP in place of 42 kW. Kindly confirm acceptance.	Refer amendment in this regard. (Amendment No : A-TG-11)
162	VI/A	II-A-24	2 to 4 of 17	Annexure-I	Make of the machines	Customer to note that only one make for machines have been mentioned in the specification. However, it is not possible to place order on a single vendor. Hence for additional sub vendors approval for various equipment, bidder shall approach customer separately during contract stage. Kindly confirm acceptance.	Please refer Clause no 2.00.00 Part-C of technical specification in this regard.
163	VI/A	II-A-24	5 of 17	Annexure-II S. No. 8	Gas cutting and heating equipment - Quantity LOT	Customer to note that size or capacity of the Gas cutting and heating equipment is not specified. We have considered Gas cutting and heating equipment quantity as one and specification as Welding capacity (Mild Steel)-25 mm (Max.), Cutting (Mild Steel)-150 mm (Max.) in line with earlier executed projects. Customer to confirm.	Shall be decided during detail engineering
164	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 1	Digital Radiography	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-01
165	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 2	Radiation Survey Meter	Customer to note that size or capacity of the radiation survey meter is not specified. We have considered radiation survey meter specification Gama & X ray radiation detection, minimum radiation detection 0.1mR/hr and maximum radiation detection 5 R/hr in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-02
166	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 3	Radiography film viewer	Customer to note that size or capacity of the Radiography film viewer is not specified. We have considered Radiography film viewer specification as Density upto 4.5, film size 10 X 4 Inch in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-03

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167	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 4	Personal digital dosimeter	Customer to note that size or capacity of the Personal digital dosimeter is not specified. We have considered Personal digital dosimeter specification as Digital hand-held dose & dose rate meter, Gama & X ray radiation detection, minimum radiation detection 0.1mR/h and 1.0µSv/h and maximum radiation detection 5 R/h and 50 mSv/h in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-04
168	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 5	Radiography film Densitometer	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-05
169	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 6	Radiography film Samples (ASME)	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-06
170	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 7	Computed Radiography Scanner	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-07
171	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 8	Ultrasonic testing machine -Conventional with Probes and calibration blocks	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-08
172	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 9	Ultrasonic testing machine -PAUT with scanner, Probes and calibration blocks	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-09
173	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 10	ToFD Equipment for weld inspection	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-10
174	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 11	Magnetic Particle Inspection-Yoke Type	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-11
175	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 12	Magnetic Particle Inspection-Coil Type with cables	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-12
176	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 13	Pie Gauge for MPI	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-13
177	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 14	Gaussmeter for MPI	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-14
178	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 15	Ni-Cr Panel for DPT	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-15
179	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 16	UV lamp for Fluorescent MPI & DPT	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-16
180	VI/A	II-A-24	13 of 17	Annexure III S. No. A) 17	Remote Field Eddy current testing/Advance Electromagnetic testing	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-17
181	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 1	Hardness Tester (Rebound Type)	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-18
182	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 2	Hardness Tester (UCI Method)	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-19

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183	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 3	Ultrasonic Thickness Meter (D-Meter-Digital)	Customer to note that size or capacity of the D-Meter-Digital is not specified. We have considered D-Meter-Digital (ultrasonic Thickness gauge) specification as Ultrasonic thickness gauge machine having range 1 mm to 199.9 mm thickness range depends on material, transducer type, surface condition and component temperature, testing method Pulse echo, Material metal and non-metals. in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-20
184	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 6	Outside Micrometer	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-21
185	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 9	Helium Leak Detector	Customer to note that size or capacity of the Helium Leak Detector is not specified. We have considered Helium Leak Detector specification as Leakage rate varies from 1.0 X 10 ⁻² to 1.0 X 10 ⁻⁵ mbar lit/sec, Temperature of dry air at out let of Vacuum pump around 49.0 deg C in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-22
186	VI/A	II-A-24	13 of 17	Annexure III S. No. B) 10	Ultimate Tensile Testing machine (UTM)	Customer to note that size or capacity of the Ultimate Tensile Testing machine (UTM) is not specified. We have considered Ultimate Tensile Testing machine (UTM) specification as Range 10 Ton, Least Count 0.001 ton, Speed Variable 1 to 10 MM/Min, Digital UTM with PC and Printer facility, Test Facility available with machine Tensile, Elongation, Compression, Yield Point, Elastic Limit, Ultimate strength etc. in line with earlier executed projects. Customer to confirm.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-23
187	VI/A	II-A-24	13 & 14 of 17	Annexure III S. No. B) 11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,30,31,35	Paint thickness Meter (Elcometer)-Ultrasonic digital, Paint adhesion testing kit, Hardness tester (TIV-Through Indentation viewing), ABI(Automated Ball Indentation) Tester for Mechanical properties (TS,YS, Hardness, Fracture toughness), Ultrasonic Tensile tester, Oxide measurement for Boiler tubes, Exfoliation Meter for SS tubes, Thermography camera, Holiday Detector, Engineering stethoscope, Portable Vibration Meter, Comparator, Surface roughness meter, Spirit level, Noise level meter, Torque wrench, Digital Techometer (Non-contact type), Digital Techometer (Contact Type)	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-24
188	VI/A	II-A-24	14 of 17	Annexure III S. No. C) 1,2,3,4,5	Replica kit for in-situ Metallography, Optical microscope for replica interpretation, Sample preparation tools / machines (Cutting, grinding & Polishing), Internal oxide scale measuring system with Probe (UT based), In-situ Metallography kit- Grinder and polisher with accessories	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-25
189	VI/A	II-A-24	14 of 17	Annexure III S. No. D) 1,2,3,4,5	Videoscope / Boreoscope for Boiler tube, Header Inspection, Binoculars, Laser alignment Kit with target kit, Video images cope with measuring facility, Magnifying glass	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-26
190	VI/A	II-A-24	14 of 17	Annexure III S. No. E) 1,2,3,4,5,6,7	Welding Simulator, MCF (Magnetic Stauroscope) for assessment of quality of PWHT, Argon Purity tester, Inspector Kit for Welding Inspection, SMAW Equipment, GTAW Equipment	Customer is requested to please furnish detail technical specification of the equipment.	Refer amendment in the relevant sections of technical specification. Refer Amendment No : E-27

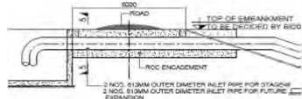
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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
191	SECTION-VI, PART-A	SUB-SEC-TION-IIB ELEC-TRICAL SYSTEM / EQUIP-MENTS	4 OF 17	1.06.00	...220 V DC System for Switchyard 110V DC system for water system area.....	If required, instead of 110V DC system 220V DC system shall be provided in water system area, provided it is not covered by main plant 220V DC system. Same shall be decided during detailed engineer-ing. Please confirm.	Separate DC system has to be provided for water system area. However, bidder may choose to provide 220 V DC system in place of 110 V DC
192	SECTION-VI, PART-A	SUB-SEC-TION-IIB ELEC-TRICAL SYSTEM / EQUIP-MENTS	6 OF 17	1.09.01	In addition to above, HT power cables, as indicated under Clause 1.19.00, required for Employer's requirement shall also be in bidder scope.	In clause no. 1.19.00, no requirement of HT cable is defined. Accordingly, same is not being considered. Please confirm.	Confirmed
193	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION 0	1 OF 15	1.05.00	d) 220V/110V/48 V DC +/-15% to +10%	Voltage variation shall be -15% to +10%. Please confirm.	Bidder's understanding is correct. Please refer to amendment no.
194	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION 0	4 OF 15	3.03.00	The continuous rating of the Generator circuit breaker and Generator busducts.....	Please confirm if GCB is applicable for this project; as there is no electrical specification for the same and also GCB has not been defined in tender ESLD.	Bidder's understanding is correct. Please refer to amendment no.8-15
195	SECTION-VI, PART-B	SUB SEC-TION-B-10 CA-BLING, EARTH-ING & LIGHT-NING PROTEC-TION	2 OF 21	2.01.04	No sub- zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.	Some small switchgear/control panel may come at 0.0M elevation inside power House building, for which cable trench/ slit shall be permitted.	Bidder understanding is not correct. Bidder to comply with the technical specifications
196	SECTION-VI, PART-B	SUB SEC-TION-B-10 CA-BLING, EARTH-ING & LIGHT-NING PROTEC-TION	9 OF 21	4.04.04	Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every one metre....	As per IS 1255 clause no. 8.8.5, when single core cables are laid in trefoil formation distance of 'D' (one cable diameter) between two adjacent trefoils is to be maintained. Same shall be followed in this project also. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.
197	SECTION-VI, PART-B	SUB SEC-TION-B-10 CA-BLING, EARTH-ING & LIGHT-NING PROTEC-TION	18 OF 21	9.00.00 (b) (1)	Bus duct support or Transformer body shall be at least 8.0M from A-Row of TG building to clear the movement of GT/ Stator/UT/ST/UAT on rail line....	Distance from A-row of busduct support or transformer body shall be decided during detailed engineering. However, it will be ensured that clear movement space shall be provided for transformer movement. It may also be noted that Stator handling shall be through unloading bay using tandem operation of EOT crane.	Bidder understanding is not correct. Bidder to comply with the technical specifications
198	SECTION-VI, PART-B	SUB SEC-TION-B-10 CA-BLING, EARTH-ING & LIGHT-NING PROTEC-TION	19 OF 21	9.00.00 (b) (1)	Separate Switchgear Rooms shall be pro-vided for each unit. For TG building, all HT boards shall be provided in HT switch-gear room at only one floor and all LT boards shall be provided in LT switchgear room at only one floor	All LV switchgear pertaining to power house building cannot be placed at single floor. General-ly, unit, station PMCCs are kept at one floor level and boiler boards are kept at other floor level. Al-so, AC plant swgr is also kept in AC plant room. Hence, please confirm different floor levels for LV boards as per load center in power house building. Also, as per requirement very limited numbers of LT board can also be placed inside MV swgr room in case of space constraint in MV switchgear room. Moreover, in offsite area Placing MV & LV switchgear in same switchgear room is allowed as per specification. Inline with that same may please be allowed in Power House building.	Bidder understanding is not correct. All HT board for TG building shall be provided in HT switchgear room at only one floor as per technical specifications. All LT boards for TG, Boiler, AC plant shall be placed at same place in their respective switchgear room
199	SECTION-VI, PART-A	SUB-SEC-TION-IIA-24 WORK-SHOP, LAB, M&C EQUIP-MENTS	5 OF 17	ANNEXURE-II	TABLE SL.NO. 3: WORKSHOP T & Ps- (A) HV AC TEST KIT-25KV & SL.NO. 9: Electrical test bed for HT & LT drives. ((suitable for the largest HT motor)) & SPEC FOR THE FOLLOWING ITEM: -HV AC TEST KIT-PG 5 OF 17 -AUTOMATIC CAPACITANCE & TAN DELTA KIT- PG 7 OF 17 -PRECISION GRADE FULLY AU-TOMATIC DIGITAL RECORDER- PG 9 OF 17 -4 CHANNEL DSO- PG 11 OF 17 - ELECTRICAL TEST BED FOR HT & LT DRIVES- PG-11 OF 17	A) Please confirm that the specification details mentioned for HV AC test kit at page 5 of 17 and Electrical Test Bed for HT & LT motors at page 11 of 17 are applicable for table sl.no. 3: workshop T & Ps- (a) HV AC test kit-25KV & Sl.no. 9: electrical test bed for HT & LT drives. ((suitable for the largest HT motor)). B) If the above is not correct, then please provide the BOQ for the items for which spec is provided at page-5,7, 9, 11.	In annexure-II the HV ac test kit and electrical test bed along with other equipments are indicated in table and subsequently specifications of the same is provided.
200	SECTION – VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	12 of 17	1.19.00, sl.no. 1	415V switchgear feeders as indicated below (at suitable location to be decided during detailed engineering). (a) 4 Nos. MCCB–125A (b) 4 Nos. MCCB–250A (c) 4 Nos. MCCB–400 A (d) 6 Nos. ACB outgoing – 1000 A (in unit emergency switchgear and station service switchgear for feeding owner's loads).	We understand that a) Only un-cabled feeders shall be provided for feeding owner's loads as per the list in specification. The load of these feeders shall not be considered in system equipment (viz transformer, PMCC, MCC, Emergency DG etc) sizing. b) The quantity of the feeders indicated in the list indicate total quantity (considering both the units). Total 18 nos. feeders shall be provided for owner's load as per the list. Please confirm.	a) Confirmed. b) Confirmed.

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201	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	1 OF 15	1.05.00	Allowable Voltage variation under worst operating condition: 11kV/3.3kV +/- 6%	In line with the standard practice followed in all projects engineered by bidder, a voltage variation of +/- 10% may please be allowed.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.
202	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	2 OF 15 & 15 OF 15	1.11.00	Locked rotor MVA of ID Fan and MDBFP motors shall be restricted to 75 MVA. & The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance): (e) Above 4000KW : 6 to 6.5	Please confirm which criteria shall be applicable for ID Fan & MDBFP.	Bidder understanding is not correct. All HT board for TG building shall be provided in HT switchgear room at only one floor as per technical specifications. All LT boards for TG, Boiler, AC plant shall be placed at same place in their respective switchgear room
203	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	5 OF 15	3.04.01	Each unit transformer shall be sized for the following: a) The loads of One set of unit auxiliaries corresponding to 60% TMCR plus b) Loads due to outage of largest transformer connected to the bus plus d) SCR load requirement of 1 MVA plus c) Multiplied by no load voltage correction factor as defined at Cl. 3.04.00.	Un-cabled feeder shall be provided for feeding customer's load requirement of SCR (1MVA).	Bidder understanding correct.
204	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION & SUB SECTION-II-B-02 MOTORS	8 OF 15 & 1 OF 4	3.06.00. (h).(a)	Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85. & Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30	As per the LT motor spec, premium efficiency class-IE3 type motors are only allowed for the continuous duty LT motors. In line with this clause, value of efficiency as per IE3 efficiency class shall be considered in LT swbd sizing, for uni-directional, continuous drives. P.f shall be considered 0.8 in line with specification. Please confirm.	Confirmed.
205	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	9 OF 15	3.06.00. (m). (f)	At least one spare core shall be made available in each of the control cable.	In line with standard practice followed in all projects engineered by bidder, spare core shall be provided in control cable for size 5C & above. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.
206	SECTION-VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	8 & 9 OF 15	3.06.00. (h).(d) & 3.06.00. (k)	A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads can-not be predicted during the Rating selection of the Board. & Spare capacity and Future Requirements: Each of the LV switchboards shall be de-signed for 1.1 times the required rating as a spare capacity.	In line with the standard practice followed in all projects engineered by bidder, please note that 10% design margin is already considered in LT swbd. sizing to cater to future load variations. Additional 10% spare capacity margin is not envisaged.	Bidder's understanding is correct.
207	SECTION-VI, PART-B	SUB-SECTION B-04: TRANSFORMERS AND ASSOCIATED MAINTENANCE, MONITORING & TESTING & ESLD 4540-001-POE-J-001-A	7 OF 33	1.05.01. (f) & ESLD NOTE (E)	LT Auxiliary outdoor transformers up to and including 2500KVA, 33kV shall have maximum losses of STAR-2 rating or better as per latest BEE guideline. The outdoor transformer up to 2500KVA, 33kV shall also comply with latest IS:1180. & Standard LT transformer ratings to be used are indicated below: 2000/1600/ 1000/ 630/500/315 KVA	We understand 2500KVA outdoor oil filled transformer is allowed in line with the clause 1.05.01. (f) of transformer specification SUB-SECTION-B-04: TRANSFORMERS AND ASSOCIATED MAINTENANCE, MONITORING & TESTING. Further, for indoor applications, LT transformers upto 2500KVA, DTT shall be applicable. Please confirm.	Bidder's understanding is not correct. 1. Outdoor oil filled transformers shall have ratings as indicated in tender SLD, 2500 kVA rating is not acceptable. 2. For indoor DTT, 2500 kVA rating is acceptable.
208	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	10 OF 18	4.04.00	Junction box for indoor lighting shall be made of fire-retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type.	The Material of JB shall be Thermoplastic or thermosetting or FRP type. However, the same shall not be fire retardant material. Fire retardant JB's are required in Hazardous areas however now a days the hazardous area lighting fixtures comes with inbuilt JB so the indoor JB's are not required to be made of fire-retardant material. Please confirm.	Bidder proposal is not acceptable. Bidder to comply with the technical specifications
209	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	10 OF 18	4.04.00	Flexible conduit shall be water proof and rust proof made of heat resistant TERNE coated steel.	We propose to provide Electro galvanised PVC coated flexible conduit. Please confirm.	Bidder proposal is not acceptable. Bidder to comply with the technical specifications
210	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	11 OF 18	4.08.00	Lighting fixtures shall generally be group controlled directly from lighting panel. However, in office areas, control shall be provided through switch boxes. Each switch shall control a maximum of three fluorescent fixtures.	Please note that the loading of LED fixture is very small and as a standard practice 10-15 lighting fixtures are group controlled from the switch. If 3 fixtures are controlled from a switch, there will be lot of wiring and conduiting leading to difficulty in erection and maintenance.	Bidder proposal is not acceptable. Bidder to comply with the technical specifications

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211	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	11 OF 18	4.12.00	Occupancy based Passive Infra-red sensors The sensors shall be recess mounted, programmable type suitable for lighting load of 6A with variable off delay settings. The detection area shall be minimum 5 metres for standard room height of 3mt. All the calibrated settings shall be stored in non-volatile memory of PIR sensor which shall be unaffected by power supply fluctuations. Necessary 16A contactor shall be supplied along with each sensor & shall be located inside the switch box	Please note that in case occupancy sensor is used to control the lighting fixtures, the power supply from lighting panel is extended to occupancy sensor and lighting fixtures are controlled from occupancy sensor. The outgoing feeder of lighting panel is already protected and additional 16A contactor is not required for the sensor. Further, it will not be feasible to mount the contactor near the occupancy sensor. Accordingly, it is requested to remove the requirement of 16A contactor.	Bidder proposal is not acceptable. Bidder to comply with the technical specifications
212	SECTION – VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIP-MENTS	6 of 17	1.14.00	Control of Electrical System of Main Plant, EHV Breakers of Generator bay and Balance of Plant (BOP) shall be provided from DCS with suitable ECD (Electrical Control Desk) and/or Soft HMI.	Please confirm if ECD is required for BOP areas also.	ECD is not required for BOP areas.
213	SECTION – VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	2 of 15	1.08.00	The designed fault level for various voltage levels shall have the following minimum values 11 KV : 40 KA	The two clauses are contradictory. We understand that minimum fault level of 11 KV system including initial motor contribution shall be 40 KA. Please confirm	Bidder's understanding that ".... that minimum fault level of 11 KV system including initial motor contribution shall be 40 KA." is correct.
	SECTION – VI, PART-B	SUB SECTION B-05(A) MV SWITCHGEAR	2 of 7	2.00.00	Maximum system fault level including initial motor contribution for 11 KV shall be 40 KA (Rms)		
214	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT LT AND CONTROL CABLES	4 of 6	4.00.01	Method of curing for 33/33 KV Cables shall be "dry curing / gas curing".	We understand that Method of curing of 19/33 KV cables shall be dry curing / gas curing Method of curing of 11 KV / 11V voltage grade cables is not mentioned in the specification. We understand that for 11 KV / 11kV voltage grade cables method of curing shall be dry curing / gas curing / steam curing. Please confirm	Bidder understanding is correct
215	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION-B-08 HT LT AND CONTROL CABLES	4 of 6	4.00.03	1.1KV grade PVC power cables shall have aluminium conductor (compacted type for sizes above 10 sq.mm), PVC insulated, PVC inner sheathed (as applicable) armoured, PVC outer-sheathed conforming to IS:1554 (Part-I).	Bidder shall supply all XLPE insulated LV Power cables as per IS 7098-1. Please confirm	Specification clause and query raised is not correlated. Refer clause no 2.11.00 of Sub Section B-08 for better clarity
216	SECTION-VI, PART-E			4540-001-POC-A-007	LAYOUT AND DETAILS OF RAW WATER RESERVOIR: Section 3-3 of the drg. 	In the referred GA drg of Raw Water reservoir, 4 nos. make up water pipes have been shown coming to the reservoir (2 nos. for Proposed Stage-III and 2 nos. for future expansion). Similarly, 4 nos. pipes have been shown from Raw Water reservoir to Raw Water Sump (2 nos. for Proposed Stage-III and 2 nos. future expansion). As per Scheme of Makeup water system (4540-001-POM-A-061), we understand that only 2 nos. (2x50%) make up water pipes from makeup pump house to raw water reservoir for Stage-III is in the scope of this tender. It is not clear that from where the 2 nos. makeup water pipes for future expansion are coming to the reservoir.	Bidder to refer Amendment no. D1-8 To the referred drg.
217	SECTION-VI, PART-E			4540-001-POC-A-007	LAYOUT AND DETAILS OF RAW WATER RESERVOIR: Section 2-2 of the drg: 	Similarly, we understand that only 2 nos. pipes (2x50%) raw water pipes (along with valves) from raw water reservoir to raw water sump are in the scope of this tender. It is not clear where the 2 nos. pipes for future expansion shall be terminated. Customer is requested to kindly clarify the scope of piping, valves and civil work of the 2 nos. pipes shown for future expansion.	Bidder to refer Amendment no. D1-8 To the referred drg.
218	SECTION-VI, PART-B	SUB SECTION-A-01	56 of 101	3.02.00 (c)	Quantity of water to be cooled by Cooling Towers of One Unit: CW Pumps Flow per Unit + 10% margin	Please note there are already margin in the NDCT in the form of 0.5 deg C margin in Cooling Tower Range and 0.5 deg C margin in approach of cooling tower. Hence, any margin in NDCT designed flow is not required. Customer may please review the 10% margin on NDCT flow as this will further increase the NDCT size and may be difficult to accommodate in the plot plan. Further, how this margin will operate is not understood as pump will not deliver this higher flow.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
219	SECTION – VI, PART-A	SUB-SECTION-IV	7 of 73	1.01.02 (xii)	Per Cooling Tower - For every 0.2 deg. C rise in Cold Water Temperature from the guaranteed value	There should not be any LD upto 0.5 deg C shortfall in cold water temperature as design CW inlet temperature to condenser is 33 deg C.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
220	SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-III CIVIL WORKS	3&4 of 13	Sr. No-6c of clause no.-1.00.00	Packaged type Sewerage treatment plant (3 nos. as indicated in tender drawing General Layout Plan) and sewage pumping station including sewage pump, sump & house and connection up to sewage treatment plants (either of owner or bidder); connection of sewage lines of all buildings under Bidder's scope to the nearest sewerage system.	1. Please confirm, whether the 3-separate or a common (1-no.) tertiary treatment facility is to be provided after the 3- decentralized units. 2. Alternatively, kindly confirm if, bidder may provide a Centralized Sewage Treatment Plant for facilities within the plant with minimum combined capacity of min. 75 cum/day and MBBR technology shall be used for centralized sewerage treatment plant. This is in line with recent project of customer being executed by bidder. Kindly confirm acceptance.	1. 3 Separate packaged STP as marked in GLP 2. Centralised STP is not envisaged in EPC package. 3. For pressure flow CI pipes are required. For gravity flow Hume pipes may be used. 4. Pumping requirement for sewage to be dealt during detailed engineering. 5. This is part of detailed engineering.

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221	Section – VI, Part-B of Bid Doc. No: CS-4540-001A-2	SUB-SECTION- D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	40 of 120	5.07.00	Complete sewerage system including package type sewage treatment plant for facilities in Bidder's scope within the plant is in bidder's scope. The bidder shall provide Decentralised sewage treatment plant units. The capacity of the Decentralized Sewage Treatment units shall be as per the design requirements subject to minimum combined capacity of 75 Cum/day. Design of Sewage treatment plant shall be as per CPHEEO manual. Primary, Secondary and Tertiary treatment to be provided. Cement concrete pipes of class NP-3 as per IS 458 shall be used below ground level for sewage disposal in all areas other than main plant area. However, for pre-sure pipes and under roads spun Cast Iron pipes conforming to IS 1536 of required class shall be used. Sewage pump house shall be provided as per IS 4111. BIDDER SHALL HAVE TO PROVIDE COMPLETE ARRANGEMENT for sewage disposal up to the sewage treatment plant including pumping facilities.	3. Please note that CI pipes are available in higher sizes- 80NB and above. Being very small capacity STP requirement, the sewage shall be pumped /fed through gravity as per site requirement & the pipe size are expected to be less than 80 NB. In view of above, the pipe material of CS/HDPE/PVC may pl. be allowed. 4. Since the pumping is of very small capacity and hence no sewage pump house is required. Small submersible pump will meet the requirement. Please allow. 5. System requirement wrt clause: complete arrangement for sewage disposal up to the sewage treatment plant including pumping facilities, may be elaborated/clarified. 6. Disposal arrangement of Treated Water after tertiary treatment from the respective STPs at 3-locations is not clear. It is envisaged that same shall be used for nearby horticulture area/dust suppression at CHP area/suitable equivalent arrangement. Kindly inform/confirm. 7. Kindly also confirm/inform the requirement of EQMS after tertiary treatment from STP.	6. Bidder's understanding is correct.
222	SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB-SECTION- A – 23 LP DOSING AND OXY-GENATED	2 of 4	2.00.00	Oxygen Dosing System At each dosing locations, system shall be designed for a maximum dosage rate of 150 ppb and number of oxygen cylinders to supplied and installed by the Contractor shall cater for one-month requirement. However, the dosing facilities shall have redundancy of 100% for each location per unit. The condensate and feed water flow shall be of the order of 1500 CU.M/hr for each unit or actual design flow whichever is higher.	Oxygen Dosing System shall be provided with redundancy of oxygen cylinder per skid (i.e. 2x 100%) only. The redundancy of other dosing facilities is not required. Thus, with above details, two (2) nos. of oxygen Dosing System skids per unit shall be provided.	Bidder to note that for each location per unit, skid containing equipments required for dosing like isolation/ check valves, cylinder manifolds, regulating valves, instruments shall be redundant (2 nos. for each location of one unit), so that problem in one dosing skid of one location shall not hamper dosing process at that location.
223	SECTION-VI, PART-B	D-1-5	83 OF 127	5.19.02.02.01	The tank foundation shall be as per IS:803 and as specified in Cl. No.7.01.04.	CL No. 7.01.04 not available in the specification, bidder shall provide the foundation of Tanks as per IS 803 in which tank lies on the top of foundation ring wall as per standard practice.	Bidder to refer Amendment no. D1-33
224	SECTION – VI, PART-A	SUB-SECTION-IB	6 OF 15	RAW WATER ANALYSIS (ANNEXURE-III)	Total Suspended Solids	The values of total suspended solids in Raw water has not been specified. Please furnish the same.	It is clarified that the bidder shall design the Pre-Treatment plant on the basis of turbidity specified in Raw water analysis, for the guaranteed turbidity at the outlet of the clarifiers.
225	SECTION – VI, PART-B	SUB-SECTION A – 14 (WATER TREATMENT PLANT)	2 of 36 & 4 of 36	2.01.00 (3) & 3.02.02 (1)	----- All the Reactor Clarifiers shall be equipped with full bridge. & -----, Clarifiers shall be provided with radial launders.	The Reactor Clarifier units shall be as per supplier's design recommendations. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
226	SECTION-VI, PART-B	A-24	2 OF 6	1.02.00 (2.)	Emergency safety devices: The lift shall be provided with safety devices attached to the lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the lift car up at the governor tripping speed with full rated load in car.	Please note that safety governor is installed on sides of car which come in operation during free fall of elevator or during speeds are higher than tripping speeds. During above mentioned situations safety governor gradually hold the guiderail and bring the elevator in complete rest. However, there is no safety arrangement placed beneath the car. Customer may please review the requirement and confirm.	Bidder to comply the specification requirement.
227	SECTION-VI, PART-B	A-24	3 OF 6	1.03.01 (d)	Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio and visual).	There are two condition which are envisaged for stuck up of elevator: 1) If the elevator is stuck between floors in power condition, the floor indicator will be visible with a message –"Out of Service"	Bidder to comply specification requirement.
228	SECTION-VI, PART-A	II A-01	26 OF 28	3.01.20	Passenger Elevators for ESP control room (if applicable) The Passenger elevators for ESP control room be as under: (2) nos. conventional type elevator having capacity of 10 persons	Wrt the referred clauses, incase ESP cum FGD Control room is applicable for subject tender, (2) nos. conventional type passenger elevators having capacity of 10 persons shall be provided in line with clause no-3.01.20, Page no-26 OF 28, Sub-sec- II A-01, SECTION-VI, PART-A of tender specification.	Agreed. Further, refer cl. 1.03.00 (46), G-03 also.
229	SECTION-VI, PART-B	G-03	12 of 15	1.03.00 (46.)	ESP cum FGD Control room/ Electrical building shall be provided either unitized or combined for both units. If the ESP cum FGD Control room / Electrical building is more than two (2) storey, elevator of specified capacity shall be provided.		

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230	Section-VI, Part-F	Mandatory Spares-Chap-02	19 OF 31		20	Mandatory Spares for Elevators	As per tender specification two (02) nos. conventional type passenger elevator 884 kg capacity for TG building and two (02) nos. conventional type passenger elevator 884 kg capacity for service building have been considered. i. In view of above, capacity and type of elevators for TG building and Service building are same. Hence, we have considered one (01) common set of applicable list of spares (as applicable) as per SI. no. (i) mentioned below. Kindly review and furnish your confirmation. Please note that we have considered Mandatory spares for elevators of different areas as per following clauses as mentioned in technical specification: ii. TG Building & Service Building- 884 kg conventional elevators: as per clause no-20, Page-19 of 31, Mandatory Spares-Chap-02, Section-VI, Part-F iii. Admin Building: as per clause no-20, Page-19 of 31, Mandatory Spares-Chap-02, Section-VI, Part-F Customer may please review the requirement and confirm.	Bidder to comply specification requirement.
231	SECTION- VI, PART - B	SUB SECTION- G-03	Page 11 of 15	41		All cranes shall be provided with approach rung ladders at least at two places. Where ever cranes can't be maintained in situ on the carriage, facility to draw them to maintenance platforms as well as provision of suitable platforms shall be considered by the bidder.	Feasibility of providing two rung ladders and maintenance platform depends upon layout constraints, hence same shall be confirmed during detail engineering.	Bidder to follow specification requirement . Constraints if any shall be reviewed during detailed engineering .
232	SECTION – VI, PART-B	SUB-SECTION-B-15	2 of 4	8.01.01		These motors shall be provided with VPI insulation and insulated bearing on one side and shall be suitable for Inverter duty.	Insulated bearings are generally available for motors above a particular frame size (generally 280M and above). Insulated bearings for all motors can be decided during detail engineering based on availability in market.	Please refer amendment No.B-17
233	SECTION – VI, PART-B	SUB-SECTION-B-15	3 of 4	vi)		Provision for controlling the motion from operator cabin (in case of Turbine hall EOT crane) as well as remote control shall be available.	We understand that RRC are not applicable for BFP handling crane. Kindly confirm.	Bidder Understanding is incorrect. Bidder to provide the RRC for BFP.
234	SECTION-VI, PART-B	SUB-SECTION-D-1-5	112 OF 120	5.25.00		The Central Workshop Building shall be designed considering EOT crane of 50T capacity	We understand that this requirement of 50T workshop crane capacity is for civil design only. Capacity of workshop crane to be provided shall be sized to handle heaviest component to be handled with 25% margin as per clause no. 3.11.00.a) of sub section A-01, section VI, Part B of specification	Bidder's understanding is correct.
235	SECTION-VI, PART-B	SUB SECTION-A-01	69 OF 101	3.11.00.a)		Cranes & Hoists should be sized to handle heaviest component to be handled with 25% margin (with minimum capacity if specifically indicated elsewhere for any system/equipment) and should comply to IS: 3177/IS: 3938 (as applicable).		
236	SECTION-VI, PART-B	SUB SECTION-A-01	49 OF 101	2.04.00		In addition it shall also be possible to handle Generator Stator with tandem operation of two Turbine hall EOT cranes for which necessary arrangements shall be provided. In such case, the combined capacity of two EOT cranes shall not be less than 105% of weight of Generator Stator, including the weight of lifting beam with swiveling arrangement and slings.	Criteria for finalizing capacity of lifting beam for tandem operation of TG Hall EOT cranes has not been mentioned in tender specification. 5% margin over Generator Stator weight and slings weight has been envisaged for finalizing lifting beam capacity.	Lifting beam shall be size by taking 5% margin over combine weight of Generator Stator, attached lugs and slings.Further, This shall be finalised during detail engineering.
237	SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-11	10 OF 18	b		Master Controller for Aux. Hoist	Since cabin is not applicable for CWPB Double Girder crane, Master controller shall also not be applicable for the same.	Shall be decided during detail engineering of spare item.
238	SECTION-VI, PART-A	SUB-SECTION-I-A	11 OF 36	4.15		The Bidder/ its sub-vendor should have designed, manufactured, erected and commissioned EOT cranes of capacity 100T or more with minimum crane span of 28 meters, which is in successful operation in at least one (1) station for a minimum period of one (1) year.	Since Double Girder EOT Cranes supplied in power station are designed based on similar Indian Standard (i.e. IS 3177 and IS 807) as for any other building viz. Steel Plant (which is comparatively heavier duty w.r.t power station), workshop sheds, manufacturing units, cement factories, oil refineries etc; we understand that the word 'station' indicated in provenness criteria includes crane supplied in any of the said buildings and not only power station. Please confirm.	Bidder to note that the word "station" indicated in provenness criteria doesn't restrict any vendor for meeting the provenness criteria as long as it meets the crane specified parameters (i.e., Crane capacity and Span) in the provenness clause. Bidder to comply the specification requirement
239	SECTION- VI, PART A	IIA-01	21 of 28	2.24.03		Contractor shall provide motorized hoists and trolleys for all items requiring maintenance and weighing 500 kg or more.	All the mentioned three clauses are contradictory w.r.t selection of electric or manual hoist. Bidder shall be following clause 4.02.09 of sub-section A-02/Section VI part B for selection of electric or manual hoist.	Bidder to comply the specifications requirements as specified in various chapters for the equipments in corresponding areas.
240	SECTION- VI, PART B	A-01	94 of 101	4.02.09		Hoists: (i) More than 2.0 tonne or more than 10.0 m lift or hoists coming out-side the buildings: Motor driven for both travel & lift (ii) Other hoists including the hoists for handling Take up pulley and take up weight: Manual for both travel & lift.	Kindly confirm	

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	SECTION- VI, PART B	A-24	6 of 6	2.05.00	For the hoists with more than 2.0 ton lifting capacity or more than 06.0 M lift, motor operated hoist block for both long travel and lift shall be provided. Other hoist blocks shall be of hand operated type for both travel and lift. However, all monorails coming out of the building shall be provided with electric hoist block, irrespective of load and lift.		
241	SECTION- VI, PART A	IIA-01	21 of 28	2.24.03	Access ladders with suitable platform shall also be provided for approach to all motorized hoists/trolleys mounted on their runway beams for the maintenance of hoists/trolleys.	Considering the layout & space constraints, it may not be feasible to provide all electric hoists with maintenance / repair platforms with handrails. Hence maintenance platform shall be provided depending upon feasibility.	Bidder to comply the specifications requirements which also envisage safety aspects.
242	SECTION- VI, PART F	Mandatory Spares		Chapter-08	Mandatory Spares for Cranes & Hoists:	Electric Hoists & Chain Pulley blocks: Further, spares of Electric hoists have been mentioned only for Water system. Hence, mandatory spares shall be provided for Electric hoists of water system only. Also, no spares are mentioned for chain pulley blocks. Hence, we understand that no spares shall be provided for chain pulley blocks. Please confirm.	Bidder to supply mandatory spares as specified in the respective chapters of technical specification
243	SECTION- VI, PART A	IIA-19	1 of 2	2.01.00	Suitable EOT Crane/HOT Crane/Monorail beams with hoists/Chain Pulley Blocks of adequate capacity, to meet the erection and maintenance re-quirements are to be provided by the vendor for the various equipment/areas. Some of the areas/equipment not covered by TG hall EOT crane are indicated be-low. For balance areas/equipment, not listed herein after, the requirements of Specification shall be followed. (a) Feed water heaters & deaerator. (b) Various pumps & Heat Exchangers. (c) Fans, motors, gear boxes etc., of Main Condenser, vacuum pumps, control fluid room etc. (d) Auxiliary cooling water pumps and DM cooling water pumps of ECW sys-tems and Plate heat exchangers. (e) Central lube oil system room (f) Any other equipment. The above requirement is indicative only; the requirement given in the respective chapter is to be adhered to.	a. For erection, Feed water heaters shall be lifted to the destination floors with the help of TG Hall EOT and then dragged to their final location. For maintenance also, they can be dragged to EOT accessible area and can be handled by EOT there-after. This is as per standard practice. As such, there is no requirement of separate hoist arrange-ment. For de aerator erection, separate mobile crane will be used to lift the different parts to the De aerator floor. Once erected, it need not to be taken out. If any maintenance is required, the same can be done in situ. b. Heat exchangers can be attended at position. Handling arrangement for the same is not required. However, handling arrangement shall be provided for motors of the pumps wherever applicable. For balance equipments, lifting equipment shall be provided as applicable.	EOT crane is not envisaged for Feed water heaters & deaerator. However, applicable Hoists/Chain pully block for general maintenance purpose shall be provided.
244	SECTION-VI, PART A	SUB-SECTION-IIID CIVIL WORKS	PAGE 1 OF 13	4	Dismantling, removal, and disposal of identified facilities/ structures/ substructures/foundations of dismantled quarters/buildings/structures, reinforcement, pavement/paving, pipes and any underground structure/materials, debris etc. all complete.	1.Please provide super structure as well as foundation the drawings of buildings/facilities/structures whose dismantling are in bidder's scope. 2.Dismantling of underground structures will be done only at the places where new structures/facilities (of bidder's scope) are required to be erected. Please confirm.	1. Drawings are not available. Bidder to visit site to update itself regarding existing structures. 2. Bidder to refer Cl. Bidder to refer Clause 1.00.00 of Part-A, Section-VI, Sub Section -IID
245	SECTION-VI, PART A	SUB-SECTION-IIID CIVIL WORKS	4 OF 13	6. I	Watch Towers	Please provide the plan dimension (Length X Width) of watch tower.	This shall be discussed & finalised during detailed engineering
246	SECTION-VI, PART B	SUB-SECTION-D-1-5 CIVIL WORKS	48 OF 120	5.15.00	WATCH TOWERS		This shall be discussed & finalised during detailed engineering
247	SECTION-VI, PART B	SUB-SECTION-IIID CIVIL WORKS	8 OF 13	25	Facilities for rainwater harvesting in Plant area and other buildings in Bidder's scope.	Please provide the detailed specification, scheme and requirement of water storage pond/capacity for the rain water harvesting in main plant area and other buildings/facilities/structures.	This shall be discussed & finalised du
248	SECTION-VI, PART B	SUB-SECTION-D-1-5 CIVIL WORKS	1 OF 120	5.01.00.i	All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rainwater harvesting scheme for the project and obtaining approval of the scheme from Central Ground water board is in bidder's scope		This shall be discussed & finalised during detailed engineering
249	SECTION-VI, PART B	SUB-SECTION-IIID CIVIL WORKS	8 OF 13	30	Civil, structural, architectural works for SOLAR PV plant on 'A-Row' elevation for main power house and roof top of building/facilities in the bidder's scope.	Please provide the list if buildings/facilities on the roof of which SOLAR PV plant is required.	Bidder to refer Amendment no F-3 to SECTION – VI, PART-B, SUB-SECTION-A-25 SOLAR P.V.
250	SECTION-VI, PART B	SUB-SECTION-IIID CIVIL WORKS	8 OF 13	30	Primary health center with rest room.	Please provide the detailed specification (mentioning type of structure, architectural finishes etc.) and dimension (length x width x height) of building.	To be provided as per local bylaws.
251	SECTION-VI, PART B	SUB-SECTION-D-1-4	3 OF 4	4.03.02	All existing drains/channels in the plant and other areas associated with the plant except those proposed to be constructed by the Owner shall be suitably diverted by the Bidder before taking up any construction.	Please provide L/S, C/S, discharge quantity, velocity etc. of the existing drains/channels in the plant and other areas associated with the plant, whose diversion is required.	This shall be dealt with during detailed engineering

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	SECTION-VI, PART-B	SUB-SECTION-D-1-5	1 OF 120	5.01.00.i	All the buildings and site development including landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rainwater harvesting scheme for the project and obtaining approval of the scheme from Central Ground water board is in bidder's scope	The referred clauses are contradictory about landscaping. Please confirm landscaping is not in the bidder's scope.	Landscaping is not in EPC scope. However, future landscaping is to be taken into consideration while providing rain water harvesting scheme.
	SECTION-VI, PART-A	SUB-SECTION-III TERMINAL POINTS & EXCLUSIONS AND OWNER'S INPUT	2 OF 3	4.03.00 c)	Landscaping		Landscaping is not in bidder's scope
252	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	15 OF 120	5.02.11.01.04	The minimum grade of concrete for all RCC structures shall be M30.	We understand that the minimum grade of concrete for all water retaining RCC structures shall be M30. Please confirm.	Confirmed
253	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	88 OF 120	5.19.01.23	2.0m wide walkway with concrete paving shall be provided connecting all structures, buildings and facilities. The top of walkway shall be minimum 200mm above FGL.	Roads along with shoulders shall be provided as per specification and plot plan. No such separate walkway is envisaged in the given scope of work. Please confirm. If at all it is to be provided please provide the lay-out and sectional details.	Walkways are to be provided as per technical specifications. Layout and detailed engineering has to be done by the bidder.
254	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	46 OF 120	5.12.05	The entire fuel Oil Handling area shall be fenced all round with minimum 1.50m high metal fencing with provision for gates at key locations.	We understand that metal fencing of height 1.5 mtr is to be provided for both transformer yard and FOPH area. Please confirm.	Bidder to Refer clause 8.05.00 of Section-VI, Part-B, Subsection- D-1-8
255	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	8 OF 120	5.02.07.iii.	Entire transformer yard, which shall be adjacent to the building, shall be provided with metal fencing with gates.	If yes, then please provide the detailed specification for fencing.	Referred clause is for ESP Control Room. Please refer 5.12.00 for FOPH
256	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	10 OF 31	9.10.09	All internal paints shall be of low VOC (Less than 50 g /L) content conforming to GRIHA rating for reduction of VOC content.	The same shall be applicable for on those buildings which are having GRIHA requirements such as service building. Please confirm.	The referred Clause is applicable for internal paints of all buildings
257	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	13 OF 120	5.02.10	This building shall be four storeyed (Ground + 3 stories above) and shall be provided with floor area of 3700 sq.m with RCC framed structure.	Total floor area of the Service Building is 3700 sqm. Please confirm.	Confirmed
258	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	47 OF 120	5.14.00	The CISF Building shall be 2-storied building. It shall be of RCC Frame structure & brick masonry. The floor area of this building shall be minimum 700 sq. m.	Total floor area of the CISF Building is 700 sqm. Please confirm.	Confirmed
259	SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS	114 OF 120	5.30.00	This building shall be three storeyed (G+3 stories above) and area 2800 sq.m. with RCC Frame structure & Autoclave Aerated Concrete Block masonry.	Total floor area of the Administration building is 2800 sqm. Please confirm.	Confirmed
260	SECTION - VI	----	Sl. No. 1	----	General layout plan. (4540-999-POC-F-001)	During site visit one no. covered well is observed at proposed chimney location. Please provide the detail.	The structure is an above ground tank which is being demolished by NTPC
261	SECTION - VI	----	Sl. No. 1 and Sl. No. 5	----	General layout plan. (4540-999-POC-F-001) SITE LEVELING PLAN (4540-001-POC-A-003)	During site visit one temple is observed at the south side of the plant. Please clarify whether the same will be dismantled by the customer. If the same will not be dismantled, please provide the revised SITE LEVELING PLAN (4540-001-POC-A-003).	Temple would be dismantled by NTPC.
262	BIDDING DOCUMENT NO.: CS-4540-001A-2	Attachment-11	1 of 4	2	2. Unit Heat rate in kcal/kWh at 303 MW (i.e. 55% of rated load) under turbine throttle main steam pressure of 150 kg/cm ² (abs) and rated Main steam and Reheat Steam temperature at 577 mmHg (abs) condenser pressure with zero (0%) make up shall not be more than 9188 kcal/kWh.	Discrepancy in turbine throttle main steam pressure requirement mentioned under different clauses @ 55% TMCR load (363MW).	Errata. Refer amendment in this regard (Amendment No : A-TG-1-COMM)
263	SECTION – VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE	1.01.01 (ii)	ii) Unit Heat Rate at 50% TMCR load (Guaranteed Unit Heat rate in kcal/kWh under turbine throttle main steam pressure of 150 kg/cm ² (abs) and rated Main Steam and Reheat Steam temperature at 577 mmHg (abs) condenser pressure with zero make up at 303 MW load (i.e. 55 % of rated load)	We understand that the turbine throttle main steam pressure requirement @ 55% TMCR load (363MW) is 150kg/cm ² (a). Please review and confirm.	
264	SECTION-VI, PART-B	SUB SECTION-A-07 STEAM TURBINE AND AUXILIARIES SYSTEM	PAGE	1.18.01 (c)	c) 55% of rated load under turbine throttle main steam pressure of 150 kg/cm ² (abs) and rated main steam temperature / rated reheat steam temp. at turbine inlet at condenser pressure of 77 mm Hg (abs) with zero make-up with one TDBFP in operation. (Heat Rate Guarantee)		
265	SECTION-VI, PART-B	SUB-SECTION-G-07 BID DOC NO.:CS-4540-001A-2	PAGE 1 OF 75	3,4 & 5	3. H&P Sizing including H&P calculation 4. H&P Sizing including H&P calculation 5. H&P Sizing including H&P calculation	NPSH calculation shall be submitted separately, as per customer other projects being executed by bidder, after finalization of pump parameters, pump model and associated pump characteristic curves. HP & LP bypass sizing shall be submitted separately as per practice followed in Customer other projects. Please accept and confirm.	To reduce the number of drawing for approval, MDL has been prepared and bidder to comply the specification requirement.
266	SECTION-VI, PART-B	SUB-SECTION-G-07 BID DOC NO.:CS-4540-001A-2	PAGE 1 OF 75	14	14. H&P Sizing including H&P calculation CORRECTION CURVES AS PER SPECIFICATION	Correction curves are part of detail engineering and submission of correction curves is also covered in document submission requirement i.e. MDL for contract engineering. Therefore, we propose submission of correction curve during contract stage as per MDL instead of along with BID. Please accept and confirm.	Correction curves to be submitted along with Bid as envisaged in tender document. Correction curves as per contract to be also submitted as per MDL. Bidder to comply specification requirement.
267	SECTION – VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	PAGE 10 OF 73	1.01.03.01(2)			

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	SECTION-VI, PART-B	SUB-SECTION-G-07 BID DOC NO.:CS-4540-001A-2	PAGE 51 OF 75		3491 1000-100-PM-A-002 Fuel gas system design, Chimney and Dust Sizing Calculation	Chimney sizing calculation shall be submitted separately being part of basic engineering. Please accept and confirm.	Bidder's understanding is correct.
268	SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	PAGE 16 OF 38			We understand that the quantity specified against heading 1.20.00(A)(1) & 1.20.00(B)(1) is a typographical error and mandatory spares are required only for the parts listed under s.no. 1.20.00(A)(1) (1.1 to 1.6) & 1.20.00(B)(1) (1.1 to 1.6) of the main APRDS valves. Customer to kindly review & confirm.	Bidder to note that there is no typographic error and bidder to comply the specifications requirements. Quantities as specified at discrete places shall be provided in line with the specifications.
269	SECTION-VI, PART-B	SUB SECTION-A-16	PAGE 3 OF 7	4.03.03	Compressor shall have 25% minimum turndown capability (at 45 deg C & 75% RH). Compressor shall be provided with IGV at the suction flange.	Bidder understand same is applicable for centrifugal compressor.	Bidder's understanding is correct.
270	Section VI, Part B	A-9, Low pressure piping.	10 of 19	2.12.02	For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.	For 50 Nb and below size valves, please also accept valve body MOC as carbon steel.	Bidder to please refer Clause No. 2.13.01 (d), Sub-section: A-09, Part-B of Technical specification, which mentions "Forged carbon steel & Forged stainless steel valves are also acceptable in place of Gun metal valves."
271	VI/A	IIA-13	1 of 2	1.04.00	The LDO shall be pumped to two (2) nos. storage tanks each of capacity 1700 cu. meter. One (1) day oil tank of capacity 100 cu. meter for auxiliary boiler shall be provided. The day oil tank shall be fed from a separate set of transfer pumps and pipeline.	Customer to pls note that the LDO pressurizing pumps for Auxiliary Boiler shall be kept in Fuel oil pump house nearby to Main LDO storage tanks (1700 m3) area only. Hence, the pump shall take LDO suction directly from main LDO tanks. Therefore, one (1) day oil tank of capacity 100 cu. meter for auxiliary boiler is not required. Customer to pls confirm the same.	Confirmed. Bidder to refer Amendment Amendment No : A-MH-30
272	SECTION-VI, PART-A	SUB-SECTION-I-A PROVEN-NESS	8 of 36	4.3	Provenness criteria for Natural Draught Cooling Tower:	NTPC is requested to kindly modify the Provenness criteria of NDCT as indicated below to increase the vendor base for NDCT: 4.3 Natural Draught Cooling Tower 4.3.1 The Bidder / its sub-vendor should have designed/got designed, constructed and commissioned at least one (1) number of Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill of capacity not less than 30000 Cu.M/Hr and which should have been in successful operation for at least one (1) year. 4.3.2 Bidder / its Sub Vendor who fulfills the requirements in Clause 4.3.1 above with fill type other than splash/modular/trickle type fill, can also participate provided Bidder associates/collaborates with a cooling tower designer who has independently designed a Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill, of capacity not less than 30000 Cu.M/ Hr and which should have been in successful operation for at least one (1) year. In such a case, the Bidder/its Sub vendor should furnish a letter of technical support jointly executed by it and its Cooling Tower Designer for the satisfactory performance of Cooling Towers as per the format enclosed in the bidding document. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor. 4.3.3 In case the reference cooling tower was designed by a party other than the Bidder himself /its sub vendor, the Bidder/ its sub vendor shall employ a cooling tower designer who has independently designed a Natural Draught Cooling Tower in RCC construction with splash/modular/trickle type fill, of capacity not less than 30000 Cu.M/ Hr and which should have been in successful operation for at least one(1) year. In such a case, the Bidder/its Sub vendor should furnish a letter of technical support jointly executed by it and its Cooling Tower Designer for the satisfactory performance of Cooling Towers as per the format enclosed in the bidding document. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements

						4.3.4 Bidder / it's sub vendor can use experience of its foreign / domestic parent company / subsidiary of parent company / associated company of parent company. Besides above, as an alternate route, NTPC is kindly requested to consider below mentioned: "Bidder / its sub vendor who has constructed min 220 M high concrete chimney in a power plant can also bid and shall employ a cooling tower designer who has independently designed a Natural Draught Cooling Tower in RCC construction with splash/modular/trickle/Film/Cross Fluted type fill, of capacity not less than 30000 Cu.M/Hr and which should have been in successful operation for at least one (1) year. In such a case, the Bidder/its Sub vendor should furnish a letter of technical support jointly executed by it and its Cooling Tower Designer for the satisfactory performance of Cooling Towers as per the format enclosed in the bidding document. This letter of technical support should be submitted to Employer prior to the placement of order on approved sub-vendor. Bidder / its sub vendor can also employ a jump form supplier who has independently designed and supplied jump form system for a Natural Draught Cooling Tower in RCC construction of capacity not less than 30000 Cub.M/Hr and which should have been in successful operation for at least one (1) year. Bidder / its sub vendor should furnish a letter of technical support jointly executed by it and Jump Form supplier."	

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
273	VI/B	A-05	5 of 28	3.03.02	Quick opening Bi-plane motorized/pneumatic damper along with 2x100% seal air fans & 2x100 electrical heaters shall also be provided in the by-pass duct...	As per the technical specification- Section-VI, Part B, Sub-Section- A-05 (FGD), Clause no: 3.03.02 (Page 5 of 28), in the FGD Bypass duct, Bypass Damper is only applicable & Bypass Gate is not applicable. However, as per Clause: 3.03.04, the material of "gate in the bypass duct" is also mentioned. Bidder understands that Gate in FGD Bypass duct is not applicable. This is also in-line with Scheme of FGD- Absorber System (4540-001-POM-A-022) Bidder understand, Gate in FGD Bypass duct is mentioned in the specification at various clauses inadvertently. Please confirm bidder's understanding.	Bidder's understanding is correct. Pl. refer amendment No
	VI/B	A-05	5 of 28	3.03.04	The blade and other components in the gas path, of the bypass damper and gate in the bypass duct and gate at Absorber outlet shall be made of Carbon steel with C276 cladding of sheet of minimum thickness 1.6 mm or better material.		Please refer amendment no. A-SG-23 in this regard.
	VI/E		Drg. No. 4540-001-POM-A-022		No gate shown in FGD bypass duct		
	VI/A	IIA-04	2 of 7	2.04.01	 The Gates shall be provided with 2x100% seal air fans. Gates at outlet to Absorber and <u>in the bypass duct</u> shall also be provided with 2x100 electrical heaters...		
	VI/A	IIA-04	4 of 7	4.01.04	Motorized isolation gates at Absorber gas inlet, Absorber gas outlet and FGD bypass in the main duct to Chimney along with 2x100 seal air fans for each gate and 2x100 heaters for absorber outlet gate & bypass gate . A bi-plane bypass damper along with 2x100 seal air & 2x100 heaters shall also be provided in the bypass duct.		
274	VI/E	-	Drg. No: 4540-001-POM-A-022		For FGD Inlet Guillotine Gate's Seal Air System, Temperature Transmitter (TT), Flow Switch (FS), Temperature Switch (TS), and Pressure Transmitter (PT) are shown in the Scheme of FGD- Absorber System drawing.	Please note that FGD Inlet Guillotine Gate does not require any Seal Air Heaters (as per technical specification). Temperature Transmitter (TT), Temperature Switch (TS) and Flow Switch (FS) are applicable only when Seal Air Heater is applicable (as in the case of FGD Outlet Guillotine Gate & FGD Bypass Damper). However, for FGD Inlet Guillotine Gate, seal air heater is not applicable and hence, Temperature Transmitter (TT), Temperature Switch (TS) and Flow Switch (FS) are not applicable. Only Pressure Transmitter (PT) is applicable for FGD Inlet Guillotine Gate (similar to ID Fan Outlet Guillotine Gates). Please confirm bidder understanding.	Bidder's understanding is correct.
275	VI/A	II A-01	10 of 28	2.14.01 (13)	Adequate number of thermocouples or platinum resistance temperature detectors (RTD) for measuring cold and hot end bearing metal temperature for interlock protection and monitoring shall be provided	APH bearings are of Anti-Friction type & immersed in the Sump Oil. Also, the APH rotor rotation speed is less than 2 rpm. Hence, the Sump Oil Temperature is the reliable indication of the APH Bearing Metal Temperature. RTD's provided for Bearing oil Temperature measurement are adequate for the intended purpose.	Bidder's proposal is not acceptable. Bidder to comply specification requirement.
276	VI/B	A-02	16 of 65	9.01.03 (4) ii)	The maximum air in leakage of flue gas after 3000 hours continuous operation. shall be guaranteed and demonstrated. The Contractor also demonstrate that drift in air heater leakage does not exceed 1%, one year after demonstration of guaranteed air-in- leakage. Within this period of operation till all air heater leakage demonstrations are completed there will be no need for any shut down for seal replacements or any internal adjustments.	Boiler tuning is mandatory for conducting APH Leakage test. Hence the test shall be conducted along with Boiler PG test within or just after completion of 3000 hours. Prior to boiler PG test, internal inspection / adjustment of Air Preheater Seals & Sealing surfaces is required as per Air preheater test code ASME PTC 4.3.	Bidder to comply with the specifications requirements.
277	VI/B	A-02	16 of 65	9.01.03 (4) iii, iv	Seals shall have life not less than 2 years (with leakages not exceeding guarantee limits). The seal should be of flexible soft thin material and hardness should be less than that of sector plate / seal plate	Soft touch seals will get eroded faster and will result in more leakage. This is based on the customer feedback from various sites. 2 years seal life specified in the Tender is not possible with flexible soft seals. Hence Bidder proven design leaf type seals with Corten steel material will be offered.	Bidder to comply with the specifications requirements.
278	VI/B	A-02	17 of 65	9.01.03 (5) iv	One of the drive of each of the air preheater shall be provided with VFD for speed regulation from full design rotational speed or 1 rpm, whichever is higher, to about 0.3 rpm. The Contractor shall carry out a test after commissioning to detect the optimum speed of the air preheater to maximize gas temperature reduction.....	APH rotational speed is decided in such a way to give maximum residual time for heat transfer. Reducing the rpm that is increasing the residual time further will not have any improvement in performance. On maintenance aspect also, VFD is not advisable. Hence, the constant speed drive which is the proven design and is working satisfactorily in all the installations is recommended instead of VFD drive.	Bidder to comply with the specifications requirements.

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279	VI/B	A-02	17 of 65	9.01.09 (a)	Sufficient space provision for future installation of minimum additional 15% of APH heating surface area shall be made in the design so that, the same can be installed if required.	In boilers with SCR application, the Air Preheater heating elements are subjected to Ammonium bi-sulphate (ABS) deposition since part of the heating elements falls under the ABS formation temperature zone. Hence, it is important to limit the ABS formation temperature zone within cold end layer (deep cold end) to retain all the ABS deposition in cold end for effective using HP water cleaning. Cold end heating element is designed to absorb all the ABS in the cold end layer itself. Heat transfer depends on all the layers of elements. Accordingly, proportion of cold end depth to total APH is decided. Further adding elements either at hot end or cold, the temperature zone shifts up or down. Adding future element in hot end will shift the ABS zone upward in to the intermediate layers which will lead to chocking. Also, since the original APH is selected for maximum effectiveness, adding future element will not help in further heat recovery. Hence, nowadays we are not recommending / providing future elements.	This will be reviewed and finalised during detail engineering based on proven practice/ experience of lesser pressure.
280	VI/B	A-02	17 of 65	9.01.09 (c)	One semi retractable device per APH either stand alone or incorporated into a twin lance in the Cold End Steam soot blower. This system shall use needle jets of high pressure water at 150-250 bar (g) provided by dedicated High pressure water wash (HPWW) pump.	Cleaning pressure of 100-200 Bar is sufficient cleaning heating elements and excess pressure may damage the heating elements. Hence 100 – 200 Bar pressure is considered inline with all earlier contracts.	This will be reviewed and finalised during detail engineering based on proven practice/ experience of lesser pressure.
281	VI/B	A-02	18 of 65	9.01.09 (I)	Leakage control system. This shall also online maintain the seal gap/radial seal clearance based on pre-set temperature and thereby ensure leakage control at various loads.	Automatic Leakage Control System by Bidder works based on measuring the actual gap between seals and sealing surface using RF system which is more reliable compared to just temperature based control.	Bidder to comply with the specifications requirements.
282	VI/F	VI Chapter - 01	10 of 38	1.10.00 (B)	12. Spare for cleaning device: 12.1 Worm & worm wheel for gear reducer. - 2 set 12.2 Coupling - 2 set 12.3 Bearing & seals for spec reducer - 2 set 12.4 Bearing for cleaning device – 2 set 14. Bushing for worm gear reducer – 2 set	These spares enquired are not applicable for LRNR Cleaning device. Hence the following spares will be offered against the specification requirement. a) Chain – 2 Set for LRNR Cleaning device b) Glands -2 Set for LRNR Cleaning device c) Gaskets -2 Set for LRNR d) Bushing for Travelling carriage - 2 Set for LRNR	The spares as applicable to the offered design shall be reviewed and finalised during detail engineering in line with the Contract requirements.
283	VI/F	VI Chapter - 01	12 of 38	1.13.00 (4)	Reduction gear box & motor for air preheater soot blower oscillation. – 4 Nos.	Instead of these two items meant for Swivel type soot blower, Power pack assembly a single assembly is applicable for LRNR Soot Blower. Power pack assembly (LRNR at Hot end)- 4 Nos is offered as spares. In addition, Motor for Multimedia cleaning device (Cold end) -2 Nos is offered.	The spares as applicable to the offered design shall be reviewed and finalised during detail engineering in line with the Contract requirements.
284	VI/F	VI Chapter - 01	13 of 38	1.13.00 (10)	Sweep action / swing arm/ Long retractable non rotating blower for Air Preheater 3 Nos	3 Sets of Long retractable non rotating Steam soot blower (Hot end of APH) are offered. Multimedia cleaning devices (applicable for Cold end of APH) are not considered.	Bidder to comply with the specifications requirements.
285	VI/A	IV	16 of 73	1.01.05.01	The performance test on electrostatic precipitator will commence after a minimum period of three thousand (3000) hours of cumulative operation after completion of initial operation.	The performance test on electrostatic precipitator will be conducted soon after completion of trial operation or along with Boiler PG test whichever is earlier.	Bidder to refer amendmen in this regard. (Amendment No : A-SG-42)
286	VI/A	IV	16 of 73	1.01.05.02 e)	The corrections for the flue gas flow and ESP inlet flue gas temperature in excess of the values for these parameters under guarantee point conditions, shall be allowed only in case and to the extent such variations are caused solely due to changes in specified coal properties and ambient conditions. Further, the corrections for the flue gas flow and temperature lower than the guarantee point values shall be applied based on actually measured test values. Subject to the above, the corrections for the variation in flue gas flow, inlet dust burden and ESP inlet flue gas temp. shall be based on the above computed test values and procedure indicated in next para.	The tender indicates that estimating and applying corrections to parameters for their variation to the extent of change in specified coal properties and ambient conditions (during PG test), while assessing ESP performance. It may kindly be noted that ESP is designed for a specified set of parameters and is operated at actual condition. Hence, corrections will be applied for variation on actual test parameters (viz. gas flow, temperature & inlet dust) from guarantee point parameters while assessing ESP performances. This is applicable even for ESPs included in SG package as the change in parameters are not due to ESP. If the measured values are higher and corrected values are lower, corrections for design values will be taken for calculation of ESP efficiency. NTPC to note that corrections are allowed for actual measured values for all direct ESP contracts including recent projects like Mouda, Solapur, etc.	Bidder to comply with the specifications requirements.
287	VI/A	IV	17 of 73	1.01.05.03	Ca. Cb .Cc etc. are Correction factors for flue gas at temperature, moisture content in flue gas, ESP inlet dust loading, sulphur and Na contents of coal ash based on correction curve furnished by the Bidder and approved by the Owner.	The corrections for variation in flue gas flow, gas temperature, inlet dust concentration, sulphur content will be considered and the same will be submitted during contract stage.	Bidder to comply with the specifications requirements.

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288	VI/A	IV	27 of 98	1.01.08.01 Note-4	Method of computation of Aux. Power consumption for ESP: The measurement for guaranteed auxiliary power consumption shall be carried out during ESP collection efficiency test. The method for computing the power shall be as described below: a) Power consumption of ESP will be measured pass wise and for one pass (Say ESP-A) at a time with the help of energy meter in ESP MCC. b) Energy meter reading will be taken before starting the collection efficiency test and after completion of collection efficiency test. c) Before starting collection efficiency test, switch off all the TR sets, all hopper heaters, all insulator heaters/pent house fans (if applicable) and rapping systems serving to one pass.....	The method specified involve shutting down of total ESP fields just before start of emission test to measure external loads connected in ESP LTMSB. It is suggested that such switching off of the fields, heaters, rappers shall not be resorted to just before starting emission test. Hence, no external loads shall be connected to ESP LT Switchgear or (if not) this external load can be measured after completion of emission test i.e. ESP can be switched off after the emission test. Hence the power measurement test shall be taken up after completion of emission test.	The detailed aspects shall be discussed sufficiently before the test during engineering stage.
289	VI/B	A 13	1 of 8	1.00.0 (b) (i)	(a) Shot content: 5% by weight (max), size of any shot not to exceed 5 mm in diameter.	As per IS 8183, LRB mineral wool shall be with shot content of max. 15% over 250micron sieve and 5% over 500 microns sieve. Shot content shall not exceed 5% max. by weight. NTPC may review and revise the tender spec.	Bidder to refer amendment A-SG-24 in this regard.
290	VI/B	D 01-6	8 of 24	6.03.04	Shop connections will be all welded type and field connections shall be bolted.	Field connections of ESP supporting structure will be of bolted design. However, casing structure above support bearing level shall be either bolted or welded as per OEMs standard design.	Bidder to adhere to technical specifications
291	VI/B	A-03	58 of 65	2.01.01 (b)	The model shall include all connecting duct work from the air preheater gas outlets to the induced draft fans inlets, induced draft fan outlet to FGD inlet, FGD outlet to chimney flue inlet and also from induced draft fan outlet to chimney flue inlet (in FGD bypass condition) including the inlet duct transition piece...	The ESP Physical Flow Model will include the design of all connecting duct work from the air preheater gas outlets up to the ESP outlets only. Physical modeling for Induced draft fan outlet, Ducts to/from FGD & chimney flue Inlet (FGD bypass duct) including the inlet duct transition piece is excluded from Physical Flow Model study as we are not measuring air velocities in the Physical Flow Model beyond ESP Casing, as per ICAC standard, flow correction devices if any, beyond ID fan is not required since this will not have any significant impact on Flow Model study.	Bidder to comply with the specifications requirements.
292	VI/B	A-03	58 of 65	2.01.01	The model study shall also include gas distribution study in the inlet and outlet duct as well as, the cross over duct to find out the effect of isolation of one stream of the ESP,	As per ICAC code, the gas distribution study will be conducted at ESP inlet duct only and not at ESP outlet ducts.	Bidder to comply with the specifications requirements.
293	VI/B	A 03	64 of 65	14.00.00	Ash flow ability study of ESP hoppers. A comprehensive flow ability study of fly ash from ESP hoppers shall be conducted by the contractor to ensure smooth flow of ash under various operating conditions of the plant including Steam Generator, ESP and Fly Ash Re-moval System. The hoppers are required to promote mass flow without arching and rat hol-ing problems. The main aim of the flow ability study is to ensure consistent flow from each hopper to the ash removal system and following requirements shall be met by the contractor in this connection: i) The flow ability study could be conducted on scaled down model of ESP hopper prepared by the Bidder and at different relevant tempera-ures.	Bidder clarifies as below for conductance of the test.: Evaluation of mass flow design parameters under gravity condition i.e valley angle for a given top opening of hopper with specified material of construction and outlet opening dimension by conduct-ing shear test on three ash samples, as provided by NTPC. The test will be conducted at: a) Ambient temperature at test condition b) Maximum 60 deg. C. Bidder may engage an external laboratory to con-duct the above test. The report on the above study will be furnished to NTPC by Bidder for information purpose. The study shall be conducted independent of the design of ESP hopper for the subject package. There shall be no effect on the project work sched-ule and no hold on the detailed engineering of ESP. No physical modeling is envisaged.	Bidder to comply with the specifications requirements. Procedure for ash flowability study of ESP hoppers shall be discussed and finalised during detail engineering.
294	VI/B	A-02	61 of 65	8.03.00	The dust hoppers shall be electrically heated up to a minimum of lower one third (1/3) of the dust hopper height but not less than 1.5 metre in height by thermostatically controlled curved panel heating elements matching with curved surfaces of conical hopper to prevent ash bridge formation n by maintaining the ash temperature above 140 deg C...	The panel type heaters - curved metallic enclosures are bent to the desired radius/shape at factory and supplied. However, during erection at site, any slight variation in the installation location may result in improper contact of panel heaters with the hopper curved sur-face, which may affect the desired performance. The vendors for curved panel type heaters are only one or two. In view of the above, bidder request NTPC to con-sider blanket type and other heater types that are suited to conical hopper surface heating require-ments.	Bidder to comply with the specifications. Further, bidder to apply requisite quality control measures both at factory and site at various stages of fabrication and erection so as to ensure the desired envisaged performance.

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295	VI/B	A-02	62 of 65	8.07.00	Acoustic 3D Level Scanner Based Level Monitoring System for each ESP Hopper in the First Field shall be provided complying with requirements indicated in Sub-Section-IIIC-03	The 3D level scanner is yet to be commissioned and proven for ESP hopper applications for the ex-isting power plant projects which are envisaged with 3D level scanner. The cost is about 15 times the cost of conventional Ash level indicators, and the vendor availability is limited. Hence, NTPC may consider conventional ash level indicators instead of 3D acoustic level scanner for ESP hopper applications. NTPC may kindly review and confirm.	Bidder to comply with the specifications requirements.
296	VI/B	B0	7 of 15	3.06.00 , c	MCCB shall be provided for all supply feeders of current rating upto and including 400A.	For ESP LT Switchgear, MCCB shall be provided up to 630 A, and breaker modules shall be provided for current above 630 A. This is in line with the standard design practise of ESP switchgear for the other projects.	Bidder's proposal is not acceptable. bidder to comply with specification requirements.
297	VI/B	II-B02	1 of 4	3.01.00	b) Continuous duty LT motors up to 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615 or IEC:60034-30.	The ESP geared rapping motor is fractional horse power drive and is operated intermittently for ESP application. Though the motors are designed for continuous du-ty, their operation is intermittent and hence energy efficiency is not applicable for ESP rapping motors and hence not provided.	Bidder's understanding is correct.
298	VI/B	B-06	13 of 18	7.00.00	Each motor/heater feeder shall consist of MPCB/MCCB (with S/C release only), Power contactor & intelligent motor controller (IMC) to ensure Type-2 Co-ordination.	a) The ESP rapping motors are controlled by the ESP controller / rapping controller. The ESP rapping has to be carried out in close coordina-tion with the ESP controls for achieving the de-sired emission parameters. The ESP rapping motors are also fractional horse power motors that are operated intermittently. Hence ESP rapping motor feeders need not be controlled at MCC end and hence not provided with the IMC (intelligent motor controller). b) The ESP heaters (hopper/ insulator) are ther-mostat controlled for maintaining the desired temperature. Hence ESP heater feeders need not be controlled at MCC end and hence not provided with the IMC (intelligent motor control-ler). NTPC may kindly review the same considering ESP feeder special requirements and confirm.	If the ESP controller and rapping motor are provided in the ESP switchgear, same shall be with IMC having MPCB/MCCB. If separate controller is provided and only supply feeder is envisaged from ESP Switchgear, the requirement of IMC may be excuded.
299	VI/B	B-08	4 of 6	4.00.04.01	Cables shall be supplied in steel drums of heavy construction.	Bidder proposes wooded drum also in addition to steel drums for the cables. Owner may kindly review and confirm.	Bidder's proposal is not acceptable. bidder to comply with specification requirements.
300	VI/B	IIIC-04	5 of 34	3.02.00	Type of RTD: Four wire, Pt-100	Bidder proposes that 3-wire RTD may also be given for temperature measurement of the various equipment (FANS/ Motors etc.) as per the bidder's proven design. This is in-line with all the other projects. NTPC may kindly review and confirm	Bidder proposal is not acceptable. Bidder to comply specification requirement.
301	VI/B	IIIC-04	5 of 34	3.02.00	Complete Level Monitoring System comprising of Acoustic Frequency Based 3D Level measurement system, Scanners and all other accessories required to make the system complete and fully functional, shall be provided on as required basis for continuous level measurement and monitoring of level of each coal bunker, each Fly Ash Silo and each ESP Hopper (First to Third Field of ESP) complying...	Bidder understands that the 3D level measurement system is to be provided only for the first ESP field hoppers as mentioned in the tender specification chapter for ESP. Hence the 3D level measurement is not applicable for second and third field hoppers. NTPC may kindly review and confirm.	Bidder's understanding is correct. Also refer Clause No-1.17.00, ESP Sub Section-IIIB, Section-VI, Part-A of Technical Specification.
302	VI/B	IIIC-17	1 of 4	3.00.00	Electrical actuators for valves / dampers / gates These actuators shall be Non-Intrusive type electric actuators. The interface of these actuators with DDCMIS shall be of two type's viz. with Hardwired interface and with Fieldbus interface.	Bidder proposes that all the actuators for the gates and dampers can be hardwired interface instead of fieldbus interface for the following reasons: a) Lesser cost b) Uniformity of actuators c) Some vendors don't have the Profibus based actuators for the complete range NTPC may kindly review and confirm.	Bidder proposal is not acceptable. Bidder to comply specification requirement.

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303	VI/B	IIIC-17	2 of 4	4.11.00	All actuators shall be certified for SIL 2 or better.	The SIL-2 compliant models include imported ac-tuators and are about 5 times costlier. Considering the initial cost, maintenance as well as spares costs and the import requirements, bidder request NTPC to kindly remove the SIL-2 requirement for actuators. NTPC may review and confirm.	Bidder proposal is not acceptable. Bidder to comply specification requirement.
304	NA				General Electrical query-1	The maximum size of the LT transformer is not mentioned. Bidder understands that the maximum LT transformer size is 2.5 MVA based on standard NTPC specification NTPC may kindly review and confirm.	Bidder's understanding is not correct. Note no. 2 (E) of Electrical SLD to be followed for LT transformer standard sizes.
305	NA				General Electrical query-2	The number of layers of cables in the cable trays is not mentioned. Bidder understands that the maximum cable layer is 2 layers for power cables and 3 layers for control and instrumentation cables. This is based on standard NTPC specification. NTPC may kindly review and confirm.	Confirmed
306	VI/A	IV	30 of 73	1.03.03.vi	The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for the range of specified coal(s) and based on CaO content of 51% in limestone.	Limestone purity of 89% as CaCO ₃ is necessary to get 90% of Gypsum Purity. So Gypsum purity will be guaranteed based on 89 % of Limestone purity as CaCO ₃ .	Bidder to note that the description for the limestone purity against specified gypsum purity for guarantee condition is already given at 'Notes' under Annexure-IV-5, SS-IB, Part-A of the technical specifications. The same is in line with the bidder's understanding in the query.
307	VI/B	A-05	4 of 28	3.01.00.5	Maximum flue gas velocity through the Absorber (m/sec: Not more than 4 m/s at Design Point Conditions (not applicable for bubbling type absorber)	As per DCFs FGD design practice, maximum gas velocity through the Absorber shall be 4.0-4.5m/s. Kindly accept.	Bidder to comply with the specifications requirements.
308	VI/B	A-05	10 of 28	5.06.11	The complete absorber vessel (absorber oxidation tank, absorber tower & absorber outlet duct) shall be made of clad sheet of C276 / Alloy 59 (minimum 2 mm thick-ness) having minimum 7 mm thick carbon steel as base material..	As per clause no: 5.06.11, it is mentioned that the Absorber outlet duct shall be made up of C276 clad sheet whereas in clause no: 3.02.01, it is indicated as Titanium / C276 clad sheet. These statements are contradictory. Kindly confirm the MOC of Absorber outlet duct.	Bidder to refer amendment A-SG-25 in this regard.
309	VI/B	A-05	5 of 28	3.02.01	The duct from Absorber outlet to bypass duct & duct after by pass damper/gate to chimney inlet shall be made of clad sheet of minimum 2 mm thickness of either Titanium (Grade 2 as per ASME SB265) or C-276 over 8 mm thick (minimum) mild steel base metal	As per bidder experience, the duct will be provided with the carbon steel of min. 7.0 mm thickness in-stead of 8.0 mm. This is being followed in all NTPC FGD projects.	
310	VI/B	A-05	11 of 28	5.06.17	The spray headers (if provided) and air supply headers shall be made of FRP or Carbon Steel with Chlorobutyl / Bromobutyl rubber lining (minimum 10 mm natural rubber lining), corrosions and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry).	As per DCFs design, Oxidation air supply header is not exposed to slurry. The oxidation header piping will be connected to Jet Air Sparger system. Jet Air Sparger system will help to oxidizing calcium sulphite. JAS is made of Ceramic material with FRP coating and it is proven & installed in many FGD system worldwide. Please accept.	Bidder to refer amendment A-SG-26 in this regard.
311	VI/B	A-05	7 of 28	5.02.00	Sufficient number of agitators, as per the prov-en practice of the contractor, shall be provided for thorough mixing of the re-circulating slurry. In case the Contractor's Absorber includes side entry agitators, the contractor shall offer and demonstrate mixing arrangement such that n-1 number of agitators are sufficient to avoid the slurry settlement in the absorber tank in case of one agitator under breakdown (n-total no. of working agitators).	As per DCFs FGD design, Oxidation System -Jet Air Sparger (JAS) works to keep the slurry in suspension and no agitators are required to be in operation. The Agitators are required only during FGD stoppage to prevent the deposit settlement. For this purpose, two numbers of Agitators will be installed in Absorber tank. This is being accepted in all NTPC FGD projects. Please accept.	Bidder to refer amendment A-SG-27 in this regard.
312	VI/B	G-01	2 of 4	1.01.00 (n)	Plant shall be designed to give life of not less than 25 years. Further, expected num-bers of Steam Turbine Generator start ups during design life are as follows: Type of Starts - Number of Starts a. Hot start - 4000 b. Warm start -1000 c. Cold start -150	The requirements of number of starts, 5150 (for TG) and 5915 (for SG) along with daily start stop with one shift off & daily 3 load cycling are contradictory and not practical. 5915 nos. of starts in 25 years means 237 starts in a year i.e. One startup in every 1.5 days. Moreover, number of given starts translate into approx. 15 years of standstill	Bidder should not mix the load cycling requirements with start/stops. Further, hot start ups will get covered under daily start

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	VI/B	A-02	3 of 65	1.05.00, (i)	To match the desired plant operating capabilities, the Steam Generator shall also be designed for cyclic/two shift operation. Expected numbers of Steam Generator start-ups during 25 years of design life are as follows: Type of Starts - Number of Starts a. Hot start (after 8 hours of unit shut down) 4550 b. Warm start (after 36 hours of unit shut down) 910 c. Cold start (after 72 hours of unit shut down) 455	non-productive period of the machine. Practically load cycling will be possible for remaining 10 years of operation. In addition, daily start stop is equivalent to 9125 starts. NTPC to reconsider the practicability and clarify the design requirement.	stop. Two shift requirement was being specified in past also. Bidder to comply specification requirements.
313	VI/B	G-01	2 of 4	1.03.00	The plant shall be suitable for load cycling which implies that it should be designed to operate continuously under two shift mode (daily start stop with one shift off) and load follow mode as specified. The design would cover adequate provision for quick startup and loading of the units to full load at a fast rate. The unit shall have minimum rate of loading or unloading of 3% per minute above the control load (i.e. 50% MCR). Plant shall be capable of minimum N1 number of daily load cycles (N1 shall not be less than 2), load variation from 100% to 50 % (and vice versa) of MCR with a minimum ramp rate of 3% per minute without affecting the design life of boiler and turbine-Generator systems. In addition, the plant shall also be capable of minimum N2 number of daily load cycles (N2 shall not be less than 1) from 50% to boiler minimum once through load (and vice versa) with a minimum ramp rate of 1% per minute without affecting the design life of boiler and turbine-Generator systems. The main plant and its auxiliaries with their controls would be designed to permit operation of the units on house load without there being any necessity to shut down the units in the event of sudden loss of total load due to tripping of transmission lines or any other grid disturbances. The design of the plant equipments and control system would permit participation of the plant in automatic load frequency control.	The following requirements have been mentioned. 1. Two shift mode (daily start stop with one shift off) / Cyclic loading - N1 & N2 cycles defined. 2. Nos. of startups defined. All the above requirements have impact on boiler and turbine design life which is stipulated in specification as 25 years. Such stringent boiler design considering both cyclic/two shift operation requirements and nos. of startups as defined in the specification is not required / possible for all practical purpose. Bidder proposes to consider designing of boiler & turbine to meet the more stringent of the below mentioned requirements. 1. Nos. of cold/ warm/ hot start ups as mentioned in the specification as it represents worst case. (OR) 2. Daily load variation requirements of N1 & N2 as defined in the specification. (OR) 3. Load cycling for remaining 10 years of operation, after removing 15 years of standstill period because of number of startups mentioned. Any one of above three cases only will be considered for design. NTPC to confirm.	Bidder to note that the specified requirements are based on the future practical scenario of load cycling. Accordingly, bidder to work-out the most stringent cases and design the system accordingly. However, designing for only one (01) case among the three (03) as proposed by the bidder is not acceptable. Further details shall be discussed & reviewed during detail engineering in line with the specifications requirements. Bidder to comply the specifications requirements.
314	VI/B	G-01	2 of 4	1.04.02	For the steam generator, in addition to the above requirement, specific design features incorporated and design/process improvements which are being offered for N1/N2 cycles shall be submitted along with the bid. Such design features and design/process improvements over and above conventional design shall be clearly brought out by the bidder in its bid. The Bidder shall provide references for earlier supplied steam generators which meet the specified cyclic duty requirements...	The results of the Creep, Fatigue analysis will be provided during detail engineering, since this analysis requires the final geometry of critical components.	Agreed.
315	VI/B	G-01	2 of 4	1.04.00	-	Clause number missing	Pl. refer amendment (Amendment No : A-TG-15)
316	VI/B	E-01	1 of 13	1.01.01	Drum / Separator/ Storage Tank... (i) All full penetration welds shall be subjected to ultrasonic examination after stress relief.	UT will be done on full penetration nozzle welds only.	Bidder to meet the specification requirements.
317	VI/B	E-01	2 of 13	1.01.01	Drum / Separator/ Storage Tank... (l) Complete-Drum/Separator/storage tank/Mixing sphere shall be subjected to hydraulic pressure test.	Hydro test on mixing sphere is not envisaged.	Bidder to meet the specification requirements.
318	VI/B	E-01	2 of 13	1.01.02	Headers... (c) All full penetration nozzle and attachment welds shall be subjected to UT prior to stress relieving.	Prior to PWHT, UT is done on full penetration welds of carbon and low alloy steels. However, UT will be done on Gr 91/92 full penetration welds after PWHT. On all attachment welds only MPI will be done.	Shall be tied up during detailed Engg & finalization of MQP. On all attachment welds Specification to be fullfield.
319	VI/B	E-01	3 of 13	1.01.03	Tubes & Tube Elements... (i) Panel /Coils: In case of spiral wall design ,TA of complete wall of each side shall be carried out	Trial assembly will be carried out excluding V bend panel spiral wall tubes.	Shall be tied up during detailed Engg & finalization of MQP

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320	VI/B	E-01	5 of 13	1.01.06	Valves (a) Pressure retaining parts of valves shall be subjected to (min.) NDT as per Table 1.	NDT on valves is done as below: 1. For Class 600 and above all sizes of Casting (body, bonnet) are 100% RT tested. 2. Vendors are developed to produce RT quality casting for valves less than Class 600. Hence, MPI is not done. 3. In case of forged valves, UT is done for bar diameter ≥ 50mm used for forging and MPI done for finished forgings for all classes.	Bidder to meet the specification requirements.
321	VI/B	E-01	9 of 13	1.02.05	Coal Feeders (b) Type tests including degree of protection and routine tests shall be done as per relevant Indian Standards or equivalent International Standards.	Type test certificates for the feeder of same size and design on explosion proof test, weighing accuracy and repeatability will be submitted for review and acceptance.	The requirement of type test conductance shall be reviewed and finalised during detail engineering in line with the Contract requirements.
	VI/B	A-02	55 of 65	22.01.04	Type Test: Following tests on Coal Feeder (a) Explosion proof test at 50 psi as per NFPA codes (b) Weighing accuracy test at various speeds with coal flow. (c) Calibration and repeatability test at various speeds		
322	VI/B	E-01	10 of 13	1.02.07	EOT CRANES 3.0 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM 3.01 The plates of thickness 25mm and above shall be ultrasonically tested.	The plates of thickness > 40 mm shall be ultrasonically tested. Vacuum degassed condition is not envisaged for structural purpose and applicable only for pressure vessel components.	EOT is safety item hence UT above 20 mm to be followed.
	VI/B	D-1-10	2 & 3 of 4	10.04.01 & 10.04.02	...Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.		
323	VI/B	E-01	11 of 13	1.02.11	Steel Structure of Boiler... Ducts, Hoppers, etc. (a) Only material which has been identified against mill sheet or test certificates shall be used for construction.	Materials of t>40mm will be identified with TC and for others traceability will be from specification and grade only.	Bidder to meet the specification requirements.
324	VI/B	E-01	11 of 13	1.02.11	Steel Structure of Boiler... Ducts, Hoppers, etc. NDT requirements of structural steel welds (other than Coal Bunkers) shall be as under: (i) 100% RT /UT on butt-welds of plate thickness ≥ 32mm (ii) For plates of 25mm < thickness < 32mm - 10% RT and 100% MPI (iii) For plates of thickness <25mm – 10% MPI/LPI. (iv) All fillet welds of built up plate girders shall be inspected 100% by MPI.	Bidder practice is to carry out 1. 100% RT/UT on Butt welds of thickness > 32 mm for P1, ≥ 16 mm for P4, > 12mm for PSA, 2. For thickness > 25 mm and upto 32 mm 100% MPI, 3. For thickness ≤ 25 mm only 10% MPI is carried out. 4. 100% MPI will be done on fillet welds if both plates are of thickness > 25 mm, tension flange with bearing and stiffeners, splice plates with beams and 10% MPI on all other fillet welds	Bidder to meet the specification requirements.
325	VI/B	E-01	11 of 13	1.02.12	Drum Sling Rods (Required only with Boiler Drum)... (b) Welds shall be examined by UT and MPI after stress relief. (c) Trial fitment of the rods with the drum shell shall be carried out to ensure proper contact.	(b) UT is done before SR & MPI after SR. (c) The established process controls ensure the profiles of “Drum” and “Sling Rods” as per drawing. However, template check will be done.	b) NDT after SR is recommended. c) Item is critical. Trial fitment can not be substitute by Template check. Spec to be followed.
326	VI/B	E-01	12 of 13	1.02.13	Hangers & Supports: c) Butt Welds shall be tested for UT...	Butt Welds of thickness ≥ 32mm will be tested with UT (after PWHT for Gr 91). Butt welds of thickness < 32mm will be tested with MPI (after PWHT for Gr 91).	Bidder to meet the specification requirements.
327	VI/A	I	6 of 8	4.08.00	All the plant layouts shall be made in computerized 3D modeling system as detailed in Part C of the Technical Specification.	It is clarified that for Steam generator & auxiliaries, • 3D Plant review model of boiler reflecting “as designed” conditions will be delivered at the end of the project • 3D model will be utilized to develop plant layouts and for interference checking internally, however, finalized drawings will be completed using AutoCad • Major equipment & sub system of the boiler will be covered in the plant	Bidder to comply with the specifications requirements.
	VI/C	GTR	14 of 114	8.03.04, a), i)	All the plant layouts shall be made in computerized 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check...		
328	VI/B	D-1-6	22 of 24	6.04.03 corrosivity category C3	Painting of steel surfaces (other than those embedded in concrete) a) Surface preparation: Blast cleaning to Sa 2 1/2 grade b) Primer: One coat of Inorganic Ethyl Zinc Silicate DFT 70μ. c) Intermediate Coat: One coat of epoxy Polyamide cured pigmented MIO intermediate paint DFT 100μ. d) Finish coat: Aliphatic acrylic polyurethane finish paint DFT 70μ. Total DFT = 240μ.	Following painting scheme proposed as a clarification for steel structural components having operating temp <95°C, exposed to atmosphere (C3 environment) like Columns, Beams, Structures, Boiler supporting structures, Galleries, Bracings, Buck stays etc. a) Surface Preparation: Blast cleaning to SSPC-SP10. b) Primer: One coat of epoxy zinc phosphate primer to IS13238 - DFT of 30μ. c) Intermediate: One coat of epoxy based MIO coating - DFT 75μ/coat. d) Finish: 1) One coat of epoxy based finish paint to IS14209 DFT of 30μ. 2) One coat of aliphatic acrylic polyurethane paint to IS13213 DFT of 30μ. Total DFT = 165μ.	Bidder to comply with the specifications requirements.

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329	VI/B	A-12	4 of 8	Sl. No. 4	Piping hangers/ supports other than CLH/ VLH. (un-insulated) a) Power tool cleaning to SP3. b) Two coats of red oxide alkyd based primer as per IS-12744 to the DFT of 25µ/coat. c) Two coats of synthetic enamel (long oil alkyd) to IS2932 to the DFT of 25µ/coat. Total DFT = 100 microns.	It is clarifying that, tender specification will be followed for piping hangers/ supports (other than CLH/VLH) & un-insulated components like miscellaneous sheets, plates (having thickness <5mm) other than structural items mentioned above. (Operating temperature up to 95oC).	Bidder's Understanding is correct and applicable for Power Cycle Piping Related Hangers / Supports (Un insulated) only.
330	VI/B	A-12	4 of 8	Sl. No. 2	Design Temperature above 600C - 200 OC a) Power tool cleaning to SP3 b) Two coats of HR Aluminium Paint IS13183 Gr.III total DFT 40 microns (Minimum)	Following scheme is proposed as clarification for fuel pipes having temperature up to 120oC, since aluminum paint IS2339 withstands temperature up to 150oC. a) Power tool cleaning to SP3 b) Two coats of General purpose Aluminium Paint IS2339. Total DFT 40 microns (Minimum).	Bidder to refer cl. 1.06.09 of the referred sub-section chapter for fuel piping.
331	VI/B	A-12	6 of 8	B) Steam generator & auxiliaries, NOTE. 01	SG membrane walls and other flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.	Following schemes are proposed as CLARIFICATION as there is no specific painting scheme is given in tender specification. For Heat exchanger coils coming in the gas path (like Economizer, SH coils, water platens etc.). Power tool cleaning followed by one coat of dip-coat paint –Red-oxide Zinc phosphate primer to Bidder Specification . DFT = 35 microns. For components coming in the gas path like WW panels, headers, loose tubes etc. Power tool cleaning followed by 2 coats of Red-oxide Zinc phosphate primer.to IS 12744 DFT = 60 microns.	Bidder to note that the requirements for the SG membrane walls and other flue gas swept pressure part surfaces are already specified under the referred sub-section. Accordingly bidder to provide the adequate protection.
332	VI/B	A-12	6 of 8	B) Steam generator & auxiliaries, Sl.No.2	All surfaces with temperature above 95°C and which are insulated a) Power tool cleaning to SP3. b) Two coats of HR Aluminium Paint. total DFT 40 microns	Following painting scheme is proposed in line with Bidder Std. Painting Practice for all insulated components like hot ducts, Furnace Casing sheets, Riser tubes, External piping etc., a) Surface Preparation: SP3 by Power tool cleaning. b) Primer paint: 2 coats of red-oxide zinc phosphate to IS 12744 Total DFT = 60 µ.	Bidder to comply with the specifications requirements.
333	VI/B	D-1-6	24 of 24	6.04.06	Hand railings & ladders: All Mild steel (MS) handrails and ladders in outdoor locations shall be galvanised at the rate of 610 gm/sq.m as per IS 4736.	It is clarifying that following scheme is proposed for Hand rails, Posts, and ladders, chequered plates etc., a) Power tool cleaning to SP3 grade b) 1 coat of red oxide alkyd based primer as per IS-12744 to the DFT of 30µ/coat. c) 2 coats of Synthetic enamel to IS 2932 to a DFT of 20µ per coat (black shade) Total DFT = 70µ.	Bidder to comply with the specifications requirements.
334	VI/B	A-12	6 of 8	Point no. 2	For valves below 65NB and temperature up to and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.	Clarification For forged valves, Phosphating to thickness of 1500mg / Sq.ft will be done.	Bidder proposal not acceptable. DFT for all coats to be maintained as per specification requirement only.
335	VI/B	D-1-6	22 of 24	6.04.02 a)	Painting of steel surfaces embedded in concrete Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).	It is clarified that; temporary rust preventive fluid can be applied to protect these surfaces from corrosion until erection.	Bidder to comply with the specifications requirements.
336	VI/A	II-A-01	24 of 28	2.30.00	6. Flue Gas Ducts to be provided with strain gauge/ ash level meter at sharp bend locations of duct and common duct area after air-preheater.	Bidder requests NTPC to kindly elaborate on the type of ash level meter required for this application.	Radar type ash level measurement is envisaged for this application. However, any other technology for measurement as per bidder's standard/ proven practice is also acceptable.

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337	VI/A	II-A-03	1 of 1		Further, the related special monitoring & analytical instruments on account of bio-mass co-firing towards satisfactory performance of the boiler & auxiliaries are also included.	Bidder requests NTPC to provide the list of special monitoring and analytical instruments for Biomass co-firing.	Bidder to note that the details of special monitoring & analytical instruments shall be discussed and reviewed during detail engineering based on the bidder's specific offered design. The same may include (as a minimum) instruments like for temperature measurement at feeder inlet/bunker/bunker outlet portion, biomass flow detection/establishment from feeder, steam generator tubes/ walls thickness/corrosion detection & analysis on account of biomass co-firing etc.
338	VI/B	B-0	7 of 15	3.06.00	d) For protection of motors below 30kW, MPCB (only Short-circuit release) and Intelligent motor controller (IMC) with current sensing module shall be provided.	Soot blowers are fractional HP motors powered from Soot blower MCC (SBMCC). In line with our current practice for NTPC projects, bidder proposes to envisage conventional type Soot Blower MCC without Intelligent motor controller, numerical relay and associated specification requirements. Switch fuse units will be used in protection circuit of blowers in SBMCC. NTPC may please confirm.	Bidder's proposal is not acceptable. bidder to comply with specification requirements.
	VI/A	II-B	3 of 17	1.05.03	a) Communicable Numerical Relays (with IEC 61850) in all MV Switchgears & LV Switchgears in the bidder's scope		
339	VI/A	IIA-02A	1 of 3	2.00.00	... Liquid ammonia from the storage tank is sent through ammonia vaporizer and diluted with air before injection on upstream of SCR reactor.	Ammonia vaporiser and glycol/water heating system is not required per the standard design of the QSCRM. In the proven QSCRM ammonia injection design, liquid ammonia is forwarded by pump and vaporized in a heated air stream to the SCR reactors. All projects have been designed by the QSCRM to comply with applicable safety code (ANSI/CGA-G2.1-2014) and have undergone complete US OSHA process reviews for safety as applied for SCR systems and meets all safety requirements.	Bidder to comply with the specifications requirements.
	VI/B	A-01	26 of 101	1.05.19.04	iii) Ammonia Vaporizer System ...Glycol/Water/Glycol-Water heater...		
	VI/B	Annexure SS1	15 of 22	9.05.00	Ammonia Vaporizer		
340	VI/B	A-01	27 of 101	1.05.19.04	iv) b) Accumulators	Any sudden surge/drop in requirement can be absorbed by the system inherently, hence separate accumulator is not required. The differential pressure across the constant speed pump is maintained by the pump return line pressure regulating valve. This valve maintains pressure set point for any process upset that occurs (e.g., ammonia injection demand changes). The system design results in relatively constant ammonia supply to the injection flow control valve.	Bidder to comply with the specifications requirements.
	VI/B	Annexure SS1	16 of 22	9.06.00	Accumulator		
341	VI/B	Annexure SS1	2 of 22	2.06.00	Statutory Approval It shall be the responsibility of the Contractor to obtain the all necessary approvals/permits from the inspection/regulatory authorities etc. on behalf of the Employer, as may be required for design/calculations, manufacturing and erection procedure, testing etc. As called for under the statutes, regulations and the safety codes. All such documentation required to be submitted to the statutory authorities shall be submitted to the Employer for its review.	Employer to get all the statutory approval, Bidder shall support and furnish necessary documents.	Bidder to comply with the specifications requirements.
342	VI/B	A-01	23 of 101	1.05.19.01, 2	Each Reactor shall be sized - ii) 25% excess air	In line with Flue gas duct sizing, the SCR reactor shall also be sized for 20% Excess air.	Bidder to refer amendment A-SG-28 in this regard.
343	VI/B	A-01	25 of 101	1.05.19.03 i)	Height of catalyst module (maximum) (mm) – 1300 mm.	The catalyst is arranged layers, the total height limited to 1300 mm. These layers are arranged in a catalyst cage of height more than 1300 mm.	The specific aspects of product design shall be reviewed during detail engineering in line with the Contract requirements.
	VI/B	Annexure SS1	6 of 22	4.03.03	Depth of the module shall be determined based on cleaning efficacy of the selected catalyst de-dusting system but shall not be higher than 1300 mm.		
344	VI/B	Annexure SS1	1 of 22	2.02.00 f)	Prevention of plugging of the catalyst by ash particles, especially “popcorn ash”.	Popcorn ash is not generated in Indian coals. Hence plugging of the catalyst by ash particles will not occur. No preventive mechanism is envisaged.	Bidder to comply with specification requirement.

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345	VI/B	Annexure SS1	4 of 22	4.02.01	...The reactor casing shall be fabricated from all welded reinforced, 6 mm minimum thickness, carbon steel plates conforming to ASTM A36.	IS 2062 E350 material has a superior yield stress when compared to ASTM A36 and confirms to the min yield stress requirement suggested by QSCRM. Also There are no weldability issues while using IS 2062 E350.	The bidder can use the similar or superior alternate material suitable for the intended purpose.
346	VI/B	Annexure SS1	5 of 22	4.02.01 (d)	The reactor load shall be transferred from the reactor side walls, equally distributed via springs and external slide bearing pads, to the supporting steel structure.	The SCR reactor loads are distributed through reactor side walls and wall corner members to the SCR reactor base. The loads are then transmitted to slide bearing pads and finally to the supporting steel structure without the use of springs. This method of SCR reactor construction and load transfer is the proven standard design and practice of the QSCRM.	Bidder to note that the details shall be reviewed during detail engineering based on the bidder's specific offered design of the De-Nox system.
347	VI/B	Annexure SS1	15 of 22	9.04.05	Bypass line to the forwarding pump shall be provided to operate during periods when the storage tanks have sufficient pressure or during period when the pump is not available. Bypass line of each pump shall be adequately sized to meet the ammonia requirements of all the two (02) SCR Systems.	In the proven QSCRM ammonia injection design, liquid ammonia is forwarded by pump and vaporized in a heated air stream to the SCR reactors. Inclusion of forwarding pump bypass line inherently increases the number of potential ammonia leak points in the system and is not advised. Ammonia pump bypass line has not been installed on any of the QSCRM anhydrous ammonia projects and the standard redundant pump design provides suitable reliability for continuous operation.	Bidder to comply with specification requirements.
348	VI/B	Annexure SS1	17 of 22	13.02.00	Partition between storage tank and other ammonia handling and preparation equipment shall be provided.	As per proven practice of QSCRM, pump will be located as close to Tank to maintain a positive NPSH	Bidder to comply with specification requirements.
349	VI/B	Annexure SS1	19 of 22	15.01.04	All pressure relief valves connected in the ammonia pipelines shall be connected to pressure relief valve manifolds which are led back to the storage tank.	Discharge of pressure relief valves, including hydrostatic relief valves cannot be connected to the storage tank. Storage tank connection would result in back pressure on the relief valve. Please refer to ANSI/CGA-G2.1-2014 code. The relevant sections of the CGA code for pressure safety relief devices are 6.3, 5.83 and 5.84. The QSCRM standard practice is to route the pressure relief device discharge vent a minimum 3 m above nearest working platform within	This will be reviewed and finalised during detail engineering based on proven practice/ experience and safety issue in this regard.
	VI/B	Annexure SS1	18 of 22	14.01.00	Contractor shall design the Ammonia unloading, storage and handling system complying to the requirements of IS:4544, CGA G-2.1— 2014 6th Edition (formerly ANSI K61.1), OSHA etc.	Please refer to ANSI/CGA-G2.1-2014 code. The relevant sections of the CGA code for pressure safety relief devices are 6.3, 5.83 and 5.84. The required ammonia code does not allow discharge of the ammonia storage tank pressure relief to either the ammonia waste dilution tank or the boiler chimney. The QSCRM standard practice is to route the pressure relief device discharge vent a minimum 3 m above nearest working platform within 12 m such that persons, property and the environment are not harmed. The QSCRM has not installed a discharge into the chimney / Waste Ammonia	
350	VI/B	A-01	28 of 101	1.05.19.04, Note	In case the discharge from PRV's and blow-out of the loading arms are connected to the waste ammonia dilution tank instead of boiler chimney, waste ammonia dilution tank and retaining basin shall be sized considering maximum discharge of ammonia at any moment of time	The width of the platform shall be at least 3 m at Catalyst loading side. For other sides, Platform of 1.5m clear width shall be provided. The platforms for the catalyst modules shall be designed for loads of 1 t/m2 as per the proven practice of QSCRM.	This will be reviewed and finalised during detail engineering based on proven practice/ experience and safety issue in this regard.
	VI/B	Annexure SS1	19 of 22	15.01.09 (a)	The blow-off pressure relief valves of ammonia storage tanks, blow-out of the loading arms, pressure relief valves installed on pipes and which are connected to storage tanks shall be led up to boiler chimney/ Waste ammonia dilution tank for safe discharge.		
351	VI/B	Annexure SS1	21 of 22	16.02.00	Platform shall be provided at each catalyst elevation all around the reactor. The width of the platform shall be at least 3 m. The platform shall also be used as laydown area/ temporary storage for the catalyst. The depth of such platform on certain sides shall be worked out based on such requirements. The platforms for the catalyst modules shall be designed for loads of 1.6 t/m2. On the sides where Dedusting system get retracted the depth shall be higher as required.	The width of the platform shall be at least 3 m at Catalyst loading side. For other sides, Platform of 1.5m clear width shall be provided. The platforms for the catalyst modules shall be designed for loads of 1 t/m2 as per the proven practice of QSCRM.	Bidder to comply with the specifications requirements.
352	VI/B	Annexure SS1	22 of 22	18.00.00 (c)	For continuous measurement of NOx/SO2/O2 concentration in the flue gas, sample shall be extracted from all the four walls of the duct on the upstream and downstream of the SCR Reactor. The sample shall be uniformly mixed to have a single sample, truly representing the actual flue gas conditions. This sample shall be supplied to the online gas analyzers for analysis.	The QSCRM proven standard design incorpo-rates dilution extractive sampling subsystem for SCR flue gas NOx/SO2 measurement. Tender specification required sampling of O2 cannot be performed for dilution extractive systems as dilu-tion air biases the measurement. An insitu O2 analyser is envisaged accordingly. Additionally, specification requirement for flue gas samples to be extracted from all four walls of the duct(s) into a single uniform mixed stream has not been performed in QSCRM experience and is not advised for the application. Dilution extractive technique requires precise dilution ra-tio control for accurate measurement of flue gas constituents. Mixing samples streams requires additional unproven design complexity to main-tain accurate dilution control. With QSCRM Del-ta Wing static mixers, the flue gas is well mixed and the extracted sample is representative of actual process conditions required for SCR NOx control and monitoring.	Regarding O2 measurement, bidder's proposal is acceptable. Regarding sample collection, bidder to comply specification requirements.
353	VI/B	G-06	5 of 14	3.02.05	SCR SYSTEM Complete pre-commissioning work including tests of facilities such as pressure drop test of SCR system and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.	This clause is to be deleted as there is no SCR system supply.	Refer amendment A-SG-29 in this regard.

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354	VI-A	IIA-02A	3 of 3	Annexure-SG-04	j) Adequate nos. of HT/LT feeders for SCR/Hybrid load shall be provided. SCR/Hybrid load shall be taken into consideration for transformer sizing. n) Associated Civil, Electrical systems & C&I systems	j) NTPC shall furnish the electrical load (quantity, rating etc.) list in tender for arranging HT/LT feeders and transformer sizing for SCR/Hybrid system since the electrical equipments are not under Bidder's scope of supply. n) Since SCR/Hybrid system is not under bidder's scope of supply, the supply of associated Electrical, C&I systems, instruments, analysers are not possible and not envisaged by Bidder. Bidder requests NTPC to review and modify the specification requirement.	Bidder to refer the scope at cl.1 at Annexure- SG-04 of SS-IIA, part-A. Accordingly such systems are included towards SCR ready/Hybrid ready plant.
355	VI/B	Annex-SS1	13 of 22	9.02.06	After completion of unloading of ammonia from the tank truck, the compressor must be switched off by means of a flow monitor and the unloading process completed.	In line with proven practice of our SCR collaborator, completion of ammonia unloading operation from tank truck is identified by monitoring the tank truck liquid level and tank truck pressure for liquid transfer and vapour recovery phases respectively. However, Sight glass in ammonia liquid transfer line will be envisaged for monitoring the ammonia flow during unloading operation. Separate flow monitor is not used for switching off compressor. Bidder requests NTPC to review and modify the flow monitor requirement.	Bidder to comply with the specifications requirements. Further, the bidder may also give additional provisioning of flow monitoring as per safe & reliable standard practices.
356	VI/A	II A-01	5 of 28	2.09.03	Steam from Cold Reheat Line shall be predominantly used for soot blowers. However, during low load operation or during non-availability of soot blowing steam of appropriate parameters, alternate source can be taken from Super Heater circuit...	Soot blowing supply steam shall be taken from CRH line alone. The parameters of CRH steam are sufficient for regular steam blowing operation. Hence additional steam tapoff from Superheater circuit is not required and not envisaged.	Bidder to comply with the specifications requirements.
357	VI/A	II A-01	13 of 28	2.15.05	Seal Air Fans ...electrically operated Inlet Guide Vanes,...	Offered Seal Air Fans have Inlet damper instead of inlet guide vane. Electrically operated 'Inlet dampers' are envisaged.	Refer amendment A-SG-30 in this regard.
	VI/B	A-02	22 of 65	10.05.01, D)	Seal Air System (a) 2x100% centrifugal seal air fans with electrically operated Inlet Guide Vanes...		
358	VI/A	II A-01	21 of 28	2.24.01, (b, 2)	(vi) Four (4) nos. of pneumatic emergency retract drives with matching crank tools for each type of soot blower shall be provided...	Pneumatic emergency retract drives are not envisaged for this project. As per Bidder standard practice Emergency Hand crank shall be provided, which can be engaged to move the lance manually to the home position. This is functionally equivalent to the specification requirement.	Bidder to comply with the specifications requirements.
359	VI/A	II A-01	24 of 28	2.30.00	Specific features catering to boiler reliability... 4. Ceramic removal pads insulation to be provided in area requiring frequent insulation removal like Burner panel area and soot blower area.	1. Burner Panel / Wind box will be insulated with Ceramic Fiber Blanket in place of Ceramic Pad type insulation as the application area needs flexible type of insulation material. 2. Soot Blower area is covered with a seal box, which is filled with Castable Refractory of Gr. A and over the seal box Ceramic Blanket insulation will be installed.	Agreed
	VI/B	A-13	7 of 8	2.03.00 (9, b)	Burner panel and Soot Blower area. - Ceramic Pad type insulation		
360	VI/A	II A-01	24 of 28	2.30.00	7. Boiler to be provided with vacuum cleaning system network to ensure proper hygiene. In this context portable system to capture the ash around the boiler peripheral surface shall be provided along with net worked transmission of captured ash to a common location. Following specific elevations of Boiler requiring installation of vacuum cleaning arrangement in Boiler Front, Rear, LHS and RHS are also to be covered other than required areas: 1) Penthouse Floor 2) Gooseneck area floor covering both first pass and backpass. 3) Boiler Scaffolding door floor covering both first pass and backpass 4) Top wall blower tier floor covering both first pass and backpass 5) Top burner top floor covering both first pass and backpass 6) Burner bottom floor covering both first pass and backpass 7) S Panel (approx.8.5 to 9M)	NTPC requested to provide more details / reference of this system. Bidder understanding is to provide portable vacuum cleaners (7 Nos.) with de-dusting bin at each location.	The detailed aspects of such cleaning system shall be discussed during detail engineering in line with the specified requirements.

361	VI/A	II A-01	24 of 28	2.30.00	8. Safety valves and critical valves to be provided with temperature & sound monitoring (may be IOT based) to detect early passing and ensure reliability. Temperature point shall be provided on these valves/lines. For control and monitoring purposes the temperature values shall be taken between 50-75 Deg. C and sound value normally less than 75 db as trigger. The necessary provision shall be accordingly provided with alarm signal in the control room. Further, following may be noted w.r.t. above scope for temperature measurement on critical valves for passing a. All valves including drain and vents in critical piping such as M.S.Stop valves and its integral bypass valves, Boiler Startup vent, M.S.Pipe drains and vents, CRH & HRH pipe drain & vents b. All master drains of SH and RH spray station. c. Drains & Vents of circulation system d. Sonic leak detection system installation in Safety valves & ERV: 1) Installation of Sonic leak detection system installation in all SLSV and ERVs of critical piping's such as M.S. Safety Valves & ERV/EBV, CRH SV, HRH SV & ERV/ EBV.	Bidder understand metal temperature measure-ment for valves mentioned at points a, b & c and sound monitoring for safety valves and ERVs mentioned at point d. NTPC to confirm.	Confirmed
362	VI/A	II A-01	27 of 28		Architectural Features for Steam Generator Enclosure ...2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof with access through staircase / lift.	Pitched roof will be provided with 10deg slope. Approach through staircase/lift will be provided only up to ceiling platform level.	Refer amendment A-SG-31 in this regard.
363	VI/A	II C	28 of 41	6.02.00	All electric actuators, pneumatic control valves, Junction Boxes, Solenoid boxes and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering	Actuators including motor, integral starter, control transformer unit and all control devices shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure, which shall include the 'O' ring for complete environmental protection. The same shall be suitable for outdoor applications. Hence, canopy shall not be provided.	Bidder to comply with specification requirements.
364	VI/A	IV	2 of 73	1.00.01, (g)	PG test shall be performed by using process instruments envisaged for normal operation and control of unit. Any additional instrument/item required for PG test shall also be supplied by the contractor. Instruments to be used for PG test shall be indicated in the respective P&IDs. Control system loop tuning required to limit the variation of parameters during performance guarantee testing shall be completed prior to PG Test / initial operation. Test result for PG test is envisaged to be computed in DDCMIS.	Most of the boiler parameters will be recorded through plant instruments only. Flue gas & Air side temperature measurements will be done as per grid based method (In line with Code requirement) and Due to corrosive environment, keeping more number of TCs & O2 tapping Probes continuously in the field may leads to failure/chocking of these instruments. Hence, as per specification, additional instruments like TCs and probes required for PG Test will be supplied along with main supply. However, installation of these instruments can be done at site just before the PG test. Calibrated Flue gas analyser will be brought to site for measuring flue gas composition @ ECO outlet / APH Outlet offline.	Bidder to comply with the specifications requirements.
365	VI/A	IV	12 of 73	1.01.03.03 (i)	Test Code : As per BS EN 12952-15:2003 (By loss method based on GCV of Coal)	Correction to the tested efficiency will be as per provisions in BS EN 12952-15:2003 code. No separate correction curves will be provided.	Bidder to comply with the specifications requirements.
	VI/A	IV	12 of 73	1.01.03.03 (iii)	Test Conditions Boiler operating with rated excess air, coal fineness and firing design coal.		
	VI/A	IV	12 of 73	1.01.03.03 (ix)	Correction to tested efficiency shall be applicable for variation in following parameter only: a. Ambient air temperature. b. Relative humidity of ambient air. c. Hydrogen in coal. d. Moisture in coal. e. GCV of coal. f. Percentage of ash in coal		

	VI/A	IV	14 of 73	1.01.03.03 (xi)	The Bidder shall furnish the correction curves, for Employer's approval covering the expected ranges of variations for all these parameters for the range of coal specified.		
366	VI/A	IV	29 of 73	1.03.02 (v)	Temperature of tubes at steam generator water wall outlet: The contractor shall guarantee the following temperature values pertaining to steam generator water wall tubing: a) Maximum tube to tube temperature differential between any two adjacent tubes. b) The maximum deviation of temperature of any tube w.r.t. to the average temperature of all the tubes. The tube metal temperatures shall be measured at the intermediate header (spiral to vertical / rifled tube wall to vertical plain tube wall changer over), if provided, and outlet of the water walls (end of furnace) at minimum once through load of the steam generator with firing range of coals along with oil firing. The same shall be demonstrated during plant operation by measuring the tube temperatures by affixing thermocouples as specified in sub section A-02 of Part B of the technical specification.	The offered boiler is tangential firing with water wall construction of spiral wall type. Each tube of spiral wall passes through all four walls of furnace while absorbing heat from water wall inlet to spiral wall outlet and also intermediate header is provided enabling uniform temperature entering vertical wall section. This arrangement results in less variation in tube to tube outlet temperatures. Hence thermocouples are not envisaged on each tube of evaporator and demonstration of this variation also not envisaged. Also, there is no separate clause in sub section A-02 of Part B, Section VI, specifying nos. of thermocouples as mentioned.	Bidder to comply with the specifications requirements.
	VI/B	A-02			No clause		
	Attachment 8		3 of 13	B, I, (v)	Temperature variation in steam generator water wall tubes...		
367	VI/A	IV	29 of 73	1.03.02 (vi)	Water wall corrosion/erosion rate: The contractor shall demonstrate that the average thinning in the water wall tubes in the furnace due to corrosion, erosion etc. does not exceed the specified value as per Sub section-A-02, Part-B (Mechanical), of Technical specifications. The same shall be demonstrated by calculating the average thinning in the water wall tubes in the furnace by measuring the tube thicknesses between two overhauls at about 1500 locations arranged in a grid around the furnace. The areas to be covered under the grid shall include burner zone extended upto the OFA Nozzle location.	As performance of boiler pressure parts depends on many variables viz. fuel, operating conditions, O&M practices etc. this demonstration of corrosion rate is excluded. Also, there is no separate clause in sub section A-02 of Part B, Section VI, specifying value as mentioned.	Bidder to comply with the specifications requirements.
	VI/B	A-02			No clause		
	Attachment 8		3 of 13	B, I, (vi)	Water wall erosion/corrosion rate...		
368	VI / B	A-01	6 of 101	1.05.02, (d)	The working fluid temperature to be considered for design of pressure part tubes starting from water wallbottom ring header upto and including the water wall outlet headers shall be arrived by adding an additional margin of minimum 40°C to the maximum predicted/expected fluid temperature in these pressure parts. The working fluid temperature to be considered for design of pressure parts starting from downstream of water wall outlet headers upto first stage of superheater attemperation shall be arrived by adding an additional margin of minimum 15 deg C to the maximum predicted/expected fluid temperature in these pressure parts. The margins as per IBR and other codes shall be taken over and above the working fluid temperatures so arrived. For the other pressure parts where no design margin is specified in the IBR and the above specified 40 °C or 15°C margin is not applicable, the working fluid temperature to be considered for design of pressure parts shall be arrived at by adding following margin to the maximum predicted/expected fluid temperature in these pressure parts: i) 5 °C for inlet headers and its connecting tubes, pipes downstream and upstream of attemperators and other pipes in pressure parts. ii) 15°C for outlet headers and their connecting tubes except at final super heater and final reheater outlet. iii) For final super heater and final reheater outlet a margin of 5°C shall be taken.	Pressure parts design temperature will be based on worst case of all operating conditions and over and above adding additional margin will increase the thickness of the pressure part components. For cyclic loading design thickness of components is important and should be as minimum as possible and hence margins will be as specified in the IBR. NTPC is requested to remove requirement of additional margins specified in the specification.	Bidder to comply with the specifications requirements.

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369	VI/B	A-01	7 of 101	1.05.02, (e)	(v) Upto & above 610 degree Celsius Austenitic stainless steel, SA- 213 UNS S30432 Shot Peened, TP347H FG or approved equivalent.	TP347H Shot peened also shall be included in the list.	Bidder to comply with the specifications requirements.
370	VI/B	A-01	8 of 101	1.05.04, (5)	Means of Temperature Control (b) REHEATERS* Tilting of burners/gas biasing/gas recirculation (gas to be tapped off after ID fans), spray water attemperation (utilising water tapped off from interstage of BFP)	Excess Air will be used for RH Temperature control as per Bidders practice.	Agreed. However, the bidder to carefully select the excess air requirement and within allowable limits as governed by the upstream and downstream equipment sizing (like FD & ID fan) so as also not to increase the pressure drops, velocities & power consumption of the equipment/fans handling air & flue gas.
371	VI/B	A-02	5 of 65	3.01.04	Furnace Bottom hopper Design of Boiler and its supporting structure shall be considering 50% ash/clinker loading in furnace bottom hopper and corresponding to ash density of 1600 kg/m3. Further minimum sixteen (16) Nos. of load cells shall be installed by Contractor in the furnace roof enclosure to give indication of ash build up in the furnace bottom hopper. The contractor shall provide the design basis for the selection for number of load cells, their distribution and fixing up of alarm set points.	For supercritical boilers with spiral wall construction, the tubes are almost horizontal and ash accumulation is to be avoided to protect the panel tubes from deformation. Boiler should not be operated with ash accumulation in furnace bottom as this is an unsafe condition and boiler should be stopped immediately if accumulation is happening. Hence the 50% ash load will not be considered in Furnace hopper bottom.	Bidder to comply with the specifications requirements.
372	VI/B	A-02	8 of 65	3.07.00	Provide stainless steel expansion markers/indicator on all the four furnace walls to monitor thermal expansion. Predicted thermal expansion at different levels to be indicated. In addition to local indicators, measurement system (4-20mA Output) for remote indication shall also be provided on all the four furnace walls.	Product meeting this specific requirement is not available with contacted vendors & online sources. No such system can be offered.	Bidder to comply with the specifications requirements.
373	VI/B	A-02	11 of 65	6.04.00	The pump shall be suitable for cyclic operation as specified in part-A-01 of part-B of the technical specifications. The specific features adopted in this regard shall be brought out by the contractor like casing shape & design including its curvature/corner radius, stress concentration areas, no. of pieces/joints for a pump casing, materials adopted, performance monitoring etc. with proper justification. A CFD and FEM analysis to conform to specified cyclic requirements shall be carried out and furnished by the contractor alongwith the pump data sheet. Online monitoring requirements on the pump casing/heat barrier shall be recommended by the OEM like an array of thermocouples to give adequate indication of temperatures. The pump OEM shall share the test/inspection/feedback data of high load cycling power plant cases where the offered pump design has been successfully run.	Boiler recirculation pump is in operation during wet mode/less than minimum once through load only. Cyclic loading requirements are specified for the loads above minimum once through load, where pump will not be in operation. Hence these additional requirements are not required and not considered.	Bidder to comply with the specifications requirements.
374	VI/B	A-02	12 of 65	7.01.01, (3)	Construction of Superheaters & Reheaters Maximum depth of tube banks/ sections in the direction of gas flow: 2 metres or maximum soot blowing radius, whichever is lower	Due to design requirement/limitations, tube banks / sections depth will be <2.5 metres for some vertical SH/RH pendant sections. However it will be limited to maximum soot blower radius.	Refer amendment A-SG-32 in this regard.
375	VI/B	A-02	13 of 65	7.01.01, 10	Space Provision Keep provision of space for atleast 20% addition of additional economizer and 10% for the reheater surfaces in future. The surface pro-visioning shall be flue gas upstream section of the economizer. Structure/hanger design shall be suitable for loads due to these additional surfaces (filled with water) also.	Bidder understands, provision of space requirement mentioned is for the heating surfaces provided in second/back pass (horizontal banks). NTPC to confirm.	Confirmed

376	VI/B	A-02	14 of 65	7.02.02	For continuous monitoring of temperature var-iation across the length of the headers, six (06) thermocouples shall be provided on each Su-perheater header and reheater header except the final superheater header. The number of thermocouples for each final superheater header shall be 30. This require-ment is over and above the requirements specified in clause no. 7.02.01 above.	Thermocouples will be provided on inlet and outlet headers of Pendant / Horizontal superheater / reheater sections only. Headers of steam cooled Roof / Enclosures are not considered for this requirement.	Bidder to comply with the specifications requirements.
377	VI/B	A-02	40 of 65	13.01.09 (b)	(2) ...Such internal stiffeners for the flue gas duty between boiler and ESP shall be provided with erosion protection shields.	Internal stiffenetrs are provided with sufficient thickness to take care of the flue gas erosion. Separate erosion protection shields are not required.	Bidder to comply with the specifications requirements.
378	VI/B	A-02	47 of 65	15.18.00	The furnace should be provided with wall blowers so selected such that cleaning coverage per wall blower should not be more than 2m in radius and there should be no left out portion. One wall blower elevation below the lowest burner elevation shall be provided along with wall blowers located immediately above top elevation coal burners upto the horizontal plane at the furnace nose tip at entry to the radiant superheater...	Bidder does not recommend wall blowers upto the horizontal plane at the furnace nose tip. Wall blowers will be provided in furnace zone below intermediate header (spiral to vertical wall). Presence of spiral wall support systems, Buckstays & furnace opening limits space availability to locate wall blowers above intermediate header in vertical wall upto the horizontal plane at the furnace nose tip.	Bidder to comply with the specifications requirements.
	VI/B	A-02	48 of 65	15.21.00	While deciding coverage of LRSBs the maximum coverage of LRSB shall not be considered more than 2m.		
379	VI/B	D-1-5	5 of 120	5.02.04	Bidder shall integrate the boiler supporting structure with Mill & Bunker Building Structure.	Boiler structure will be integrated with Mill & bun-ker building structure through interconnection plat-forms at required levels.	Confirmed
380	VI/A	II D	10 of 13	1.00.01	All steel structures shall be fabricated in factory, transported and erected at site. All factory-fabricated structures shall have bolted field connections.	All boiler structural members will be fully bolted field connections except, secondary members (floor beams) connection to primary member which will be site welded as final inputs will not be available during release of fabrication drawings for primary structure/main boiler structure (i.e., column, column connecting beam, vertical bracings).	It is already covered in the refered clause 8.07.00
	VI/B	D-1-6	8 of 24	6.03.04	Shop connections will be welded type and all field connections will be bolted.		
	VI/B	D-1-8	9 of 19	8.07.00	All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections... Note: ...Site welding can be permitted in special cases where final inputs are not available before release of fabrication drawings.		

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
381	Part-A	SUB-SECTION-IIIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 10 OF 17	1.16.05	FOTE (Fiber Optic Terminal End) Equipment along with all necessary accessories	a. Kindly provide the line length of each line. b. We understand that remote end FOTE is not in scope or bidders. Please confirm. d. Please provide the specification and BOQ of FOTE system	a. length shall be provided in detail engineering. b. confirm d. Pls refer Amendment B-18 .
382	Part-B	SUB-SECTION-B-17 SWITCHYARD	Page 2 of 60	1.01.15	The switchyard shall be provided with peripheral roads and roads for maintenance/approach for GIS equipment, GIS Duct, major AIS equipment for maintenance purpose	We are not considering any periphery road inside switchyard fence due to limited space. Main road outside switchyard fence shall be connected to maintenance/approach roads inside switchyard. Please confirm.	Bidder proposal is not acceptable. Bidder to comply technical specification.
383	Part-E Tender Drawing	SECTION - VI			Dwg No.: 4540-001-POE-J-001, Rev:A SINGLE LINE DIAGRAM	We understand that spare bay shown in SLD of 400kV Switchyard is future Bus Reactor bay. Please confirm or else specify the type of spare bay.	Bidder understanding is not correct. The spare bay indicated in SLD shall be used as line bay in future.
384	Part-E Tender Drawing	SECTION - VI			Dwg No.: 4540-001-POE-J-001, Rev:A SINGLE LINE DIAGRAM	Rating of wave trap shown in SLD is 1 mH. We understand that 0.5mH wave trap is also acceptable meeting the blocking bandwidth.	Bidder proposal is not acceptable. Bidder to comply Technical specification.
385	Part-E Tender Drawing	SECTION - VI			Dwg No.: 4540-999-POC-F-001, Rev:0 GENERAL LAYOUT PLAN	We understand that transmission line corridor shown in plot plan is only for Line I & II. Please confirm.	Transmission line corridor for both 400KV double circuit transmission lines is indicated in the plot plan.
386	Part-E Tender Drawing	SECTION - VI			Dwg No.: 4540-999-POC-F-001, Rev:0 GENERAL LAYOUT PLAN	Kindly clarify the scope for 33kV and 11kV common Misc/service switchgear shown in 400kV Switchyard Area.	33kV and 11kV common Misc/service switchgear scope are in bidder scope in line with SLD
387	VI/B & SLD 4540-001-POE-J-001	B-04	3 of 33	1.02.00	Neutral Grounding Reactor (As applicable)	As per SLD Shunt reactor required is as bus reactor, therefore Bidder understands that there is no requirement of NGR and Surge arrester, as specified in bid document. Kindly confirm & issue suitable amendment.	Confirmed.
388	SLD Drg No.-4540-001-POE-J-001	--	---	---	OLTC	As per SLD, Bidder understands that there will be requirement of Remote tap changer control, for which specification is not available, kindly provide the same.	RTCC panel not in the scope of bidder
389	Part B	SUB SECTION B-05(A)	Page 6 of 7	3.00.00 (h)	Wireless temperature monitoring system to be provided and same shall be integrated to DDCMIS/ separate HMI. Position of such sensors shall be decided at the time of detailed engineering.	Customer is requested to kindly share the further technical details of this wireless temp. monitoring system & available vendors name for this system.	The wireless temperature monitoring system shall be accorded as per the OEM standard and shall be installed at different busbar, breaker contact and position shall be decided at the time of detail engineering.

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390	SEC-VI/ PART-B	B-13	1 OF 46	1.00.10	For SAS without process bus, Bay level units shall be located in switchyard AC kiosks of respective bays.	Since SAS called in the specification is with process bus, customer to clarify the requirement of AC Kiosk.	Bay level units for SAS where process Bus is not envisaged shall be placed in AC Kiosks. For SAS with Process bus, Panels shall be placed in SAS CRP room. Bidder to comply to Technical specification.
391	PART-B	B-13	1 OF 46	1.00.12	Adequate number of BCU shall also be provided for control and monitoring of all auxiliary buses of ICT/TT and associated isolators, as applicable.	Refer SLD of 400KV Swyd 9587-999-POE-J-001, Rev-A, No ICT bay is envisaged, hence additional BCU will not be required.	Bidder understanding is correct. Additional BCU for ICT is required only when ICT is present in Switchyard.
392	PART-B	B-13	1 OF 46	1.00.13	The interface between BCU and Control Switching Devices shall be in Bidder's Scope.	CSD is non 61850 compliant and is also not shown in SAS communication architecture. Hence CSD interface with BCU shall be hardwired as required.	Bidders understanding is correct.
393	PART-B	B-13	13 OF 46	10.01.00	The Data communication network shall be made on fault tolerant ring, excluding the links between individual bay IEDs to switch wherein redundant connections are not required.	Customer to reconfirm that for links between individual bay IEDs to switch, redundant connections are not required.	Data communication network has been shown in SAS Architecture. Please refer SAS Architecture for better clarity. Redundant connections are not required for same switch.
394	PART-B	B-13	13 OF 46	11.00.00 (iii)	The layout of equipments/panels in AC kiosks shall be subject to Owner's approval. The kiosk shall be provided with fire alarm system with at least two smoke detectors and it shall be wired to SAS. The air conditioner provided in kiosk, as applicable, shall be controlled and monitored from SAS.	Since SAS called in the specification is with process bus, customer to clarify the requirement of AC Kiosk.	AC Kiosks are applicable only in case where SAS without process Bus is required.
395	PART-B	B-13	20 OF 46	11.02.03.03	Meter shall be as per the requirements outlined in clause 12.00.00. These meters will be located in Generator Relay Panel.	Since the meters for Generator and UT are to be located in GRP far away from metering LAN envisaged in switchyard, these meters will be standalone meters.	Bidders understanding is not correct. All the ABT Meters shall be part of Metering LAN.
396	PART-B	B-13	51 OF 78	12.02.00	Contractor shall supply energy meters along with metering station, 4 Nos. machine Clients, 20 nos. web client license.	Customer to confirm that 4 nos. machine clients called is only for license or 4 nos. separate metering station to be considered along with license.	Metering station is the central server and 4 Nos Client machines are clients to it.
397	PART-B	B-13	29 OF 46	12.01.00	ABT type meters shall also be provided for Station Board Interconnection between the units, Colony Feeders (02 Nos) and Solar Feeders (Min 02 Nos or as per detailed engineering).	Kindly confirm the quantity of ABT meters required. Also confirm whether these meters are to be supplied loose or separate Energy meters are to be supplied.	Quantity for the ABT meters is confirmed. These meters shall be supplied loose. However, connection of these meters along with necessary hardware shall be in the scope of the Bidder.
398				Drg: 4540-001-POE-J-002	Substation Automation System Architecture	Kindly clarify DMZ shown in CER-1.	DMZ is a configuration in the way we connect our network to an external network. The change is only in the way we connect and DMZ functionality can be achieved through most of the NGFW we are already using.
399	General				Air Circuit Breaker requirement for Outgoing Motor and Outgoing supply feeder	Kindly clarify the current rating for ACB controlled motor feeder and supply feeder. However we have considered 110 KW and above motor feeder with ACB and 630A and above supply feeder shall be ACB controlled. Kindly confirm.	Bidder proposal is not acceptable is not acceptable. I. 90Kw and above motor feeder shall be ACB controlled(DM type). II. outgoing feeder above 400A shall be Air circuit breaker(DAE type)

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400	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCKS,		pg no 29 of 50	19.06.00	One (1) Triple pole/Single Pole/Double Pole MCCB for M/M1/M2 modules respectively	Bidder propose for below modification: upto 100 A shall be SFU controlled 100A and upto 630 A MCCB controlled 630A and above shall be ACB controlled. Kindly issue suitable amendment	Bidder proposal is not acceptable. Bidder to comply Technical specification.
401	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS		PAGE 3 OF 15	1.05.02	All Switchgears, Motor Control Centers (MCCs) & AC/DC distribution boards, etc. shall have at least twenty per cent (20%) or minimum two (whichever is higher) fully equipped switch fuse modules of each rating as spares	In the above clause, it is mentioned Supply feeder with MCCB module and in this clause it is mentioned SFU module .Kindly confirm .	Bidder understanding is correct. Please read switch fuse as MCCB.
402	4540-99-POC-F001 Rev 00 General Plant Layout	4540-99-POC-F001 Rev 00 General Plant Layout				We understand there are no facilities & buildings in the proposed region of the limestone handling. Customer to confirm the same as during site visit this region was outside the plant boundary and could not be visited. However only vegetation was visible from inside the plant boundary. NTPC to kindly give confirmation regarding the same.	Bidder's understanding is correct.
403	Section-VI	Sub Section-A-12	5 of 12	4.00.00	The Fire detection and protection requirement has not been envisaged for make up water Pump house at Samal Barrage discharge.	Bidder has not considered any Fire detection and protection system for make up water Pump house at Samal Barrage dicharge which is 28 km away from Main Plant boundary. Kindly check and confirm the same.	Bidder's understanding is not correct. Bidder to refer clause 4.00.00, g) & h), Page 7-9 of 12, Sub-Section-A-12 (Plant Utilities), Part-A of Technical Specification.
404	sec-vi/B	E-32/QA		NDT(DP/UT/RT/MPI) on Generator Busduct & NG Equipment		Specific application on joints to be indicated. We shall conduct only DP tests on weld joints.	Since the Generator bus duct is a critical item, Bidder to meet the specification requirements

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405	SECTION – VI, PART-A SUB-SECTION-I		6 OF 8	4.06.00	One set of all special tools and tackles including testing, calibrating and measuring instruments required for erection, assembly, disassembly and maintenance and testing of all equipment/systems covered under the scope of the contractor shall be supplied by the Contractor as per relevant clause indicated in Part-C of Section-VI and as specified elsewhere in Part-A of Section-VI of Technical Specifications. The Contractor shall not use these special tools, tackles and testing/measuring equipment for erection/commissioning purposes and shall be in an unused and new condition, when they are handed over to the Employer. A list of all such special tools and tackles shall be submitted along with the offer.	We understand that special tools and tackles are required for erection as well as maintenance of the plant. Also, the same shall be supplied along with the equipment at no extra cost to the employer. Only ONE set of special tools shall be supplied under the contract & the same shall be used by the contractor during the erection of the equipment. After plant COD the special tools (which were used during the erection) shall be handed over to the employer for future use in good condition or replace with new tools, if damaged. Please clarify if our understanding is correct.	Bidder's understanding is not correct. The Contractor shall not use these special tools, tackles and testing/measuring equipment for erection/commissioning purposes and shall be in an unused and new condition, when they are handed over to the Employer. A list of all such special tools and tackles shall be submitted along with the offer.
406	SECTION – VI, PART-A SUB-SECTION-I		6 OF 8	4.03.00 i)	All the first fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases (excluding H ₂ , CO ₂ and N ₂ for Generator) etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases, etc. (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate Containers.	Please clarify the following: 1) We understand that one year topping requirements of consumables to be considered from completion of facilities 2) Since hydrogen generation plant is in bidder's scope, we understand that supply of H ₂ and CO ₂ gas cylinder for one year topping requirement is excluded from bidder scope of supply. Only supply of H ₂ and CO ₂ and N ₂ cylinders as applicable for the generator till successful commissioning of the generator will be included in bidder scope of supply. 3) N ₂ cylinders are required only during long term preservation. Hence, the same will not be provided for one year topping requirement. 4) Owner to clearly identify the essential chemicals & clarify.	Following may be noted against the four (04) nos. sub-clarifications- 1) Bidder's understanding is correct w.r.t. clarification at 1). 2) Bidder's understanding is not correct regarding Hydrogen Generation Plant. Hydrogen Generation Plant has not been envisaged in subject tender. 3) N ₂ cylinders to be provided as per requirement up to one year's topping period in line with the specifications. 4) Essential chemical required up to one year's topping period. Identification & requirement of essential chemical will be based on selected equipment by Bidder.
407	SECTION – VI, PART-A SUB-SECTION-I		5 OF 8	4.02.00	Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose	This clause may please be waived off and Employer to provide fuel oil and coal free of charge beyond the quoted quantity when project is delayed or additional requirement of the fuel oil and coal arises due to reasons pertaining to the Employer	Biider's request for waiving off the clause is not acceptable. Bidder to comply the specifications requirements. Since commissioning/Initial operation activities is totally in control of bidder. Hence delay of implementation of project will not affect the consumable requirement. Any additional requirement (coal & fuel oil) which is specifically agreed by employer during the commissioning/Initial operation activities due to employer's requirement/reason shall be considered.

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408	SECTION – VI, PART-A SUB-SECTION- IID		11 OF 13	2.01.00 a)	Development of Bidders temporary staff colony and labour colony along with toilets & fencing etc. Bidder may use Area-A for Labour Colony. For safety of labour, bidder to provide separate approach road for their movement, as per site conditions, which shall be completely isolated from material movement road/path. No material movement shall be allowed on approach road meant for Labour colony.	We understand that proposed Laydown area - A, B,C is not mandatory to be utilised as labour colony or material storage purpose respectively. Please confirm. Development of the abandoned ash dyke should not be under scope of bidder. NTPC To provide suitable graded land free of cost for laydown, pre-assembly, labour colony, storage, etc. Additionally, NTPC to allow bidder to opt for its own arrangement for the above.	Bidder to refer Amendment no. D1-36 and D1-37
409	SECTION – VI, PART-A SUB-SECTION- IID		2 of 13	1.00.00 (4)	Dismantling of all existing facilities and disposal of dismantled material is in the scope of the bidder. The bidder has to take care this aspect while bidding. Bidder shall be responsible for safe disposal of all such materials outside the plant boundary in environmentally friendly manner meeting all statutory requirements.	We understand that dismantled material shall be the property of the bidder after dismantling. Kindly confirm	Confirmed.
410	SECTION – VI, PART-A SUB-SECTION- IID		1 of 13	1.00.00 (4)	Refer Annexure-P in PART-B along with Tender Drawing No. 4540-999-POC-A- 015 - EXISTING FACILITIES / BUILDINGS WITHIN STAGE-III PLANT AREA, for tentative list of existing facilities. The list is only indicative and may not be exhaustive/complete.	There is ambiguity in the list of dismantling of the existing facilities. plz clearly mention the facilities to be dismantled by Owner.	Existing facilities to be dismantled are covered in Cl 1.00.00 and Annexure-P of Part-B. Bidder to also refer Amendment no.D1-4 & D1-29 for change in scope of dismantling
411	SECTION – VI, PART-A SUB-SECTION- IID		3 of 13	1.00.00 (4(a)-xv)	Central Store facilities including store sheds, Office building, material storage yard, scrap yard, weigh bridge etc..	Kindly provide the list of other facilities to be dismantled by Owner apart from mentioned list.	Existing facilities to be dismantled are covered in Cl 1.00.00 and Annexure-P of Part-B. Bidder to also refer Amendment no.D1-4 & D1-29 for change in scope of dismantling
412	SECTION – VI, PART-A SUB-SECTION- IID		1 of 13	1.00.00 (4)	Dismantling, removal, and disposal of identified facilities/ structures/ substructures/ foundations of dismantled quarters/buildings/structures, reinforcement, pavement/paving, pipes and any underground structure/materials, debris etc. all complete.	It is understood that dismantling of facilities outside the plant area is not in the scope of bidder. Kindly confirm.	Existing facilities to be dismantled are covered in Cl 1.00.00 and Annexure-P of Part-B. Bidder to also refer Amendment no.D1-4 & D1-29 for change in scope of dismantling

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413	Section VI Part A/ Sub Section II B		7 of 17	1.15.00	To meet the construction power requirement of the project, the Employer shall provide Two (02) number 6.6 kV sources through two number 220/6.9kV transformers. Bidder shall step up this power to 11kV level by providing minimum two numbers suitably rated 6.6/11.5kV transformer and associated 6.6kV RMU panel and 11kV RMU panles as perTender drawing number 4540-999-POE-F-00C. Bidder shall provide suitable 11kV O/H ring main in complete area under its scope. Bidder shall employ suitable number of 11/0.415kV Packaged Substation (PSS)/ pole mounted/Pad Mounted transformers (with proper fencing arrangements) and associated switchgears (meeting safety requirements as per IE rules)to meet the construction power requirements at the various locations included in the bidder's scope. Suitable metering arrangement along with associated Instrument transformers and Metering Cubicles meeting the DISCOM requirements shall be provided by the bidder at supply point of Construction power, for the measurement of actual energy consumed. The charges only for the actual energy consumed by the bidder (Energy Charges Only) shall be recovered by the Employer based on prevalent rate of DISCOM for 220kV drawl and type of connection used. Complete construction power arrangement along with power drawl limits shall comply with respective DISCOM service rules.	Construction Power at 415 V at one point near site may please be provided by Customer free of all charges. We understand that only actual energy consumed will be recovered by NTPC on prevelent rate of DISCOM and not the monthly fixed charges. Kindly confirm	1.Construction Power at 415 V at one point near site may please be provided by Customer free of all charge reply -Bidder proposal is not acceptable. Bidder to comply Technical specification. 2.We understand that only actual energy consumed will be recovered by NTPC on prevalent rate of DISCOM and not the monthly fixed charges. Kindly confirm - Reply: confirmed
414	Section VI Part A/ Sub Section II D		11 of 13	2.02.00 (1)	Construction Water Construction water shall be arranged during all stages of construction. However, construction water may be provided by Owner at one point near existing Stage-II reservoir on chargeable basis.	Construction and drinking water at one point near site may please be provided by Customer free of all charges.	Existing clause shall be applicable.
415	SECTION – VI, PART-D, ERECTION CONDITIONS OF CONTRACT		30 of 72	44.19.00	Penalties	Contractor may be exempted from the penalty clause. No penalty shall be imposed on contractor as mentioned in the clause. However, bidder shall ensure for adherence to requisite safety norms during the execution of the project.	Bidder to comply with the specifications requirements.
416	General				Peripheral security arrangements	Watch and ward arrangement shall be taken care by contractor. However, the arrangement for a strong security set up to insulate complete project contours shall be customer's responsibility	Bidder to consider the arrangements as specified in the specifications only.

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
417	SECTION – VI, PART-A SUB-SECTION-I INTENT OF SPECIFICATION		1 of 8	1.01.00 (d)	Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required	Bidder request Owner to obtain the necessary statutory approval and clearances. However, bidder may assist the Owner for the obtaining the same. Owner is requested to provide an exhaustive list of statutory approval to be obtained by NTPC for Talcher 2x660MW EPC project.	Bidder's role is to facilitate the employer in obtaining statutory approvals and clearances, wherever required.
418	General				Access to & Possession of site	Employer shall ensure the site is approachable from state & national highways for material movement. If there is any obstruction or local issues pertaining to movement of goods the Employer shall be responsible for resolving same, the Contractor shall be entitled to suspend the work till such site issues are resolved	The site is approachable from state and national highways for material movement, any local issue shall be dealt as per provisions of contract.
419	General				Dismantling of Superstructure / substructure, as per specifications.	Bidder request NTPC to dismantle the super-structure / sub-structure of various facilities/buildings specified in bidding documents, as per specification and provide the encumbrance free land for complete facilities under the scope of bidder as on date of NOA. NTPC To confirm and issue suitable amendment.	Dismantling is in bidder's scope. Bidder to refer Cl 1.00.00 of Part-A, Section VI Sub Section IID

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
420	SECTION-VI, PART-B	SUB SECTION-A-01	55 of 101	3.01.00 (j)	Internal Diameter of CW pipes in CW pump discharge up to inlet to cooling tower (excluding non-encased portion of piping connected to condenser): Design velocity not to exceed 2 m/sec.	Due to space constraint in TG hall near condenser and CW Pump house, it is requested to kindly allow the velocity of 2.5 m/sec for CW piping inside TG building and CW Pump discharge. Buried CW piping/duct outside A row of TG Hall shall be sized for 2.0 m/sec velocity.	Bidder to comply technical specification requirement.
421	SECTION-VI, PART-B	SUB SECTION-A-01	57 of 101	3.03.00 (b)	Flow for SG ECW system- Design flow required for all SG auxiliaries + other Station Auxiliaries (Air compressors, Mill reject, Ash Handling compressors, FGD & SCR system, any other system envisaged by the bidder)	Please note 50% of the total cooling water required for station aux's shall be considered for calculating the design flow ECW-SG Pumps and PHEs of each unit. Please confirm. Further please note the equipment sizes are becoming very large due to addition of common station aux's water requirement in SG-ECW System. Therefore, NTPC to provide option of 3x50% Pumps and 3x50% PHEs configuration for ECW-SG Aux's System also in addition to 2x100% Pumps and PHEs.	Bidder's consideration of 50% of the total cooling water required for station aux's for calculating the design flow ECW-SG Pumps and PHEs of each unit is not correct. The same shall be finalized during detail engineering. Bidder to refer amendment- A-WS-06 & 07 regarding providing option of 3x50% configuration for ECW (SG) pumps and PHE .

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
422	Attachment-11, 55% TMCR Unit Heat rate SECTION-VI, PART- B, SUB SECTION-A- 07, 55% TMCR Unit Heat rate		1 of 4 5 of 25	2 1.18.01	Unit Heat rate in Kcal/KW/hr at 363 MW (i.e. 55% of rated load) under turbine throttle main steam pressure of 155 kg/cm2 (abs) and rated Main steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero (0%) make up shall not be more than 2188 Kcal/KW/hr c) 55% of rated load under turbine throttle main steam pressure of 150 Kg/cm2 (abs) and rated main steam temperature / rated reheat steam temp. at turbine inlet at condenser pressure of 77 mm Hg (abs) with zero make-up with one TDBFP in operation. (Heat Rate Guarantee)	There is discrepancy in the referred 2 clauses related to main steam pressure required to be considered for 55% TMCR Unit Heat rate guarantee. Bidder recommends to consider 150 Kg/cm2 (abs) Main steam pressure for 55% TMCR Unit Heat rate guarantee similar to earlier THDC Khurja project. Please confirm acceptance.	Refer amendment in this regard. (Amendment No : A-TG-1-COMM)
423	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS		10 of 17	1.16.05 Vi)	33kV Transmission Line : Supply of all items for civil and structural works to include detailed route survey including survey for PTCC clearance, route marking, survey and selection of tower locations (including all crossings), route clearance / tree cutting, geo-technical investigation of soil, tower foundations for all types of soil at each location etc.	Preliminary route survey including tower location, tower profile for 33kV Transmission line for Raw Water Intake system is not available in tender specification. Owner may please provide preliminary route survey for transmission line.	It is clarified that preliminary route survey for the subject transmission lines is in bidder's scope, bidder to also note the following: (i) These line are at 33kV and to be erected on transmission towers. (ii) Route survey of makeup water pipe corridor is provided in part E, section VI of the tender documents. (iii) These lines shall be within the pipe corridor already available or being acquired by NTPC (iv) Bidder has to suitably take-up the survey for tower spotting considering the available corridor width as well as location of pipes/ pedestals/ access roads Etc. Please refer amendment no.....
424	SECTION – VI, PART-B, SUB-SECTION-A- 25 SOLAR P.V.		1 of 26	1.3	Determination of optimal grid connected solar PV systems for south facing walls (BIPV) of different buildings of this package.	Owner may please identify and provide list of Buildings for installation of BIPV Solar system.	Refer Amendment No F-3
425	SECTION – VI, PART-B, SUB-SECTION-A- 25 SOLAR P.V.		10 of 26	13	BIPV (BUILDING INTEGRATED PHOTOVOLTAIC) A BIPV system is a photovoltaic system in which the PV modules satisfy the definition above for BIPV products. It includes the electrical components needed to connect the PV modules to external AC or DC circuits and the mechanical mounting systems needed to integrate the BIPV modules into the building. BIPV facade system is to be install on the south facing building of this package with proper ventilation. Bidder shall follow all suitable standards for BIPV system with latest amendments	Specification for BIPV Solar system is not available in tender specification. Owner may please specify detailed technical specification for BIPV products, support structures and installation requirement.	Refer Amendment F-2

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426	SECTION – VI, PART-B, SUB-SECTION-A- 25 SOLAR P.V. SECTION – VI, PART-B, SUB-SECTION-A- 25 SOLAR P.V.		1 of 26 1 of 26	- 1.1, 1.2, 1.3	The final plant capacity (Rooftop/ sheds/ south facing walls) shall be as per detailed approved engineering design of each of the building's rooftops. During detailed engineering EIC may leave or relocate the building/sheds or walls of buildings depending on site conditions. 1.1 Determination of optimal grid connected roof-top Solar PV power plants capacity on different buildings of this package. 1.2 Determination of Optimal grid connected solar PV systems for all sheds (Car parking, Coal stock yard etc.) of this package. 1.3 Determination of optimal grid connected solar PV systems for south facing walls (BIPV) of different buildings of this package.	Owner may please provide estimated capacity in kW for Solar PV Roof top plant against referred clause no. 1.1, 1.2 and 1.3. Owner may please provide estimated capacity in KW for bidding purpose. If the actual capacity during project execution varies from the estimated capacity, the variation in capacity shall be adjusted on the basis of unit rate for addition/deletion of capacity on per kw basis. Owner may please accept above and issue amendment.	Refer Amendment F-1
427	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS- 4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATI ON SYSTEM		7 of 18	2.04.04	This shall include all cables and accessories required for connecting Contractor's system upto the Employer's systems such as ERP, etc	a) Bidder request Owner to inform the terminal point for interface with Employers systems such as ERP etc. b) Bidder request Owner to include all terminal points related to interface of Bidder's scope Control and Instrumentation with Employer's systems (viz. ERP, CLIMS, SPMS etc.) in Sub-section-III, Terminal Points & Exclusions and Owner's input	a) The interface point of employer's ERP system will be available in Central control room. The bidder's scope is to connect the Contractor's system to this interface point. b) SPMS is not Employer's system the same is in the scope of Bidder. Interface point for CLIMS shall be Employers network port in IT room in ADMIN building.
428	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS- 4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATI ON SYSTEM		10 of 18	2.06.00	Contractor to provide 5 nos. Fine pitch LED display (1 for Admin building gate, 1 for Main plant gate & 3 for locations to be finalized during detail engineering) for outdoor application and 5 nos. Indoor LED television (locations to be finalized during detail engineering). These displays shall communicate information & guidance about environment, Advisory from Management, NTPC generation (station wise/unit wise), Business Diversification Information, CSR Activities, safety advisories, Movie on Company's Journey & Awards and Recognitions etc. Additionally, 3 nos. Interactive display board (1 for Admin building conference room, 1 for Service building conference room & 1 for CCR conference room) shall also be provided for conference rooms. The exact location of these displays will be finalized during detail engineering	a) Bidder request Customer to inform the Screen size of Fine pitch LED display b) Bidder request Customer to inform whether these Fine pitch LEDs and Indoor LEDs shall be connected to any system	a) As per Part B Annexure IIIC-02C, clause no. 1.01.16, Fine pitch LED should have full HD resolution with a pixel pitch of 3 mm or lower. The size of the display can be derived from these two requirements. Bidder to comply the specification requirement. b) The required input connectivity provisions are mentioned in Part B Annexure IIIC-02C, clause no. 1.01.16 & 1.01.17 and the purpose of these displays has been indicated in Part A, Sub section II-C, clause 2.06.00. Bidder to comply the specification requirement.

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429	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM Annexure C to IIC Contract quantity TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IIIC-18 IIOT, DIGITAL HELMET AND AR/VR MODEL		17 of 18 24 of 24 1 of 2	21.00.00 (1a) O 1.1	IIoT Solutions for Real-time Equipment and Process monitoring and for condition monitoring 1) Real time Equipment and Process Monitoring Wireless Sensor/ Transmitters (along with required Gateway to connect to Plant Wireless Network) a) Non- Intrusive Sensors/Transmitters for Vibration measurement : 16 Nos b) Non- Intrusive Sensors/Transmitters for Temperature measurement:16 Nos. 2) Condition monitoring Wireless Sensors/Transmitters: a) Portable Wireless Non- Intrusive Sensors for Vibration measurement: 32 Nos (of these 10 no. shall be PESO Certified) b) Portable Wireless Temperature Transmitters (0 to 800 deg C): 32 Nos. (Refer Note 3) Real-time Equipment and Process Monitoring Condition monitoring	a) Requirement of IIOT sensors for equipment and process & Condition monitoring is not clear. Bidder is already providing Vibration monitoring and analysis system for critical drives. Bidder request Customer to inform the specific equipment/ process/ drives for which these IIOT solution is required for condition monitoring. b) All critical drives are provided with vibration probes in locations as per respective OEM recommendation. Mounting of additional sensors for vibration monitoring may not be feasible. This needs to be discussed with the respective Pump/motor OEM/ supplier. Hence, Bidder request Customer to clearly specify the requirement. c) Similarly, mounting of additional temperature sensors may not be feasible and needs to be discussed with the respective Pump/motor OEM/ supplier. Hence, Bidder request Customer to clearly specify the requirement.	a) for Non-Critical drives in Main Plant Area and need to be supplied in loose as per quantity. Exact drive details shall be finalised during detailed engineering, as per drive list prepared for Main plant DDCMIS. b) Requirement is for sensor with magnetic base, doesn't require mounting and need to be supplied in loose as per quantity. c) Non-Intrusive temperature sensors are available and need to be supplied in loose as per quantity.
430	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IIIC-18 IIOT, DIGITAL HELMET AND AR/VR MODEL		17 of 18 1 of 2	21.00.00 (1b) 1.2	Digital Helmet: Realwear based Digital Helmet Realwear based Digital Helmet: The solution shall combine hands-free wearable device to provide guided work instructions & procedures on site through playback of video captured by expert personnel working on similar tasks searchable using voice. This will also support access to remote experts via video chat, who can see what the field personnel sees, to advice/guide/verify the field operation. The requisite wireless infrastructure shall be in the scope of the Contractor	a) Requirement of Realware Digital Helmet is not clear. Bidder request Customer to clearly specify the purpose of Digital helmet and for which area/ application same will be used. b) Bidder wish to inform that "Realware Digital helmet" is a Realware company's product. This specific product may not be used/supported by various OEMs/Suppliers. Bidder request Customer to inform for which all applications/ machines this product shall be used.	Please refer clause 1.2, Sub section IIIC-18, Part B of specification for clarity about the purpose of digital helmet. Any equivalent ruggedized handsfree devices with robust design and having functionality similar to that specified shall also be acceptable.

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431	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 Annexure C to IIC Contract quantity TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IIIC-18 IIOT, DIGITAL HELMET AND AR/VR MODEL		24 of 24 1 of 2	O 1.3	Latest technology based Wireless Infrastructure for main plant area (exact area to be finalized during detail engineering) Industrial Wireless Network:	Requirement of Wireless Infrastructure for main plant area is not clear. Bidder request Customer to clearly specify the purpose of wireless infrastructure within Proposed power plant and other requirement of Wireless Infrastructure (No of access points, No. of buildings to be covered etc.)	Purpose of wireless infrastructure in main plant area is to give coverage to IIoT sensors. The major areas includes Boiler house, Turbine Building, Compressor house and CW Pump house.
432	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 Annexure-A to subsection II C IOPMS Annexure C to IIC Contract quantity SUB-SECTION-IIIC-14 CLOSE CIRCUIT TELEVISION (CCTV) SYSTEM		3 of 5 23 of 24	2.3. N	Drone Based Project Monitoring & visualization system Drone based safety monitoring shall be done during day to monitor critical works at a close range. The images / Video feed from drone shall have sufficient resolution to identify the work under progress. Following quantity of items shall be provided by contractor as a minimum. Drone: 1 no. Drone based Surveillance (DBS)	Bidder understands that only One no. Drone has to be provided as per Annexure C to IIC, Contract quantity for entire proposed plant. This drone shall be used for both CCTV for safety monitoring and also for Project monitoring and visualization. Please confirm.	These two requirements are different. Drone that is to be supplied for safety control room is to be used for safety monitoring exclusively. Separate Drone Based Project Monitoring & visualization system is to be supplied in line with technical specification.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

433	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM		6 of 7	5.00.00	SMART PROJECT MANAGEMENT SYSTEM It shall be the responsibility of the Bidder to coordinate with Employer and offer SPMS to furnish a complete system as per above specified requirement , and also to coordinate with Employer for proper interfacing of employer's existing system e.g. Contract Labor Information Management System (CLIMS), Employer's existing Access Control System with all other equipment and systems to be supplied as scope of this contract. SPMS has to be integrated with Employer's Project monitoring center (PMC) through NTPC LAN. Bidder to ensure cyber security aspects for the same. All hardware & software e.g. Firewall with IPS to be provided by Bidders as scope of work of this contract.	a) Bidder request Customer to provide list of Customer systems to be interfaced with SPMS and interface terminal point location for each system. b) Bidder request Customer to clarify the type of protocol for interfacing of SPMS with Customer's existing systems.	a) List of Employers systems to be interfaced with SPMS is already given in the referred clause. Interface point shall be Employers network port in IT room in ADMIN building. b)These details will be shared with the qualified vendor after award of contract.
434	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM		-	-	SMART PROJECT MANAGEMENT SYSTEM	a) Bidder request Customer to clarify no. of workstations required for SPMS and location of SPMS b) Bidder request Customer to inform the no. of user licenses to be considered for SPMS	Only functional requiremnt has been mentioned. All these is to be estimated by the Bidder. Also refer clause no. 7.00.00 of Annexure-B to Sub Section II C, Part A.
435	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 Annexure C to IIC Contract quantity		13 of 24	2.04.00	Distant plants (Common Plant Areas) Make Up Water Pump House: 02 (see note 3 below)	Bidder wish to clarify that Note-3 is not available in the referred clause. Bidder request Customer to inform specific requirement if any.	There is no specific requiremnt in Note-3 and note-3 is to be ignored.
436	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IIIC-01 BASIC DESIGN CRITERIA		6 of 6	9.03.00 (2)	Programmer Room :Programmer Room is envisaged to be located near the CER. This shall house the servers/ other workstations & Engineer station for DDCMIS (SG, TG and BOP C&I systems), various PCs and PADO hardware.	a) Since requirement of PADO is not specified in Section-VI, Part-A, sub-section- IIC Control & Instrumentation system, Bidder understands that PADO is not in Bidder's scope. Please confirm. b) Bidder request Owner to include PADO under exclusions, in Sub-section-III, Terminal Points & Exclusions and Owner's input	a) Bidders understanding is Correct. b) Part-A Scope of Work doesn't have mention of PADO in bidders scope of work.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

437	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2 GENERAL TECHNICAL REQUIREMENTS		19 OF 114	8.03.05.03	These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI) , NTPC located at Noida .	a) Bidder understands that the e-Learning course files shall be installed at the LMS server of NTPC PMI. It is understood that that deliverables under this e-Learning course shall be contents in SCORM (Sharable Content Object Reference Model) format which shall be integrated in LMS of NTPC PMI. Software applications for viewing the content is part of NTPC PMI server. Please confirm. b) Bidder would like to clarify that certain items like Blackberry, Windows Mobile are outdated and might not be in use. Please confirm.	Content to be developed in latest HTML format. Bidders understanding is Correct
			20 OF 114	8.03.05.03 (4a)	The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.		
			21 OF 114	8.03.05.03 (4d)	Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.		

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
438	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIA-15 COAL HANDLING PLANT TECHNICAL SPECIFICATIONS SECTION-VI, PART B BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	1.16.00 1.31.00 (e) 3.4.0 4.11.7	4 of 7 6 OF 7 3 of 101 20 of 101	Stockyard Management System shall be provided complying the requirements as per C&I Annexure to sub section A-20, Part-B . These solenoid shall be operated automatically through PLC of Automatic Sprinkler System (part of Stockyard Management System, refer C&I Annexure to Part-B, A-20 , subsection of the specification). Stacker cum reclaimers shall be provided with hydraulic drive for bucket wheel to reclaim at the required rate. Stockyard Management System shall be provided as per C&I Annexure-I to sub section A-20 . These solenoids shall be operated automatically through PLC of Automatic Sprinkler System (part of Stockyard Management System, refer C&I Annexure to Sub Section A-20).	Bidder wish to clarify that C&I Annexure to Part-B, A-20 is missing from the tender specifications. Bidder requests Owner to provide the same.	The missing C&I Annexure to Part-B, A-20 is being included as amendment no. 1.
439	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIc CONTROL & INSTRUMENTATION SYSTEM	1.05.00	1 of 18	All electrical devices like switches/ transmitters/ controller/ analyzer/ solenoid valves which are located in the in hazardous areas like hydrogen gas area, seal oil area etc. shall be made intrinsically safe by providing suitable type of transformer isolated barrier / Zener barrier of standard make & shall be provided with explosion proof enclosure suitable for hazardous areas described in National Electric Code (USA), Article 500, Class-I, Division-I or EN60079-14 or shall comply with the essential requirements of ATEX directives.	Bidder wish to clarify that applicable enclosure protection shall be provided as per NEC Article 500 or EN 60079-14 or ATEX directives for Hazardous Area classification as identified in project specific Hazardous area classification drawing.	Bidder to meet specification requirement.
440	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIc CONTROL & INSTRUMENTATION SYSTEM	1.06.01	2 of 18	Close Loop controls: For close loop control of following applications of main plant SG/TG/BOP (Auxiliaries of SG and TG), conventional i.e. 4-20 mA / (HART) based actuators along with 4-20 mA(HART) based electronic transmitters (which are directly used in control of final control element), shall be provided. For balance measurements for even these areas/ applications fieldbus based PT/DPT/TT shall be provided. TG BOP (a) Feed water control (b) Hotwell level control (c) Minimum Recirculation control of BFP and CEP. (d) HP/LP Heater Emergency Drain Control valves.(Measurements excluded)	Bidder proposes to add following critical CLCS also with conventional i.e. 4-20 mA / (HART) based actuators along with 4-20 mA(HART) based electronic transmitters (which are directly used in control of final control element) a) Heaters Normal Level Control Request Owner to kindly accept Bidder's proposal.	Bidder to meet specification requirement.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
441	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	2.03.02	6 of 18	Same make DDCMIS is to be provided for all DDCMIS systems indicated above including control system for SG, TG & BOP systems of Unit DDCMIS defined above.	Bidder wish to clarify that the control & protection of STG shall be provided by STG OEM as per their OEM standards. Turbine Control System (TCS) and Turbine Protection System (TPS) are provided by OEM based on their long experience in various Thermal Power Plants. Make of TG DDCMIS may be different than the make provided for other DDCMIS (SG, BOP, FGD etc.) If separate make is provided for TG DDCMIS, then Unified HMI shall be provided. This is inline with the past NTPC tenders (viz. Khargone, Lara, Singrauli etc.) In view of above, Bidder request Owner to re-instate earlier NTPC tender (Singrauli) clause indicated below: " It is preferable to provide same control system for SG, TG & BOP systems of Unit system defined above. DDCMIS of Unified HMIPIS & DDCMIS of Offsite system including Switchgear system shall be of same make. If it is a standard and proven practice of the contractor to offer STG integral controls that is of different make than the DDCMIS offered for balance TG system specified under the contract, the same shall also be acceptable."	Bidder to meet specification requirement.
442	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	2.03.05	6 of 18	The Contractor shall provide integrated HART system for each unit DDCMIS ... DDCMIS AI(4-20 mA) cards shall be HART enabled.	Since, integrated HART system is envisaged only for Unit DDCMIS, requirement of HART enabled cards may be applicable only for AI cards of Unit DDCMIS, and not for the other DDCMIS. Same may be specifically mentioned to address ambiguity.	Bidder's understanding is correct.
443	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB SECTION- G-03 LAYOUT PHILOSOPHY	2.04.03 1.02.00	7 of 18 3 of 15	OWS:19 OWS for common (1 SAC, 4 WS in centralized offsite CR, 6 AHP in centralized offsite CR, 2 CHP, 2 FGD in centralized offsite CR, <u>2 FGD in FGD CR</u>) One separate <u>Offsite Control Room</u> adjacent to main CCR at operating floor in control tower to be provided for operation and monitoring of Ash handling system, Water system and <u>FGD system</u> . So, the HMI of AHP, Water system and FGD system is to be located in this control room while <u>control panels for these systems shall be located near process area</u> .	a) Bidder wish to highlight the discrepancy found in the quantity of OWS for common systems. Total quantity is indicated as 19. However the quantities for the OWS indicated within brackets is coming out to be 17. We request Owner to resolve the discrepancy. b) As per Cl. No. 1.02.00 of layout philosophy, Panels related to FGD DDCMIS shall be placed near to Process areas (i.e ESP Control building). However, HMIs of FGD DDCMIS shall be placed in Offsite Control Room adjacent to main CCR. We understand that separate FGD CCR is not required. However, 2 nos. OWS in FGD CR is mentioned in Cl. no. 2.04.03. We understand that 2 nos. OWS indicated in FGD CR is not applicable. Please confirm.	a) Total OWS quantity to be considered is 19 (17 Nos. for common system and 2 Nos. as free issue items.) b) Primary operation of FGD is envisaged from Offsite Control Room adjacent to main CCR in TG building at operating floor. However local operation from workstations shall also be provided from FGD control room.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
444	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB-SECTION-IIIC-01 BASIC DESIGN CRITERIA SUB SECTION- G-03 LAYOUT PHILOSOPHY	9.02.00 1.01.03 1.02.00	5 of 6 2 of 15 3 of 15	The control, monitoring & operation of the off-site areas including AHP System, Water System including DM Plant, PT Plant, CW Chlorination, CPU Regeneration , Raw Water pumps, FGD System shall be carried out from Centralized Offsite Control room. FGD System (In addition LVS, Control desk and workstation shall also be provided at centralized offsite control room in control tower) NOTE: <u>FGD Control room may be a part of ESP Control Building</u> One separate <u>Offsite Control Room</u> adjacent to main CCR at operating floor in control tower to be provided for operation and monitoring of Ash handling system, Water system and FGD system. So, the HMI of AHP, Water system and <u>FGD system</u> is to be located in this control room while control panels for these systems shall be located near process area.	As per Cl. No. 1.02.00 of layout philosophy, Panels related to FGD DDCMIS shall be placed near to Process areas (i.e ESP Control building). However, HMIs of FGD DDCMIS shall be placed in Offsite Control Room adjacent to main CCR. Separate FGD CCR is not required. Please confirm.	Primary operation of FGD is envisaged from Offsite Control Room adjacent to main CCR in TG building at operating floor. However local operation from workstations shall also be provided from FGD control room.
445	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	2.04.7	9 of 18	DDCMIS vendor shall upgrade/ update all DDCMIS system along with Station LAN to the latest version/ release of DDCMIS system software/ patches, meeting the system software requirements as mentioned in Part-B, SUB-SECTION-IIIC-02 DDCMIS. This shall include the latest OS and its corresponding latest version/ release of DDCMIS system software/ patches. The upgrade/update shall be checked for and carried out six months before the completion of AMS of last DDCMIS (whose AMS started last). Any change in hardware and the requisite services (Engineering/ Erection/ Commissioning/ Documentation) required for the same shall also be carried out by the contractor within the contract price.	Bidder wish to clarify that Bidder shall provided latest version of hardware/software available with selected DDCMIS vendor at the time of Design freeze. Software update shall be carried out before completion of DDCMIS AMS. However, incase any change in hardware is required due to software update/upgrade then same shall be carried out with Cost implication which shall be mutually discussed and agreed during execution stage.	Bidders understanding is not correct. Bidder to comply the specification requirements
446	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	4.00.00 (e) (ii)	12 of 18	In addition to above other binary and analog inputs required for closed loop control system (CLCS), dual-sensing devices shall be provided.	It is understood that specified instrument redundancy is applicable only for the primary sensor used for CLCS, and not for secondary measurements used for feedforward signals. Requirement may be further clarified.	Bidders understanding is not correct. Bidder to comply the specification requirements.
447	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	4.00.00 (i) 4.00.00 NOTES - 3	12 of 18 13 of 18	In case of multiple measurements of temperature for any application, resulting in trip / protection, where logic implementation tolerates failure of one TE (e.g. 2v3, 2v4 etc.), for only one of the TE, dual TT is to be provided. For other applications, if usages of dual input TTs is recommended by the equipment manufacturers, the same shall also be acceptable. The exact applications for which this type of transmitter to be provided shall be finalised during detail engineering. Remaining temperature transmitters in main plant and <u>auxiliary plant areas are to be Single Input field mounted type</u> The instruments for CHP and AHP ash conveyor system shall be provided as per standard and proven practice of respective supplier. However, for temp elements, <u>DIN rail type temp transmitters mounted in JBs shall be provided</u>	Bidder would like to clarify AHP Fly ash handling system, bottom ash handling system, Slurry conveying system shall be provided with " DIN rail type temp transmitters " conventional HART 4-20mA type. Request Owner to confirm Bidders understanding.	Technical specification requirements are clear. Bidder to comply with the provisions of the Technical Specifications.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
448	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	4.00.00 (i)	12 of 18	These TTs shall be mounted as per clause no. 6.02.00, Sub Section IIC, Part- A Section VI.	The clause 6.02.00 could not be located in Sub Section IIC, Part- A Section VI. Request Owner to clarify the same.	Bidder to follow Sub Section IIC-04, Part- B & Part-E for TT mounting reference
449	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	4.00.00	(h)	ANALYSER INSTRUMENTS OF DM / PT, LET, CHLORINATION (CIO2), CWT AND CPU PLANT : All weather Local Panel fitted with integral Air Conditioner shall be provided for housing analyzers etc if the same are not kept in AC rooms.	We understand the requirement of panel with integral AC or installation in AC rooms, shall be selected if the Analyzer is not suitable for installation in ambient temperature of location. Request Owner to confirm the same.	Bidders understanding is not correct. Bidder to comply the specification requirements
450	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	12.01.00 13.01.01	16 of 18	Public Address system along with software including Call stations, loudspeakers, Network switches, Servers, PA system management Software & other applicable software(s), PC Stations, Interconnecting cable etc. for all the units, common plant areas and Coal Handling plant shall be provided by the Contractor IP based Closed Circuit Television System (CCTV) cameras for operation and maintenance (O&M) of plant along with network switches, Camera / Database servers, Video management software, keyboards, joy sticks, monitors, interconnecting cables & interface to the LVS of HMIPIS shall be provided common for all the units (containing some unitised & some common equipment). For quantity refer Annexure C to this sub section.	Since both CCTV and PA system are IP based and location of cameras and PA system components (Handsets/loudspeakers) may be common in many cases, Bidder proposes to consider common network (wherever feasible) for CCTV system for O&M and PA system. Request Owner to accept Bidder's proposal.	Bidder proposal is not acceptable. Bidder to comply the specification requirement.
451	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2 Annexure C to IIC Contract quantity	N	23 of 24	Contractor shall supply and install IP based CCTV system along with IP based announcement system which shall be used for monitoring safety during construction from Safety control room. It shall be possible to make announcements to alert the workers whenever required. These cameras shall be installed at all strategic locations in the plant area. These camera can be wired or wireless as per suitability at site. Initially these installations will be temporary & locations will keep on changing depending upon the work in progress. After COF of last Unit these cameras are to be installed permanently at suitable locations in consultation with NTPC.	a) Since both CCTV and announcement system are IP based and location of cameras and loudspeakers shall be common, Bidder proposes to consider common network for CCTV system and Loudspeakers. Request Owner to accept Bidder's proposal. b) Bidder request Owner to inform the area to be covered by cameras for Safety system. c) Bidder understands that make, model and specifications of CCTV system for safety shall be selected as per Bidder's standard practice and design. Please confirm.	a) Requirement mentioned under safety control room of clause no. 20.00.00 of Sub section IIC, part A is a single integrated system.Accordingly common network for the same is acceptable. b) To be decided at site as per contruction requirement. C)Bidder understanding is not correct. Refer Clause 22.00.00 of IIC, Part A. Bidder to meet specification requirement

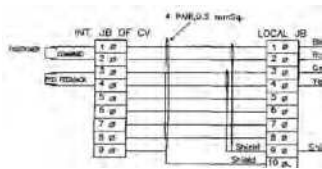
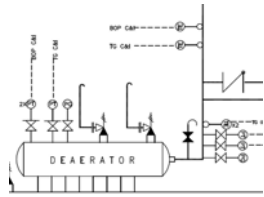
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
452	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	22.00.00	17 of 18	Make of IP based CCTV camera and VMS under scope of this package (CCTV system for O&M and CCTV system for safety control room) shall be same.	1) Bidder understands that make/ supplier of CCTV system for O&M and CCTV system for Safety can be different. Please confirm Bidder's understanding. 2) Bidder wish to clarify that make of Camera and make of video management software may be different. However, same shall be selected based on the provenness criteria indicated in the Tender for CCTV system, same is mentioned below: "The combination of offered make of IP based camera and offered make of video management software, for CCTV system, should have been in successful operation for a period of not less than one (1) year in a large industrial setup viz power plant, cement plant, petroleum refinery, steel plants or coal mine, having installation of minimum forty (40) nos. cameras" Further, providing same make CCTV cameras and VMS shall limit the number of vendors as there are a very few CCTV OEM's in the market who also have their own Video management software. Hence, Bidder proposes to provide CCTV and VMS of different make.	1) Bidder understanding is not correct. Bidder to meet specification requirement. Make of CCTV system for O&M and CCTV system for safety control room should be same. 2) Bidders understanding is correct.
453	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	1.00.0 6.01.0 6.02.0	1 of 4 3 of 4 4 of 4	Smart Project Management system (SPMS) shall be valid up to the COF of last Unit Smart Storage area/yard monitoring Minimum 80 number of CCTV cameras is to be supplied. Feed of all these cameras should be available in quality control room. Quality control Room Minimum 25 no of Camera is to be considered for this purpose. Quality control room will not be a dedicated physical room, rather all the data will be available on server & two no of LED screens of minimum 50 inches will be placed adjacent to the Head of FQA for monitoring the project progress activities.	a) Bidder understands that CCTV system for Quality control is common which includes 80 nos. cameras for Storage area/ yard monitoring and 25 nos. for plant areas. 1 no. Common Server and 2 nos. 50" LED screens will be used for monitoring of these CCTV cameras. b) Bidder wish to clarify that selection of PTZ cameras and Fixed type cameras for different areas shall be as per Bidder's design. c) Specification of cameras, common server and other hardware/software shall be as per Bidder's design. d) CCTV for Quality control is a temporary set-up to be used during Erection and commissioning stage and it shall be available up to the COF of last Unit. e) Bidder understands that 80 nos. cameras for Storage area/ yard monitoring and 25 nos. for quality monitoring of plant areas are to be provided separately and the Cameras indicated under CCTV for O&M cannot be utilized for CCTV for quality application. Please confirm.	a) Bidder's understanding is correct however server shall be redundant (Hot standby). Please refer clause no. 7.00.00, Annexure-B to Sub Section IIC, part A. b) Selection of PTZ camera and Fixed type camera shall be as per Bidder design meeting specification requirement mentioned at clause no 6.01.00, Annexure-B to Sub Section IIC, part A. c) Bidder Understanding is correct. d) Bidder Understanding is correct. e) Bidder Understanding is

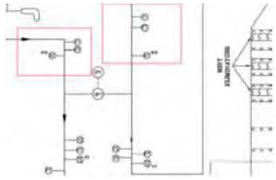
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
454	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 SMART PROJECT MANAGEMENT SYSTEM	2.00.00 2.01.00	PAGE 1 OF 4	Contractor shall ensure all its OEM/suppliers must affix RFID tags/Trackers on the item & punch the same before dispatch with RFID reader/BLE beacon & enter details of item associating with RFID tag no./Tracker no. For low value items QR code-based solution shall also be acceptable I. Contractor shall enter the details of material shipment in a web portal/Mobile Application and will generate a unique code before the material is dispatched & affix the same to material package & configure the same with RFID tag attached. II. Receipt of this material at NTPC gate by authorized personnel (e.g. CISF) at NTPC gate by scanning the same RFID - automatic status update in web portal from "under transit" to "receipt at site". Contractor will use the same RFID to store the material at site - status will be updated in web portal regarding storage location at site. Now status shall reflect "material in storage" along with storage location. So material is identified till it is erected at site.	Bidder understand that along with the RFID readers/ BLE Beacons/QR code, Bidder may use it's available applications / systems to meet the purpose. A scanner will be provided to CISF team at Owner gate to scan the incoming material.	Bidder proposal is not acceptable. Bidder to comply the specification requirement.
455	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	1.03.04	2 of 24	Contactor to provide thirty (30) percent spare relays for 1 COC Slim Relay (< 7mm) and ten (10) percent spare relays for 2 COC Heavy Duty relays.	As per tender specifications, 10% spare channels are to provided and hence inline with Spare channels, Bidder proposes to provide 10% spare relays. Request Owner to accept Bidder's proposal.	Bidder's proposal is not acceptable. Bidder to comply the specification requirement.
456	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	1.03.04	2 of 24	For fieldbus based system refer Annexure IIIC- 02G of Part-B for spare requirements.	We understand that spare requirements for fieldbus based system shall be considered as per CI no. 1.04.02 of Annexure IIIC- 02F. Please confirm.	Bidder's understanding is correct .
457	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	2.00.00	2 OF 24	Guidelines for Functional Grouping of Controllers Electrical system of Unit DDCMIS will be a separate process block. <u>However, electrical breakers of other DDCMIS shall be distributed along with respective process areas.</u>	In referred clause it is mentioned that "Electrical system of areas other than Unit DDCMIS" shall be distributed along with respective process areas. However, in Functional grouping details of SAC DDCMIS and other BOP DDCMIS, electrical system is not mentioned. Bidder would like to confirm that , "Electrical system of areas other than Unit DDCMIS" shall be distributed along with respective process areas as mentioned in clause 2.00.00. Request Owner to confirm the same.	Bidder's understanding is correct.
458	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	2.04.01 2.04.02 2.04.03	5 OF 24	Main Plant AC common Block Common Air conditioning & ventilation system of various areas like CER, SWAS Room etc. Main Plant AC Unit#1 Block Air conditioning & ventilation system of part of CCR/CR, CER, UPS/Battery Charger Room, ESP Control Room of UNIT#1 etc. Main Plant AC Unit#2 Block Air conditioning & ventilation system of part of CCR/CR, CER, UPS/Battery Charger Room, ESP Control Room of UNIT#2 etc.	Bidder would like to inform , HVAC system for "Unit-1 and Unit-2 CCR/CER/UPS/Battery charger room" is common. Therefore, it is not feasible to have separate process block for " Main Plant AC Unit#1 Block " and " Main Plant AC Unit#2 Block ". Bidder proposes to implement, these systems in " Main Plant AC common Block ".	Bidder proposal is not acceptable. Bidder to comply the specification requirement.

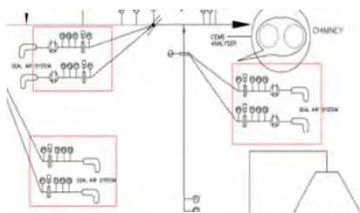
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459	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	2.05.02	6 OF 24	Water System DDCMIS PT plant block ----- Portable water , CW Blow down system, Raw water, effluent treatment plant etc.	Bidder would like to clarify , Potable water chlorination system shall be implemented in PT Plant block of Water system DDCMIS. Request Owner to confirm the same.	Bidders understanding is correct.
460	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	2.11.00	7 OF 24	Switchgear DDCMIS This system shall have one block. It comprises of monitoring and data acquisition of 20 Signals (both Analog & Digital) from each relay (MV & LV circuit breakers / MV Vacuum contactors on IEC-61850 protocol). This shall be communicated to Switchgear DDCMIS on IEC 61850 protocol.	Bidder understand , Switchgear DDCMIS shall be common for complete plant. It shall have only redundant IEC 61850 interface with Relay network switch located in Central Control building. Request Owner to confirm the same.	Bidder understanding that Switchgear DDCMIS is common for complete plant is correct. Bidder to comply specification requirement.
461	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	2.03.00	13 of 24	Common Plant Areas - Coal Handling Plant/Lime Stone Handling Plant/Gypsum Handling Plant Wagon Tippler (each): 2 nos.	Bidder wish to clarify that wagon tippler is not envisaged for this project, hence CCTV camera for these areas are not applicable and these 2 nos. cameras shall be deleted from scope. Please confirm.	It is to be clarified that if any system is not applicable than camera envisaged for that is to be installed at some other location based on site requirement.
462	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB SECTION- G-03 LAYOUT PHILOSOPHY	4.00.00 1.02.00	14 of 24 3 of 15	(ii) Work Stations with Monitor, External Speaker (min. 5 W) Keyboard & Joystick: Twelve (12) nos. for plant common area (see note-2 below). Note-2. Common areas shall include Office of Head of the Project, Office of O & M In-charge, Erection In-charge's Office, Central Fire Station, FGD control room, Water System Control Rooms, Ash Handling System Control Room , Plant Security Control Room, Main Gate of the Plant, Safety control room, Admin. Building, Service Building and any other locations to be decided during detail engineering. (iii) Work Stations with External Speaker (min. 5 W), Keyboard & Joystick (without Monitor): three for common plant areas (AHP, FGD and water system) and one for CHP. One separate Offsite Control Room adjacent to main CCR at operating floor in control tower to be provided for operation and monitoring of Ash handling system, Water system and FGD system. So, the HMI of AHP, Water system and FGD system is to be located in this control room while control panels for these systems shall be located near process area.	As per Cl. No. 1.02.00 of layout philosophy, Panels related to FGD DDCMIS shall be placed near to Process areas (i.e ESP Control building). However, HMIs of FGD DDCMIS shall be placed in Offsite Control Room adjacent to main CCR. Separate FGD CCR is not required. Further, operation and monitoring of AHP and Water system also shall be carried out from Offsite control room. Separate control rooms of AHP and Water systems are not applicable. In view of above, Bidder understands One no. CCTV workstation shall be provided in Offsite control room. Requirement of CCTV workstations indicated for FGD control room, water system control room and AHP control room is not applicable and shall not be considered by Bidder. Accordingly quantity of Workstion with monitor for common areas shall be changed to 10 nos. and Work Stations without monitor for common areas shall be changed to 1 no. Please confirm.	Primary operation of FGD is envisaged from Centralized Offsite Control Room adjacent to main CCR in TG building at operating floor. However local operation from workstations shall also be provided from FGD control room. Operation and monitoring of AHP and Water System shall be from Centralized Offsite Control Room Quantity of workstation with monitor and workstation without monitor is already indicated at Clause 4.00.00 (page 14 of 24), F, Annexure- C, Sub section IIC, Part A. Bidder to meet the specification requirement.
463	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	7.04.00	14 OF 18	Heat resistant instrumentation cable shall be provided for all instruments / equipments / drives / devices located in hot areas such as Burner tilt, Hot air gates, Air Heater areas , Furnace areas , Steam Drain & Vent Valves , Turbine – Generator areas, Oil system, HP/LP BP areas etc	Bidder would like to clarify the " Steam Drain & Vent Valves" & "HP/LP BP" area does not have high temperatures, therefore the same are not considered as hot areas. Bidder proposes to consider FRLS cable in these areas. Request Owner to accept the same.	Bidder's proposal is not acceptable. Bidder to comply specification requirement.

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464	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	G	15 OF 18	LIST OF ANALYSERS Deaerator: pH, Dissolved Oxygen	Bidder understands that pH and DO analysis shall be carried out for Deaerator inlet sample in SWAS. Please confirm.	Bidder's understanding is not correct. pH and DO analysis shall be carried out for Deaerator OUTLET sample in SWAS.
465	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	G	15 OF 18	LIST OF ANALYSERS Note: 1. Multistream for Silica and Sodium Analyser shall be acceptable. Multistream analysers shall have at least one stream as spare.	Bidder wish to clarify that Chloride analysis is not indicated in the list of analysers mentioned in the referred clause. Incase, Chloride analysis is required as per Bidder's design then Multi Channel Chloride analyser shall be considered.	Bidder's proposal is acceptable. However chloride analyser (if needed as per Bidder's design) shall be supplied within the contract price.
466	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	K	20 of 24	Vibration sensors shall be provided in Motor DE & NDE and Fan/Pump DE/ NDE bearing as a minimum for all Major/ HT drives as per OEM's standard and proven practice.	Bidder proposes to provide Vibration monitoring system for critical HT drives (continuous operation of which is required for Plant availability). Vibration sensors shall be provided on pumps/motors as per OEM recommendations.	Bidder to comply specification requirement.
467	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	N	PAGE 24 OF 24	Analytics for Safety vest and helmet is to be deployed on all 25 nos. of cameras and any safety violation shall be alerted through IP based announcement system. Any over speeding of vehicle should also be warned through speakers automatically.	Bidder wish to clarify that the algorithm for safety vest and helmet will be deployed for all the safety related cameras however alerts will be thrown on best efforts basis. As vest and helmets in many situations are not identifiable.	Bidder proposal is not acceptable. Bidder to comply the specification requirement.
468	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2 Annexure C to IIC Contract quantity	N	PAGE 24 OF 24	24/7 safety control room shall be functional from initial stage of the project construction. Temporary safety control room for the same is to be made functional within three (3) months of LOA. Permanent safety control room shall be made functional within six (6) month from LOA	a) Bidder wish to clarify that temporary safety control room shall be made functional based on the site requirement and same may not be within three months of LOA. b) Bidder request Owner to inform the location of temporary safety control room. c) As per General Layout Plan (4540-999-POC-F-002) permanent safety control room is part of Safety park. However, Safety control room is not indicated in the Safety park drawing (4540-001-POC-A-002) attached with the tender. Please clarify the location of Permanent Safety Control room c) Bidder wish to clarify that permanent safety control room shall be made functional based on the readiness of the site and same may not be within six months from LOA	a) Bidder to meet technical specification requirement. b) The location of temporary control room shall be envisaged by the Bidder based on site requirement. c) Safety control room and Safety Park building are separate structures. In GLP, the area is marked for both. Please refer Clause 5.16.00 and 5.33.00 of Part-B, Section-VI, Sub-Section-D-1-5 for Safety Park Building and Safety Control Room details respectively. d) Bidder to meet technical

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469	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB-SECTION-IIIC-02 DDCMIS	8.00.00 16.00.00	2 of 17 4 of 17	All the signal exchange between various functional groups of each control systems shall be implemented through redundant system bus. 3. If triple/dual analog sensors are required both in CLCS and OLCS for control purpose, then all of these triple/dual sensors shall be wired to the controller where CLCS loop is configured. 4. If based on the same set of sensors, any protection action is required in OLCS (e.g., protection stop of drive) in another controller(s), then CLCS Controller shall provide three digital outputs for each such controller from three separate output modules (at defined LVM-Limit Value Monitor blocks inside Controller). The three such digital outputs of CLCS controller shall be acquired in each of the OLCS controllers in three separate digital input modules. 5. If triple/dual/single binary sensors are required in OLCS in multiple controllers for protection function in these controllers, each of these sensors shall be shared among these controllers. Each of these sensors shall be directly shared from marshalling TBs without any 'active' multiplying hardware ('active' defined as hardware which requires a separate power supply for its functioning).	As per referred Cl.No. 8.00.00, signal exchange between various DDCMIS controllers shall be implemented through system bus, accordingly hardwiring of signal exchange (specified in Cl.No. 16.00.00) may not be applicable.	Bidder's proposal is not acceptable. Bidder to comply the specification requirement.
470	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02F	1.02.00	1 of 5	For all fieldbus devices GSD and DTM file are to be provided and configured/ tested in the DCS for proper interfacing and diagnostics	GSD files will be applicable only for Profibus devices, and not for Foundation Fieldbus based devices. All references to 'GSD' may be suitably updated	Bidder understanding is correct. Please read 'GSD' as 'GSD/DD' in the referred clause
471	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB SECTION- G-03 LAYOUT PHILOSOPHY	1.01.03	2 of 15	External CHP CR at Mine end	Bidder understand that External CHP CR at mine end is not in Bidder's scope. Please confirm.	Bidder's understanding is correct.
472	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB-SECTION-IIIC-01 BASIC DESIGN CRITERIA SUB SECTION- G-03 LAYOUT PHILOSOPHY	1.01.03 1.02.00 (c)	6 of 6 4 of 15	SWAS Room. SWAS room for every two units shall be at 0.0 meters in Main Plant building. A common SWAS room for both units shall be provided and shall be located at 0.0M in TG building. However, unitized SWAS room for each unit shall also be acceptable, subject to owner's approval during detail engineering.	Bidder understand that SWAS Wet panels and Dry panels for both the units located in common SWAS room is also acceptable. Please confirm	Bidder's understanding is correct.

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473	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 SUB-SECTION - IIIC-12 SWAS SUB SECTION- G-03 LAYOUT PHILOSOPHY	2.06.00 1.02.00 (c)	2 of 6 4 of 15	Two sets of 2x100% capacity water cooled chillers shall be provided by Contractor. The specification of chiller system shall be as per SWAS manufacturer's standard and proven practice. A common SWAS room for both units shall be provided and shall be located at 0.0M in TG building. However, unitized SWAS room for each unit shall also be acceptable, subject to owner's approval during detail engineering.	Bidder understands that two sets of 2x100% chiller is required incase separate SWAS room is provided for each unit. However, incase common SWAS room is provided for both units then 2x100% chiller common for both units shall also be acceptable. Please confirm.	Bidder's understanding is correct.
474	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO. 0000-999-POI-A-065 INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE	-	3 of 14	Internal JB on the control valve is indicated in tender drawing for interfacing with Local Junction Box. 	No signal grouping envisaged for Control valves. The command and feedback signals are available from positioner. Therefore, Bidder proposes to consider 2 pair branch cable from positioner to Local junction box.	Bidder's proposal is acceptable.
475	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO. 0000-999-POI-A-065 INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE	-	11 of 14	Tender drawing indicates input TB for connecting thermocouple branch cable to TT. However Note-3 mentions, first element thermocouple cable shall be directly connected to TT after glanding. 3) AFTER GLANDING OF T/C CABLES ON JB, THE CABLE PAIR OF FIRST ELEMENT WILL BE DIRECTLY CONNECTED TO TT AND THE CABLE PAIR OF SECOND ELEMENT LOOP SHALL BE KEPT, BEFORE TERMINATION AT INPUT TBs FOR FUTURE USE.	Bidder proposes to follow Note-3. This will also avoid junction.	Technical specification requirements are to be met by the bidder.
476	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO. 4540-999-POM-A-007 EXTRACTION STEAM P&ID FOR HEATERS	-	-	Drawing indicates separate instrument for same measurement for interfacing with "BOP C&I" control system and "TG C&I" control system. For example: 	Bidder proposes that if same make of DCS is considered for TG C&I and BOP C&I, then separate instrument shall not be considered.	Bidder's proposal is not acceptable. Bidder to comply the specification requirement.
477	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO. 4540-999-POM-A-009 CONDENSATE P&ID	-	-	Each condenser is indicated with divided Hotwell and two number specific conductivity analyzer.	Bidder would like to clarify, if condenser has single Hotwell then one conductivity analyzer shall be provided with each Hotwell.	Bidder to comply specification requirement.

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478	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO. 4540-999-POM-A-009 CONDENSATE P&ID	-	-	Temperature element is indicated for each CEP suction in addition to CEP suction header temperature.	Bidder would like to clarify, there will no change in temperature from suction header to individual CEP suction. Hence, Bidder proposes to consider temperature measurement at CEP suction header only.	Bidder to comply specification requirement.
479	Section-VI, PART-A /Annexure C to IIC Contract quantity Section-VI, PART-A /Annexure C to IIC Contract quantity	2.07.00 2.08.00	6 of 24 6 of 24	Coal handling System (CHP) DDCMIS The Control System of CHP DDCMIS has following process blocks: CHP stream-A block CHP stream-B block Lime handling system stream-A block Lime handling system stream-A block Flue Gas De-Sulphurisation (FGD) DDCMIS The Control System of FGD DDCMIS has following process blocks. i. Unit-1 FGD ii. Unit-2 FGD iii. Gypsum De watering Handling common system block iv. Lime stone preparation common system block	Since, Lime handling system is a part of FGD, Bidder understands that process block requirements for Lime handling system mentioned in Section-VI, PART-A /Annexure C to IIC Contract quantity, Clause 2.07.00 is not applicable. For Lime handling system process block shall be considered as Section-VI, PART-A/Annexure C to IIC Contract quantity, Clause 2.08.00 S. No iv) Please confirm.	Bidder's understanding is not correct. Bidder to comply the specification requirement.
480	Section-VI, PART-A /SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	1.06.01	2 of 18	Close Loop controls: ..For balance measurements for even these areas/ applications fieldbus based PT/DPT/TT shall be provided. FGD (a) Booster Fan Blade Pitch Control	Bidder proposes to consider Hardwired HART type transmitters for critical measurements related to Booster fan (including Blade Pitch Control) & FGD. Owner to please confirm.	Bidder to comply specification requirement.
481	Tender dwg No. 4540-001-POM-A-022 SCHEME FOR FGD ABSORBER SYSTEM	-	6 of 24		Bidder proposes the following: 1. 2 No. of SOx analyser & 1 No. of FT to be provided at Absorber inlet. 2. Absorber outlet SOx & Flow measurement shall be measured from CEMS Sox analyser & FT. Hence, no separate SOx & FT measurement at absorber outlet is considered. Owner to please confirm Bidder's understanding.	Bidder's proposal is not acceptable. Bidder to comply specification requirement.

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482	Tender dwg No. 4540-001-POM-A-022 SCHEME FOR FGD ABSORBER SYSTEM	-	6 of 24		Bidder proposes 1 No. of PT at discharge of each seal air fan of FGD inlet damper & FGD bypass dampers. TT, TS & PS shall be provided in case separate heater is provided in seal air lines of FGD inlet damper & FGD bypass dampers. Owner to please confirm Bidder's understanding.	Bidder's understanding is correct.
483	Section-VI, PART-A /SUB SECTION-IIA-14 LIMESTONE & GYPSUM HANDLING PLANT Tender dwg No. 4540-001-POM-A-022 SCHEME FOR FGD ABSORBER SYSTEM	4.00.03 -	5 of 5 -	For measurement of tank level in water application ultrasonic type level transmitter and for slurry based application Radar type level transmitter are to be provided. For specification of these instruments and all other measuring instruments shall be complying to specification requirements of Part-B, Section-VI. Note 8. Only Ultrasonic/ Radar Type Level transmitters shall be provided for Slurry Tanks/ Sumps	Bidder understands that DP type LT shall be provided for water application & Ultrasonic/ Radar Type Level transmitters shall be provided for Slurry Tanks/ Sumps Owner to please confirm Bidder's understanding.	Bidder's understanding is not correct. Bidder to comply to specification requirement.
484	Section-VI, PART-A /SUB-SECTION-IIA-15 COAL HANDLING PLANT	1.45.00	7 of 7	For measurement of tank level in water application ultrasonic type level transmitter and for slurry-based application Radar type level transmitter are to be provided. For the specification of these instruments and all other measuring instruments shall be complying to specification requirements of Part-B of Measuring Instrument (Primary and Secondary).	Bidder understands that DP type LT shall be provided for water application & Ultrasonic/ Radar Type Level transmitters shall be provided for Slurry Tanks/ Sumps Owner to please confirm Bidder's understanding.	Bidder's understanding is not correct. Bidder to comply to specification requirement.
485	Section-VI, PART-B /SUB-SECTION-A-05 (FGD)	6.02.03	12 of 28	Each Silo shall be provided with three(3) no. of radar type level transmitters.	Silo level measurement is used for monitoring / open loop control of conveyors. Since conveyor operation is intermittent , Bidder proposes 2 Nos of LT for each Silo. Owner to please confirm Bidder's understanding.	Bidder's understanding is not correct. Bidder to comply to specification requirement.
486	Section-VI, PART-B /SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	4.01.00	82 of 101	The operation of the Employers' Cross-country conveyor & Employers' downstream conveyors, feeding coal from Mines to bidders' Transfer Point chute shall be controlled from Employer's PLC based Control system being procured in separate package. However, the monitoring & operation of this system is also envisaged from Main CHP control room. Necessary hardwired signal exchange & Soft Connectivity with CHP DDCMIS required for operation & monitoring of this system shall be envisaged by Bidder. The same shall be finalized during detail engineering.	a) Bidder understands that necessary hardware / software modifications / upgradation, as required at Employer's System end, to interface with Bidder's system, shall be in Employer's scope. b) Owner to please inform the type communication protocol and number of soft I/Os to be considered at CHP DDCMIS end. c) Owner to please confirm location of employer's PLC.	Refer clause 2.02.00 of Sub-section IIC Part A. Bidder to note that technical specification requirements are clear and are to be met by the bidder.

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487	Section VI, Part A, Sub-Section IID	4	2 of 13	Dismantling of all existing facilities and disposal of dismantled material is in the scope of the bidder. The bidder has to take care this aspect while bidding. Bidder shall be responsible for safe disposal of all such materials outside the plant boundary in environmentally friendly manner meeting all statutory requirements.	Bidder understands that Owner is presently disposing the dismantled items within the plant premises. Accordingly Bidder request Owner to earmark location of disposal site for keeping dismantled items within vicinity of plant premises.	Any existing facility to be dismantled within the boundary of the project area can be stacked temporarily by the bidder within the project boundary and the same shall be removed/disposed off timely as per technical specs. No claim in terms of time and monetary terms shall be entertained for multiple handling.
488	Section VI, Part A, Sub-Section IID	4	1 of 13	Dismantling, removal, and disposal of identified facilities/ structures/ substructures/foundations of dismantled quarters/buildings/structures, reinforcement, pavement/paving, pipes and any underground structure/materials, debris etc. all complete.	Bidder understands that the dismantling methodology adopted during execution will not ensure future operability/usage/ serviceability of existing equipment/technological structures/rails/rail sleepers, all steel sections/members/plates etc. Please confirm.	Bidder understanding is correct. All materials arising out of dismantling has to be removed and disposed of as per provision of contract.
489	Section VI, Part A, Sub-Section IID	5.09.00	3 of 3	Bidders should visit site and make a logistic study of ODC consignments.	Present approach road is passing through a congested market & busy railway crossing (electrified) area, which will restrict movement of oversized trucks, dumpers, trailers etc. during construction period. The only other possible approach to the project site is through Railway Over Bridge (ROB), which is still under construction. In this context, kindly note that construction of a portion of this ROB is pending for past few years. Bidder understands that approach to site through the aforesaid ROB shall be made available by Owner on or before the issuance of Notification of Award (NOA). Please confirm.	Approach road to the plant is available through a level crossing. For ease of movement, construction of balance work of Rail Over Bridge (ROB) is under construction by R&B department, Govt. of Odisha. In addition to this, Anugul Talcher State highway can also be used for transportation and approach to TTPS site directly. Further for approach to the designated laydown area in abandoned ash dyke, ROB is not required.
490	Section VI, Part B, Sub-Section D-I-2 (I)	5.02.00	1 of 4	This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area 'A', 'B' & 'C' has been identified for this purpose.	Existing 220 KV transmission lines are passing between the two ash dykes i.e. dyke no. B and C, with significant elevation difference, which will restrict the vehicular movement within the laydown area from dyke B to C. Also in order to make ramp, existing dyke needs to be excavated which will not be allowed. Thus, the laydown earmarked within the dyke C having substantial area will remain unutilized. We request NTPC to ensure rerouting of transmission lines prior to handover of laydown area to the EPC Contractor.	Rerouting of existing 132kV transmission line is not feasible and hence not envisaged. The transmission line is sufficiently above the existing ground level and sufficient headroom is available.
491	Section VI, Part B, Sub-Section D-I-2 (I)	Annexure - (I)	1 of 4	This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area 'A', 'B' & 'C' has been identified for this purpose.	Development of abandoned ash dyke as specified in Annexure (I) is applicable only when Bidder is utilizing the aforesaid area for laydown purpose. It is not a mandatory requirement. Please confirm.	Bidder to refer amendment no D1-36 and D1-37 in this regard.

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492	Section VI, Part A, Sub-Section IID	4 e	3 of 13	Temporary fencing, by employer, shall be provided around existing station facilities to isolate from the Stage-III project areas. (Marked in GLP)	Additional space will be required between proposed Main Plant facilities of Unit 1 and existing TPS Stage-II BOP facilities for carrying out pre-assembly work, crane movement for erection of Main Plant equipment, temporary storage etc. We, therefore, request NTPC to provide additional space to EPC Contractor by arranging to dismantle the adjacent TPS Stage-II BOP facilities like rail lines, store, etc. before the issuance of NOA.	Dismantling of existing Railway Siding and Ash water reservoir is in the scope of EPC Package. Above ground structures of Stores would be dismantled by Owner. However, dismantling of below ground structures of stores i.e. foundations etc. is in the scope of EPC Package. Please refer Technical Specifications for clarity. Additionally, 75 acres of land is available for Laydown & Pre-assembly and an additional 10 acres are available for Batchings
493	Section VI, Part A, Sub-Section IID Sub section IIA - 15	4 d 1.08.00	3 of 13 3 of 7	ETP Facility at SI No. 4(a)-xvi shall not be dismantled. Same is to be utilized for Stage-III. Stackyard shall be covered with structural shed all along the coal heap.	Existing ETP facility needs to be dismantled by Owner else Bidder will not be able to construct Coal shed structure. Owner to kindly confirm acceptance of the same.	Dismantling of existing ETP is in EPC Scope. Bidder to refer Amendment no. D1-4
494	Annexure P, Section VI, Part B, Sub Section D-1-12 Sub Section IID	1.00.00 4) 4 i)	1 of 13 3 of 13	Details of facilities to be dismantled Dismantling and disposal of ash water reservoir to locate other facilities for stage-III are in the scope of the bidder.	Bidder understands that the facilities listed by Owner for dismantling purpose may vary based on the approved layout, which will be finalized during detail engineering. Hence it is understood that existing facilities of Stage I and Stage II which are not fouling with proposed Stage III facility shall not be dismantled by Bidder. Please confirm.	Bidder to refer Clause 1.00.00 of Part-A, Section-VI, Sub Section -IID
495	Section VI, Part B, Sub Section D-1-4	4.01.00	1 of 4	The preliminary layout plan proposed for the project is shown in the drawing no 4540-999-POC-F-001 titled "General Layout Plan". It shall form the basis for further elaboration by the Bidder for the plant facilities, which are in his scope. Area identified for facilities remain same as indicated in GLP, however, minor modification of location of building may be done to optimize layout.	Bidder understands that General Layout Plan (GLP) furnished in the tender is for guidance only. Bidder has the option to modify the existing layout and develop their own GLP within the given area while meeting functional requirement and external interface points. Please confirm.	Bidder is requested to adhere with provision of contract. Area identified for facilities remain same as indicated in GLP, however, minor modification of location of building may be done to optimize layout.
496	Section VI, Part B, Sub-Section D-1-2 (I)	5.02.00	1 of 4	Complete storm water drainage system of Plant area is in bidder's scope. Storm water drain shall be designed taking into account the finished ground levels of the plant/township area, drainage pattern, intensity of rainfall, etc as stipulated/mentioned in 'Area drainage study report'. These values shall be based on minimum rainfall intensity of 75mm/hr.	Area drainage study report also includes drainage requirement for other areas like abandoned ash pond, OCP Mine void etc. Drainage system in these areas are excluded from Bidder's scope of work. Please confirm.	Drainage system of Plant Area, ash dyke (if used as laydown area), surrounding area of plant is in EPC scope.
497	Section VI, Part A, Sub-Section IID	4	2 of 13	Dismantling planning shall be as detailed below: a. Existing structures over-lapping with Stage-III facilities:	Dismantling of existing Stage I&II Raw water reservoir is included in EPC scope, however Bidder understands that dewatering of these reservoir shall be done by Owner before start of dismantling work. Please confirm.	Bidder to note that dismantling work including dewatering is in the scope of the Bidder.
498	Section VI, Part E, Tender drawings			PT Plant	Chemical house drawing and overall dimension (Length and Width) furnished in the tender are indicative and non binding. The layout and dimension for this building shall be as per system requirement. Please confirm.	Bidder's understanding is correct.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply (EPC)
499	SECTION VI / PART E/ Tender Drawings 4540-001-POC-A-005, Rev 0	-	17 of 35	Layout of Drains	Bidder request Owner to confirm that storm water drain and storm water flow from existing plant areas are not in EPC scope and shall be taken care by Owner. <u>Bidder shall calculate drain size considering the catchment area as calculated from the area grading drawing no 4540-001-POC-A-003 (i.e. hatched portion covered under EPC Scope of work).</u>	Drainage system in EPC package shall be designed considering the storm water flow from St-I & II areas and adjoining areas as per the Area Drainage study report and technical Specifications.
500	SECTION VI / PART E/ Tender Drawings 4540-001-POC-A-005, Rev 0	-	15 of 35	Site levelling Plan	Bidder understands that any modification (in profile and cross section) including side slope protection works for Nandira and Mundabasti nallah are not included in bidder scope of work. Please confirm.	Nandira nalla is outside the plant boundary wall. Any modification required for connection of drainage from Mundabasti area to existing drainage system is in the scope of bidder.
501	SECTION VI / PART E/ Tender Drawings 4540-001-POC-A-005, Rev 0	-	17 of 35	Layout of Drains	Bidder request Owner to Kindly provide the storm water drain layout, sanitary network layout and Road Layout drawings of existing plant.	Drawings are not available. Bidder to visit site and acquaint itself with site conditions.
502	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	Figure 6.2 Figure 6.3	607 611 619 620 622 625 630	Figure 6.2 Partition of plant area into Zones and Nandira Nala Figure 6.3 Drainage map of entire area Figure 6.5 Drainage for Zone X Figure 6.7 Drainage for Zone Z Figure 6.9 Drainage for Zone B Figure 6.10 Trunk Drain Figure 6.11 The trunk Drain	Presently the drawings/figure are not legible from the area drainage study report shared with tender specification. Bidder request Owner to provide copy of readable Figures (i.e. drawings which are part of area drainage study report) for understanding / clarity.	These drawings/figures are the part of area drainage study report. Seprate drawings/figures are not available.
503	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	6.3.1	608	Channel slope, length, bed width is worked out such that capacity utilization in each of the channel segment (ratio of discharge contributed by connecting sub-catchments to the channel carrying capacity) is near to 1.0. However, in few channel segments this requirement may have to be compromised based on hydraulic and drainage layout considerations.	Bidder request Owner to kindly confirm that, as the storm drain sections are designed to capacity nearly 1 and in some parts more than 1, thus same sections to be followed during detail engineering. Please confirm bidder's understanding.	This will be delt at detailed Engineering stage.
504	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	6.4.1 5.08.00	609 of 659 50 of 659	Bed slope of 1:1000 and 1:1500 have been considered for internal drainage channels. Bed slope not milder than 1 in 1000 shall be provided.	Mismatch in specification. Bidder understands that, minimum/milder slope allowed for the drains is 1:1500. Please confirm.	Bed slope not milder than 1 in 1000 shall be provided. However, in some case 1:1500 may be provided as per requirement as given in area drainage study report.
505	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	Figure 6.10	629	Figure 6.10 (d). Part 4 of The trunk drains on western boundary to carry runoff from Jagannathpur and Mundabasti area	Bidder request Owner to kindly provide drawing of existing drain DJ53 with detail coordinates.	Drawings are not available. Bidder to visit site and acquaint itself with site conditions.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply (EPC)
506	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	6.2.3	605	A trunk drain along western boundary starting from location I3 and up to outfall at OP1 on Nandira nala is proposed (photo 6.13). A 600 m long drain (rectangular, concrete) along and inside western boundary already exists. This trunk drain shall be extended upstream and shall cater exclusively to the storm water from outside NTPC premises (i.e. Jagannathpur village area). However, there is constraint on availability of land along western boundary in existing plant area of stage I and II. Therefore, as an alternative, a trunk drain passing through zone Z and with outfall OP8 on Mundabasti nala is also considered for drainage of runoff from Jagannathpur area till the time stage I & II remain in operation.	a) Owner to clarify which trunk drain to be considered in Bidder's scope as alternate options are provided in area drainage study report: Option 1 - I1 to I2 (Refer figure 6.13) trunk drain shall be constructed to cater exclusively to the storm water from outside plant. OR Option 2 - Trunk drain passing through zone Z and with outfall OP8 on Mundabasti nala Owner to clarify which option i.e. Option 1 or Option 2 to be considered in EPC scope of work. b) Bidder understands that drain length of 600m from point I2 to outfall in nandira nala is already existing thus no modification or new construction required for drain section. Please confirm.	a) Trunk Drain to be provided as per tender drawing 'Layout of drain' and as per requirement of disposal of storm water up to final disposal point. b) Drain from I2 to outfall in nandira nala will be required.
507	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Area Drainage Study Report	6.2.3	605	A trunk drain along western boundary starting from location I3 and up to outfall at OP1 on Nandira nala is proposed (photo 6.13). A 600 m long drain (rectangular, concrete) along and inside western boundary already exists. This trunk drain shall be extended upstream and shall cater exclusively to the storm water from outside NTPC premises (i.e. Jagannathpur village area). However, there is constraint on availability of land along western boundary in existing plant area of stage I and II. Therefore, as an alternative, a trunk drain passing through zone Z and with outfall OP8 on Mundabasti nala is also considered for drainage of runoff from Jagannathpur area till the time stage I & II remain in operation.	Additional trunk drains are mentioned in area drainage study report like trunk drain from location I1 to I2, trunk drain passing through zone Z and with outfall OP8, 600 m long drain along and inside western boundary etc. The aforesaid trunk drains are not mentioned in the drain layout drawing. Hence bidder understand that the storm water drains as mentioned in Drain layout drawing only shall be considered by Bidder. Additional trunk drains mentioned in area drainage study are excluded from Bidder's scope of work. Please confirm bidder's understanding.	Trunk Drain to be provided as per tender drawing 'Layout of drain' and as per requirement of disposal of storm water up to final disposal point.
508	SECTION VI / PART B/ Book 4 of 5 - Civil Works	5.08.00	50	Plant Storm Water Drainage System	In absence of any information in tender documents, Bidder shall consider runoff coefficient for storm drain network design as 0.6 for unpaved areas and 0.9 for paved areas as per past NTPC projects.	Bidder understanding is correct in this regard.
509	SECTION VI / PART B/ Book 4 of 5 - Civil Works SECTION VI / PART E/ Tender Drawings 4540-001-POC-A-006, Rev 0	5.06.08 5.10.00.01	50	Roads shall be of concrete as per IRC standards, with minimum thickness of pavement (PQC) as 250mm (in M 35 grade) The concrete pavement for roads shall be minimum 225 mm thick slab.	Mismatch observed in PQC road thickness between specification and tender drawing. As per clause 5.06.08 minimum thickness of PQC mentioned in 250mm and as per drawing number 4540-001-POC-A-006, Rev 0 thickness specified as 225mm, Kindly clarify which document to be followed.	The concrete pavement for roads shall be minimum 250 mm thick slab. This is typographical error. Bidder to refer Amendment no. D1-30
510	SECTION VI / PART B/ Book 4 of 5 - Civil Works	5.07.00	50	Complete sewerage system including Sewage Treatment Plant for facilities within the plant is in bidder's scope. Bidder shall provide 'De-centralized Sewage Treatment' units.	Bidder request Owner to allow the use of bio digesters for the toilet provided in isolated areas within plant boundary.	Bidder is requested to adhere with provision of technical specification
511	SECTION VI / PART E/	4540-001-POC-A-003	14,15 of 35	Site Levelling Plan	Sheet 14 and Sheet 15 both are Site Levelling Plan. Bidder requests Owner to clarify which drawing to follow.	Site Levelling Plan drawing Sheet 14 to follow.
512	SECTION VI / PART B/ Book 4 of 5 - Civil Works	5.02.09	19 of 649	Vertical bracings to the columns in CCR building shall not be provided at the operating floor level and CCR building frames shall be designed as moment resisting frames in both transverse and longitudinal directions	Bidder understands that Vertical bracing shall not be provided in control room area where LVS of DCS system is located. Please confirm.	confirmed

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513	SECTION-VI / PART-B / SUB-SECTION D-1-5	5.19.01.21 6.03.08.18	88 of 120 11 of 24	All Insert plates (except edge protection angles) provided in liquid retaining structures shall be 12 mm thick GI with lugs not less than 12 mm diameter. Edge protection angles shall be provided as specified elsewhere	As specified in clause no.5.02.11.01.08, lugs used shall not be less than 12mm diameter rods <u>or 6mm flats</u> .	Bidder to refer amendment no. D1-31
514	SECTION VI / PART E/	4540-001-POC-A-002	11 of 35	Topographical Survey	Spot Levels of some areas like proposed CHP, Railway siding, Outfall area in south east direction etc. are not available in the tender topographical survey drawing. Bidder requests Owner to provide the aforesaid spot levels for estimation of area grading quantities.	The available spot level is provided in Topographical Survey.
515	SECTION VI / PART B/ SUB-SECTION D-1-5 SECTION VI / PART A/ SUB-SECTION III	5.01.00 (i) 4.03.00	1 of 21 2 of 3	All the buildings and site development including Landscaping shall be designed to take care of rain water harvesting & ground water recharging. Development of rainwater harvesting scheme for the project and obtaining approval of the scheme from central Ground water board is in bidder scope. Exclusions: Landscaping	Bidder understands that landscaping is excluded from Bidder's scope of work. Please confirm,	Confirmed
516	SECTION VI / PART B/ SUB SECTION D-1-5	5.01.00.k	1 of 120	For Control Rooms, CER, UPS Charger Room area in MPH dry wall construction technology shall be incorporated. Control room shall be designed as designer control room with ACP Cladded wall panelling for housing LVS	Details of dry wall for Partition is not mentioned in the specification. Bidder shall consider gypsum partition wall for dry wall construction. Please confirm.	Bidder to refer amendment no. D1- 25
517	SECTION VI / PART B/ SUB-SECTION D-1-5	5.02.09 (iii)	12 of 120	Mullion-less charged glass wall shall be provided in between the control room and the visitor's gallery.	a) Bidder requests Owner to provide brief specification of charged glass as the same was never used in any past NTPC project. b)Also bidder understands that mullion-less glass wall is same as curtain wall. Please confirm.	Bidder to refer amendment no. D1-20
518	SECTION VI / PART B/ SUB-SECTION D-1-5	5.02.10 (i)	13 of 120	Architectural Features. This building shall be four storied (Ground +3) and shall be provided with floor area of 3700 sq. m with R.C.C. framed structure.	As per Tender drawing GLP (General Layout Plan), Service building is on stilts and therefore the building shall be five storied (Stilt + 4). Please confirm bidder's understanding and accordingly modify the tender clause.	Bidder to refer amendment no. D1-14
519	SECTION VI / PART B/ SUB-SECTION D-1-5	5.02.10 (i)	13 of 120	Floor - to - Floor height shall be minimum 4.25m.	In case Owner wants Stilt+4 building as per tender drawing then the clear height of Stilt floor shall be 8 m. Please confirm and accordingly modify specification.	Bidder to refer amendment no. D1-14

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520	SECTION VI / PART B/ SUB-SECTION D-1-5	5.05.02 & 5.05.15	35 of 120 & 38 of 120	5.05.02 : Transport air compressor houses, Conveying air compressor houses, Ash slurry Pump House shall have steel shed building with side sheeting and Silo utility building, & Ash Water Recirculation pump houses shall have RCC framed structure, with RCC columns and profiled metal deck sheet roofing (filled with RCC) supported on steel purlins & truss / girders. Other buildings like MCC /switchgear rooms, control room, Disaster management room etc. shall have RCC framed structure with cast-in-situ RCC roof slabs. Bagging plant Complex building shall be closed steel shed. All RCC buildings shall have brick cladding. Crane girders or monorails shall be provided as per requirement and the same shall be of structural steel construction. 5.05.15 : Architectural Features of Ash Handling and Ash Water Recirculation System Buildings a. All buildings shall be fully covered with brick masonry cladding and Aluminium and Steel doors/ windows/ rolling shutters / ventilators.	As per clause 5.05.02, steel shed building with side sheeting is specified for Transport air compressor houses (TAC), Conveying air compressor houses, Ash Slurry pump house whereas as per 5.05.15, architectural features of ash handling is mentioned as fully covered with brick masonry cladding. Bidder requests Owner to clarify the architectural features to be considered for TAC, Conveying air compressor and Ash slurry pump house.	Bidder to refer amendment no. D1-24
521	SECTION VI / PART B/ SUB-SECTION D-1-5	5.12.04	45 of 120	250mm thick external brick wall shall be provided with provisions of fire proof door, window & rolling shutters.	Bidder understands that external brick wall shall be 230mm thick and not 250mm thick. Please confirm.	Bidder to refer amendment no. D1-15
522	SECTION VI / PART B/ SUB-SECTION D-1-5	5.14.00	47 of 120	Gate Complex	Bidder requests Owner to provide finishing schedule for Gate Complex.	Bidder to refer amendment no. D1-16
523	SECTION VI / PART B/ SUB-SECTION D-1-5	5.14.00	47 of 120	The building shall be constructed with 250mm thick brick wall with provisions for doors, windows & ventilators.	Bidder understands that external brick wall shall be 230mm thick and not 250mm thick. Please confirm.	Bidder to refer amendment no. D1-16
524	SECTION VI / PART B/ SUB-SECTION D-1-5	5.15.00 & 5.16.00	48 of 120	Watch Towers & Safety Park Building	Bidder requests Owner to provide finishing schedule for Watch Towers.	Bidder to refer amendment no. D1-23 For safety Park building refer tender drawing.
525	SECTION VI / PART B/ SUB-SECTION D-1-5	5.26.00 & 5.27.00	112 of 120 & 113 of 120	Canteen & Fire Station Building	Bidder requests Owner to provide finish schedule for Canteen building and Fire station building	Bidder to refer amendment no. D1-23
526	SECTION VI / PART B/ SUB-SECTION D-1-5	5.28.00	113 OF 120	DOZER SHED Architectural Feature This building shall be prefabricated steel framed structure with brick wall up to window sill height & prefabricated insulated double skin metal sheeting cladding above it. Roof of the building shall be prefabricated insulated double skin metal sheeting on steel roof truss. The building shall provide for Dozer shed space, Workshop space, Office Rooms, Stores, Toilet & Pantry as per functional requirement. Minimum size of the dozer shed shall be 500 Sq. m.	Bidder understands that dozer shed of 500 sqm is including Dozer washing area. Please confirm.	Dozer shed area of 500 sq.m. is excluding the Dozer Washing Area.

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527	SECTION VI / PART B/ SUB-SECTION D-1-9	9.07.04	6 of 31	Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of 625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part-III).The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls(100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in IS 6041 – 1985, IS -1905.	Bidder shall consider AAC block masonry of standard length as per manufacturer's recommendation. Please confirm.	Bidder to follow Technical Specification
528	SECTION VI / PART B/ SUB-SECTION D-1-9	9.15.00	16 of 31	The above design philosophy put into practice shall be detailed out through presentation drawings, perspective views, scale models, detail drawings, etc.	Bidder understands that the interior design presentation drawings, 3d views and detail drawing shall be submitted. However we do not envisage scale models for the interior design of the control room. Please confirm.	Confirmed
529	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 Table A	18 of 31	20 mm thick heavy duty anti skid full body vitrified tile in TG Hall. Rubber flooring at TG deck	Bidder understands that rubber flooring shall be provided on the elevated portion of the TG deck over concrete flooring. Please confirm. Also Owner to share brief specification (thickness, material properties etc) with respect to Rubber flooring.	Exposed surface of TG Deck shall have rubber flooring. Ref Cl 9.04.16 of D-1-9 Section-VI Part-B of Technical Specs for specifications of rubber flooring.
530	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 Table A	18 of 31	Ceiling finish - Aluminium false ceiling in combination with GRG plasterboard border in column depth or as per approved design.	NTPC to confirm Aluminium False ceiling shall be in 600 x 600 mm grid.	Confirmed
531	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 Table A	19 of 31	Toilet False ceiling - Main Power House building	Toilet false ceiling shall be Calcium Silicate instead of Aluminium, NTPC to check and confirm.	Bidder to refer amendment no. D1-23
532	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 - Table A	22 of 31	Service Building/Administration building : Office room/Staff Room : Wall Finish - Acrylic emulsion paint/ Designer Glass mosaic tile mural in combination with textured paint in Canteen	Bidder understands designer glass mosaic tile mural in combination of textured paint shall be provided in canteen and not in Office room or Staff Room. Please confirm.	Confirmed
533	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 - Table A - 05	25 of 31	Fire Water Pump House - Not used	As per clause 5.21.0. Fire water pump house is included in EPC scope of work. Owner to furnish finish schedule for this building.	Bidder to refer amendment no. D1-23
534	SECTION VI / PART B/ SUB-SECTION D-1-9	9.17.00 - Table A - 07	26 of 31	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Ash Water recirculation Pump House/ Transport air compressor house/ HCSD pump house/Fuel Oil Unloading Pump House with switchgear building& control room /H2 generation Building/ Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Pump house, Switchgear room, control room/Any other Building	Bidder requests owner to provide finish schedule for the Toilet blocks used in buildings specified in this section.	Bidder to refer amendment no. D1-23
535	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Sub-Section-D-1-5	5.18.01	65 of 120	Circulating Water Pump House (CWPH), Raw Water Pump House (RWPH) and Make-up water Pump House (MUWPH)	Bidder request Owner to provide exposure condition/cover requirement to be followed for design of concrete structures in MUWPH	Bidder to refer Chemical Test report in Amendment no.... And adopt exposure condition/cover requirement as per IS456.

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536	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Sub-Section-D-1-7	7.03.00 (ii)	4 of 12	minimum diameter of pile for bridge / approach bridge shall be 1200 mm.	a) Bidder understand that this stipulation is applicable for the substructure of structural steel bridges for make up water pipe crossing at irrigation canal/nallah. Please confirm. b) Also, open or pile foundation shall be considered suitably as per Geotechnical Report and foundation recommendation in that area. Please confirm	a) The minimum diameter of pile shall be 600 mm and in case of piles in water body/river, minimum diameter of piles for bridge/approach bridge shall be 1200mm (refer Tech Spec). b) Bidders understanding is correct
537	SECTION VI / PART B/ Book 4 of 5 - Civil Works/ Sub-Section-D-1-7	7.03.00	4 of 12	PILE FOUNDATIONS – In case piles are adopted, following shall be adhered to:	Bidder request Owner to provide grade of concrete and clear cover as applicable for pile, pile cap and pier if required for foundation pile/pile cap/pier of structural steel bridges for make up water pipe crossing at irrigation canal/nallah.	Minimum grade of Concrete for piling shall be as per relevant IS/IRC Code

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538	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.05.03	4 of 17	The typical configuration of such a proposed system is as enclosed in Drawings 0000-205-POE-A-001 & 0000-205-POE-A-002 .	The referred drawings Drg.no. 0000-205-POE-A-002 . is not available in tender specification. Owner may please provide.	Please refer amendment no.B-7
539	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.11.00	6 of 17	Out of the total requirement of lighting mast envisaged for station lighting, at least Thirty (30) Lighting Masts (30M height) shall be supplied, erected and commissioned at locations identified by Site Engineer prior to construction phase which shall cater to construction lighting and same shall later function as permanent lighting. LED type lighting fixtures shall be provided for Lighting Mast. Minimum 10 number of mobile lighting mast with DG set and fuel shall be provided for construction lighting.	(1) This is being EPC package, Bidder understands the quantity of mobile lighting mast, if required, shall be decided by bidder based on construction work requirement. (2) The quantity of lighting mast mentioned in specification is total requirement and not a "minimum". Owner may please confirm. (3) Owner may please clarify that the mobile lighting mast are supplied on returnable basis OR to be handed over to customer.	1. Bidder's understanding is not correct, bidder's scope consists of minimum ten (10) nos mobile lighting masts as specified in Technical specification. 2. Bidder's understanding is not correct. bidder's scope consists of minimum Thirty (30) nos. lighting masts as specified in Technical specification 3. Mobile lighting mast are non-returnable.
540	TECHNICAL SPECIFICATIONS SECTION-VI, Part-A BID DOC NO: CS-4540-001A-2 SUB SECTION-IIA-21 SOLAR P.V. SUB-SECTION-IIID CIVIL WORKS SECTION VI / PART B/ SUB-SECTION D-1-5	28.00.00 5.02.09 (iii)	11 of 120	The Solar Photo Voltaic (PV) installation on Rooftop of various buildings/ sheds /South facing Walls (BIPV) etc. as per EIC of the Power Plant shall be carried out preferably on shadow free area in such a way that the generation is maximized on each building suitable for installation of Solar PV power plants. Civil, structural, architectural works for SOLAR PV plant on 'A-Row' elevation for main power house and roof top of building/facilities in the bidder's scope. Windows on the south side at accessible level at operating floor level shall have Building Integrated Photovoltaic Cell as Glazing	(1) Bidder requests Owner to provide all necessary details comprising technical specification pertaining to the application of BIPV on glazing/window. (2) Owner may please clarify the requirement of cleaning system for BIPV system. If cleaning system is required, Bidder request Owner to provide specification for cleaning system.	Refer Amendment No: F-1

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541	SECTION-VI, PART-B, SUB-SECTION-D-1-5 CIVIL WORKS SECTION-VI, PART-B, SUB-SECTION-D-1-5 CIVIL WORKS SECTION-VI, PART-B, SUB-SECTION-D-1-5 CIVIL WORKS	5.02.09 5.02.10 5.30.00	9 of 120 13 of 120 113 OF 120	Main Power House Windows on south side at accessible level at operating floor level shall have Building Integrated Photovoltaic Cell as Glazing Service Building Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing. ADMINISTRATION BUILDING Windows on south side shall have Building Integrated Photovoltaic Cell as Glazing	Based on the referred tender specification, Bidder understands that BIPV shall be installed on following buildings only: 1. Main Power House 2. Service Building 3. Administration Building Please confirm.	Refer Amendment No: F-1
542	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2 SUB-SECTION-A-25 SOLAR P.V.			For a shade free roof, the bidder has to install the solar PV rooftop system on the buildings in this package based on maximum 15 square meter area per kWp. However, in case chances of sporadic shade occur, the installation shall be based on the shading profile and same shall be decided during detailed engineering.	Bidder requests Owner to please identify the list of building on which Solar roof top is required.	Refer Amendment for capacity. During detailed engineering buildings will be finalized.
543	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2 SUB-SECTION-A-25 SOLAR P.V. SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.15.00	7 of 17	To meet the construction power requirement of the project, the Employer shall provide Two (02) number 6.6 kV sources through two number 220/6.9kV transformers. Bidder shall step up this power to 11kV level by providing minimum two numbers suitably rated 6.6/11.5kV transformer and associated 6.6kV RMU panel and 11kV RMU panels as per Tender drawing number 4540-999-POE-F-00C.	Bidder understands the terminal point for Construction power supply will be 6.6kV RMU's. Cable from 220/6.9kV Transformer secondary to 6.6kV RMU's will be in purchaser's scope. Please confirm bidder's understanding.	Bidder's understand is not correct. Bidder shall extend the supply from 6.6kV terminal of station transformer to suitable place to install 6.6 kV RMU. Refer tender drawing for construction power.
544	Single Line Diagram Doc no: 4540-001-POE-J-001	-	-	11kV Feeder to Colony from 11kV Miscellaneous switchgear	Bidder requests Owner to provide the load details of Colony for sizing of 11kV Miscellaneous switchgear.	11kV misc switchgear has to be sized as per transformer size indicated in SLD. Two nos. 5 MVA feeder shall be provided for Colony.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
545	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2 SUB-SECTION-A-25 SOLAR P.V. COAL HANDLING PLANT GENERAL ARRANGEMENT AND DETAIL OF S/R Doc NO: 4540-XXX-POC-016	1.00.00	1 of 26	Determination of Optimal grid connected solar PV systems for all sheds (Car parking, Coal stock yard etc.) of this package.	Bidder requests Owner to provide sample drawing indicating Solar PV panels mounted on coal shed.	Refer Amendment No: F-3
546	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2 SUB-SECTION-A-25 SOLAR P.V. SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.15.00	7 of 17	To meet the construction power requirement of the project, the Employer shall provide Two (02) number 6.6 kV sources through two number 220/6.9kV transformers. Bidder shall step up this power to 11kV level by providing minimum two numbers suitably rated 6.6/11.5kV transformer and associated 6.6kV RMU panel and 11kV RMU panels as per Tender drawing number 4540-999-POE-F-00C.	Bidder understand that space will be provided by Owner near 6.6kV power source for installation of 6.6kV RMU, 6.6/11kV Transformer, 11kV RMU, HT capacitor bank, 11kV four pole structure etc. Owner to provide layout drawing of existing substation indicating location of 220/6.6kV transformer and available space for installation of proposed equipment for drawal of construction power.	Bidder has to extend supply from employer's 6.6 kV bushing terminal of station transformer upto his 6.6 kV RMU through cable. For 6.6kV RMU, 6.6/11kV Transformer, 11kV RMU, 11 kV four pole structure etc., location shall be decided by the bidder. Bidder to visit site and gather relevant details.
547	SECTION-VI, PART-B, SUB-SECTION-E-28 GENERATOR AND AUXILIARIES	PROCESS CHECK FOR CORE GENERATOR/ EXCITOR	3 of 9	Type test reports for similar type of bars for heating cycle test, thermal stability test @ Manufacturing Winding bar & phase bar Note: @: Type test reports for similar type of bars for heating cycle test, thermal stability test, and voltage endurance test manufactured from same works from which bars are to be sourced is acceptable if conducted within 5 years of bid opening.	- According to Clause 1.23.00 & its Table A of SECTION – VI, PART-A, SUB-SECTION-IIB-ELECTRICAL SYSTEM / EQUIPMENTS, Page 15 & 16 of 17, type test report validity is 10 years. Bidder considers that the above mentioned clause shall be applicable to Generator Stator bars type tests also (i.e., type test validity of 10 years from bid opening). NTPC is requested to confirm acceptance.	The chapter number and clause indicated by bidder is incorrect. However for type test validity please refer Clause 1.23.00 & its Table A of SECTION – VI, PART-A, SUB-SECTION-IIB-ELECTRICAL SYSTEM / EQUIPMENTS, Page 15 & 16 of 17,

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
548	SECTION-VI, PART-B, SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	3.01.00 - d)	4 of 15	3.00.00 SIZING & DESIGN 3.01.00 Generator d) For the Generator and its excitation system specific design features incorporated and design/process improvements which are being offered considering modes of operation as per Sub Section A-01 - Operating Capability of Plant - in Technical Specification shall be submitted within 4 weeks of award of contract. Such design features and design/process improvements over and above conventional design, results of design analysis are required to be submitted as part of the EIFS (Engineering information flow system).	Bidder understands the referred section is "Sub Section G-01 OPERATING CAPABILITY OF THE PLANT" Part-B of SECTION-VI. NTPC is requested to confirm.	Bidder's understanding is correct. Refer Amendment No.B-1
549	SECTION-VI, PART-B, SUB-SECTION : B-22 BUSDUCTS	Details of Current Transformer Parameters; Details of Voltage Transformer Parameters	Not mentioned (just after Page 6 of 6 of referred sub section)	Rating and Technical Parameters of Current Transformer and Voltage Transformer	Since this is EPC project and in line to past/ongoing project(s) practice, ratings & technical parameters of Current Transformer and Voltage Transformer shall be decided by bidder based on system requirement study which shall be Approved by NTPC during project execution stage. The mentioned parameters are to be considered as tentative. NTPC is requested to confirm.	Bidder's understanding is correct
550	SECTION-VI, PART-B, SUB-SECTION : B-22 BUSDUCTS	11.02.00	18 of 26	11.00.00 FEATURES OF STATIC EXCITATION SYSTEM (If applicable) 11.02.00 Rectifier Transformer a) Type: Indoor, electrolytic grade Copper winding, epoxy moulded dry type, 3 phase step down transformer with Thermal Class 155 (F) insulation complete with flanges and terminal lugs for connection to the generator terminals through isolated phase busducts. The transformer shall conform to IEC-60076-11. Transformer shall be provided with fans/blowers for forced air cooling however all tests and performance shall correspond to air natural cooling. Fans/Blowers (AF cooling) shall have Manual and Auto control. b) Temperature rise: 70 deg.C over an ambient temperature of 50 deg.C without fan/blower and 65 deg C. over an ambient temperature of 50 deg.C with fan/blower	There are no NTPC approved excitation transformer suppliers which complies all requirements of specification. Bidder's supplied Excitation Transformer shall confirm to IEC-60076-11 and Thermal Class 155 (F) insulation. Accordingly, bidder proposes change in referred clause as follows: "b) Temperature rise: 90 deg.C over an ambient temperature of 50 deg.C without fan/blower and 85 deg C. over an ambient temperature of 50 deg.C with fan/blower" NTPC is requested to confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
551	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION B-08 (HT and LT power cables & control cables)	2.11.00	3 of 6	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and sizes shall be of 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm However for cable sizes upto 120 sq.mm. both XLPE insulated & PVC insulated LT power cables are acceptable.	As per standard industrial practice bidder shall provide cable sizes as per cable sizing calculation which may include cable sizes of 1CX400, 1CX500, 3CX185 and 3CX300. Owner may please accept the same.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.
552	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION B-08 (HT and LT power cables & control cables)	2.11.00	3 of 6	For LT cables, Same cable sizes to be used for same type & rating of motor i.e if there are three pumps for one application, all three pumps motor should be provided with same cables sizes	Bidder shall follow the specification, however in case if equipments of Two different Units of a system are located away from each other due to layout requirements, Bidder proposes to provide different cable sizes for the same as the difference between calculated cable sizes of Two Units may be large. Please confirm.	Bidder's proposal is not acceptable. bidder to comply Technical specification.
553	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-11 (LIGHTNING)	4.00.00 (10) (a)	7 of 18	Lighting panels shall have min. IP55 degree of protection.	Bidder understands that outdoor lighting panels shall have IP55 degree of protection. However, IP54 shall be provided for indoor lighting panels. Please confirm.	All Lighting panels shall have min. IP55 degree of protection as per the Technical specifications.
554	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-11 (LIGHTNING)	4.00.00 (10) (i)	8 of 18	LP-1 :3No. 415V, 63 A, SP MCB (3 1/2Cx70sq.mm cable) LP-2 : 3No. 415V, 63 A, SP MCB (3 1/2Cx70sq.mm cable) LP-D1 : 1No. 220V,32 A, DP Isolator (2Cx35sq.mm cable)	Bidder understand Cable size requirement mentioned in lighting panel section is indicative only. Bidder shall select required size of cables as per sizing criteria. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.
555	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-02 (MOTORS)	1.01.00	1 of 4	Degree of protection for various enclosures as per IEC60034-05 shall be as follows :- i) Indoor motors - IP 55 ii) Outdoor motors - IP 55 (Additional Canopy to be provided)	Bidder proposes to provide as per standard industrial practice as below: i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 (Additional Canopy to be provided) Please confirm.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.
556	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-02 (MOTORS)	7.09.00	3 of 4	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386.	Bidder proposes to provide 11kV Motors with Separable Insulated Connector (SIC) / Phase Segregated Terminal Box (PSTB). Please confirm.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.
557	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-06 (LT SWITCHGEARS & LT BUSDUCKS)	2.04.00 (8)	4 of 18	Enclosure Details Height - 2450mm max	Bidder proposes to provide in line with the OEM's Type Tested Design. Please confirm.	Bidder stated to provide type tested design against the specification requirement of height of enclosure, bidder's query is not clear.

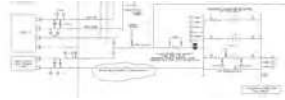
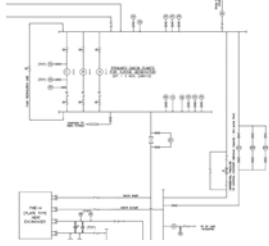
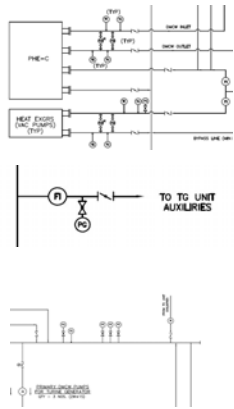
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
558	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-06 (LT SWITCHGEARS & LT BUSDUCTS)	5.00.00	13 of 18	CONSTRUCTIONAL DETAILS OF AC & DC MCCB BOX	1) Bidder proposes to provide AC & DC MCCB BOX / MCB BOX as per the requirement during detail engineering, where outgoing feeders may be either MCCB/MCB. Please confirm. 2) Bidder understands that, these AC & DC MCCB BOX / MCB BOX shall be metal enclosed, fixed type, non-compartmentalized construction, suitable for indoor/outdoor mounting on wall or steel structure. Please confirm.	1) For AC/DC MCCB box outgoing feeders are to be MCCB only. The total no of outgoing feeders must be as per specification. 2) For point no 2 bidder understanding is correct.
559	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-06 (LT SWITCHGEARS & LT BUSDUCTS)	7.00.00	13 of 18	Intelligent Motor Controller (IMC)	Bidder proposes to provide Standard Motor/Heater Feeders (Non-IMC) in the CHP & FGD Areas. Please confirm.	Entire switchgear shall be intelligent only in order to envisage motor data to DCS over profibus. Bidder to comply with specification requirements.
560	SECTION-VI, PART-B, Book 2 of 5-Electrical SUBSECTION- B-08 (HT and LT power cables & control cables)	4.00.04.01	4 of 6	Cables shall be supplied in steel drums of heavy construction.	Bidder proposes to supply cables in steel / wooden drums depending on the weight and length of cables during detail engineering. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply Technical specification.
561	SECTION – VI, PART-B, SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	1.05.00 (d)	1 of 15	d) 220V/110V/48 V DC +/-15% to +10%	Bidder clarifies that voltage variation of DC System shall be +10% to -15%	Bidder's understanding is correct. Please refer amendment no. B-2

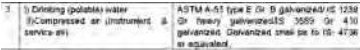
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply	
562	TECHNICAL SPECIFICATION SECTION – VI, PART - A SUB-SECTION-IV FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	g)	PAGE 2 OF 73	PG test shall be performed by using process instruments envisaged for normal operation and control of unit. Any additional instrument/ item required for PG test shall also be supplied by the contractor. Instruments to be used for PG test shall be indicated in the respective P&IDs.	PG test shall be performed by using special test instruments required for PG test and shall be separate from the process instruments. High accuracy dataloggers shall be used to retrieve the data and the same shall be used for performance evaluation through online software.	Bidder to Comply the technical specification requirement	C&I
563	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	3.4	Page 9 of 224	3.4 Provisions for Performance Test Condensate flow nozzle (ASME PTC 6) will be installed by vendor Prior to initial operations. Condensate flow data will be available in DCS during performance test. All other online process instruments will be used for conducting TG Performance test. Average value of test data of the specified test period will be collected from DCS for evaluation purpose. Offline instrument will not be used during performance test. Vendor to ensure calibration validity of all instruments used for PG Test. Calibration certificates of test instruments shall be submitted to NTPC at least 15 days before the conductance of performance test. Instrument Calibration to be carried out in a NABL accredited Laboratory.	PG test shall be performed by using special test instruments required for PG test and shall be separate from the process instruments. High accuracy dataloggers shall be used to retrieve the data and the same shall be used for performance evaluation through online software.	Bidder to Comply the technical specification requirement	C&I
564	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	Table 6.3	Page 32 of 224	Table 6.3 Number of equipment whose auxiliary power is deducted from unit output Excitation system Power including transformer loss(※) ※1 : Transformer Loss is calculated as follows. Sample calculation to be provided. $\text{Transformer Loss} = V_o + (G_i I_n)^2 \cdot V_k \cdot (273.16 + T) / (273.16 + T_n)$	As per the OEM proven practice measurement of excitation power inclusive of transformer losses through high accuracy power analyzer is carried out, hence separate calculation for transformer loss is not required.	Bidder to comply the specification requirement	ELECTRICAL
565	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SUB SECTION- G-04 STANDARD PG TEST PROCEDURE	4.8	Page 15 of 224	4.8 Frequency of Readings a) The most important measurement, that is the primary flow, shall be read at interval of as defined in DCS. b) Other important measurements, primary pressures, temperatures and secondary flows shall be read at interval as defined in DCS. c) Storage level changes, secondary pressures and temperatures, shall be read at interval as defined in DCS. d) The generator output shall be collected from online energy meter.	Frequency of readings shall be as per ASME PTC-6 . The generator output shall be collected from power analyzer connected to Generator control panel.	Bidder to comply the specification requirement.	C&I

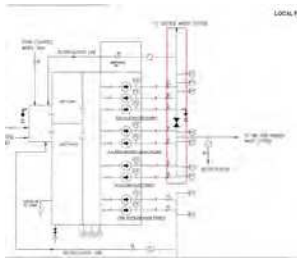
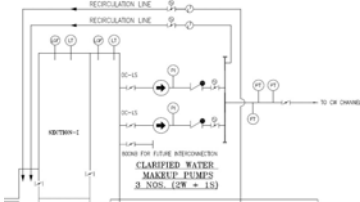
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply	
566	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO.:CS-4540-001A-2 SUB-SECTION-IIA-06 TURBINE GENERATOR AND AUXILIARIES	2.03.00	PAGE 5 OF 10	TG Integral and Other Miscellaneous Piping (I.) Steam evacuation line (HPT exhaust) from CRH piping system.	As per OEM proven practice such lines are used to take care of windage in HP turbine during low load operation and is termed as ventilator line. OEM do not have any terminology as steam evacuation line.	Bidder understanding is not correct. Steam evacuation line is used to evacuate the entrapped steam to condenser during turbine trip. Specification requirements are clear in this regard. Bidder to Comply.	TG
567	EPC PACKAGE FOR Attachment-11 Page 1 of 4 TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) BIDDING DOCUMENT NO. : CS-4540-001A-2 (Guarantee Declaration)	2		(Guarantee Declaration) Unit Heat rate in Kcal/KW/hr at 363 MW (i.e. 55% of rated load) under turbine throttle main steam pressure of 155 kg/cm² (abs) and rated Main steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero (0%) make up shall not be more than 2188 Kcal/KW/hr.	There is discrepancy in main steam pressure in commercial section (Attachment-11 Page 1 of 4) and functional guarantee (SUB-SECTION-IV FUNCTIONAL GUARANTEES clause no ii) Unit Heat Rate at 55% TMCR load) Bidder understands following as 55% TMCR Heat rate guarantee inline to functional guarantee chapter Unit Heat Rate at 55% TMCR load Guaranteed Unit Heat rate in kcal/kW/hr under turbine throttle main steam pressure of 150 Kg/cm² (abs) and rated Main Steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero make up at 363 MW load (i.e. 55 % of rated load) .	Refer amendment in this regard. (Amendment No : A-TG-1-COMM)	TG
568	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS-4540-001A-2 SUB-SECTION-IV FUNCTIONAL GUARANTEES	ii)	PAGE 4 OF 73	Unit Heat Rate at 55% TMCR load Guaranteed Unit Heat rate in kcal/kW/hr under turbine throttle main steam pressure of 150 Kg/cm² (abs) and rated Main Steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero make up at 363 MW load (i.e. 55 % of rated load) .	There is discrepancy in main steam pressure in commercial section (Attachment-11 Page 1 of 4) and functional guarantee (SUB-SECTION-IV FUNCTIONAL GUARANTEES clause no ii) Unit Heat Rate at 55% TMCR load) Bidder understands following as 55% TMCR Heat rate guarantee inline to functional guarantee chapter Unit Heat Rate at 55% TMCR load Guaranteed Unit Heat rate in kcal/kW/hr under turbine throttle main steam pressure of 150 Kg/cm² (abs) and rated Main Steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero make up with 1 TDBFP in operation at 363 MW load (i.e. 55 % of rated load) .	Refer amendment in Commercial section in this regard	TG

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply	
569	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-4540-001A-2 SUB SECTION-A-07 STEAM TURBINE AND AUXILIARIES SYSTEM	c)	PAGE 5 OF 25	Heat balance Diagrams: c) 55% of rated load under turbine throttle main steam pressure of 150 Kg/cm2 (abs) and rated main steam temperature / rated reheat steam temp. at turbine inlet at condenser pressure of 77 mm Hg (abs) with zero make-up with one TDBFP in operation . (Heat Rate Guarantee)	Bidder understand that for 55% TMCR Heat rate guarantee, One (1) TDBFP shall be in operation. Please confirm.	Bidder understanding is correct. Bidder to further refer clause No. 1.01.03/(iii) of the functional guarantee chapter/sub-section-IV/Part-A.	TG
	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-4540-001A-2 SUB SECTION-A-07 STEAM TURBINE AND AUXILIARIES SYSTEM	ii)	PAGE 4 OF 73	Unit Heat Rate at 55% TMCR load Guaranteed Unit Heat rate in kcal/kWhr under turbine throttle main steam pressure of 150 Kg/cm2 (abs) and rated Main Steam and Reheat Steam temperature at 77 mmHg(abs) condenser pressure with zero make up at 363 MW load (i.e. 55 % of rated load) .			TG
	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC.NO.:CS-4540-001A-2 SUB-SECTION-V ESSENTIAL DATA	4	PAGE 1 OF 14	1. MECHANICAL DATA 4. 55% of rated load under turbine throttle main steam pressure of 150 Kg/cm2 (abs) and rated main steam temperature / reheat steam temp. at turbine inlet of 600 deg C / 600 to 610 deg C (as selected) at condenser pressure of 77 mm Hg (a bs) with zero make-up with one TDBFP in operation . (Heat Rate Guarantee)			
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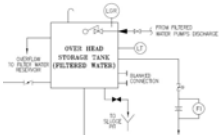
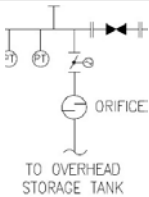
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
570	SECTION – VI, PART-A SUB SECTION IIA-11 CW SYSTEM SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	1.02.01 12.00.00 PAGE 13 OF 31	PAGE 2 OF 4	1) Two (2) numbers motor operated inching type butterfly valves of required size for isolating the hot water header to the cooling tower (each) along-with valve supports. 2). Main header shall be branched into two (02) nos. for feeding to each section of cooling tower. Two (2) nos. manually operated butterfly valves of suitable size shall be provided in branch pipe of each cooling tower	Bidder understands that MOV is required at condenser outlet and for each branch pipe (riser) of cooling tower manual butterfly valve is sufficient for cooling tower isolation. Hence two (2) nos of motor operating type inching valve is not required to isolate hot water header. Owner to please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
571	SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	14.01.00 1.02.00 (7)	PAGE 2 OF 4	1) Necessary stub connections for pitot tube shall be provided in the hot water header of cooling tower for measurement of flow. 2). Provision of six (6) numbers of Isolation (Gate valve) Valves (in the stub connections) for each unit at the locations where flow measurement is to be carried out by means of pitot tubes.	Provision of six (6) numbers of Isolation (Gate valve) Valves (in the stub connections) for each unit is may not be required. With Khargone project experience, bidder request Owner to accept for two (2) number of isolation valves per unit in stub connection.	Bidder's proposal is not acceptable. Further, it is clarified that six (6) numbers of isolation gate valves with stubs (three(3) in each Unit) shall be provided. Refer Amendment No : A-WS-3
572	SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	1.01.00 1.01.00	PAGE 1 OF 31 PAGE 1 OF 31	The duct shall be connected to the pump discharge flange through a carbon steel pipe, hydraulically actuated butterfly valve , expansion joint and distance piece (if applicable) For each unit, individual intake ducts from the CW pumps to the condenser and discharge ducts from condenser to cooling towers shall be provided. However, the supply ducts of all the modules shall be interconnected by means of motor actuated butterfly valves at the CW pump house end	For CW pump discharge one clause is asking for hydraulically actuated butterfly valve and another clause is asking for motor actuated butterfly valve. Bidder request owner to specify which type of actuator is required for this requirement.	Hydraulically actuated butterfly valve shall be provided for Pump discharge. and Motor actuated butterfly valves for Unit CW duct interconnection as specified.
573	TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	1.02.00 (12)	PAGE 2 OF 31	MODEL TEST OF CW PUMPS: For the offered pump, bidder should have carried out the model test. Bidder shall furnish the above test results along with the tender. The model test should have been conducted as per Japanese standard JIS-B-8327 and specific speed of the model tested pump shall lie within $\pm 5\%$ of the specific speed of the pump offered.	Alternatively, CW pump model test shall be done as per HIS, which is being widely accepted in the industry. Owner is requested to confirm the proposal.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
574	TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	1.02.00 (15)	PAGE 3 OF 31	Physical Modelling Contractor shall carry out a physical sump model study at a recognized Institute / Hydraulic research laboratory. Scale of the model shall be minimum 1:12. The physical sump model study shall be conducted to study flow conditions in approach CW channel, forebay, pumps bays, draft tubes for different discharges and different depths of water, different combinations of pump operations and to study velocity distribution in approach channel, forebay area, pumps bays, draft tubes etc. The model shall be based on Froude's law of similitude and shall be tested for following two more flow conditions, viz. - At twice the prototype maximum Froude number, i.e. the Froude number of the model is two times that of prototype. - At equal velocity criterion, i.e. the velocity is same both in the model and prototype.	Sump model shall be prepared considering Froude's law of similitude as per HI-9.8 and based on the scale ratio of 1:12 as per specification requirement. As per HI-9.8, Cl. No. 9.8.4.3, "Tests at prototype velocities are not recommended, as this will distort approach flow patterns and unduly exaggerate flow disturbances (e.g., vortices) in the model." Therefore, Bidder understands that "equal velocity criterion" means, equivalent velocity of model and prototype shall be established based on Froude's law of similitude (i.e. 1F for model and prototype) irrespective of actual prototype velocity as per HI-9.8. Request bidder to confirm bidder's understanding.	Bidders understanding is not correct. Bidder to comply technical specification requirement.

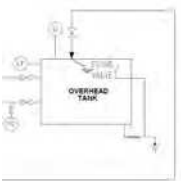
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
575	Tender drawing 4540-101-POM-A-038				Bidder clarifying that, with our Khargone project experience, bypass line for ACW system is not required. Owner requested to confirm the same.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
576	Tender drawing 4540-101-POM-A-038				As balancing line is considered for equipment cooling system then separate recirculation line is not required. Owner to please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
577	Tender drawing 4540-101-POM-A-038				Flow indicator are indicated in flow diagram at ACW header and ECW TG auxiliaries header (inlet & outlet side). Please note rotameter of such higher sizes are generally not available in market. Hence bidder propose. One (1) FT shall be installed on ACW header to measure total flow across the system and one (1) FT is installed on ECW header to measure cooling water flow across the system inline with Khargone project.	Bidder's proposal to provide FT in place of FI for ACW and ECW is acceptable. Bidder to provide one no. of FT having local display unit against each FI.
578		Clause No. 13	PAGE 6 OF 13	Quantity of water to be cooled by Cooling Towers of One Unit: CW Pumps Flow per Unit + 10% margin	We understands that 10% margin shall be considered on CW pump flow excluding blowdown water requirement. Owner to please confirm.	Bidder's understanding is not correct, 10 % margin shall be considered on CW pump flow including blowdown water requirement.

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579	SUB-SECTION- A-9 (LOW PRESSURE PIPING)	1.03.00	PAGE 1 OF 19	Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.	We understands that maximum 1.8 m/s velocity is acceptable in channels. Owner to confirm.	Confirmed
	TECHNICAL SPECIFICATION SECTION-VI, PART-B SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	5.08.00	40 OF 120	The maximum velocity for RCC open drains shall be limited to 1.8 metre per second		
	TECHNICAL SPECIFICATION SECTION-VI, PART-B SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	5.18.01.06	70 OF 120	the maximum velocity in CW channel shall be restricted to 1.8m/sec		
580	TECHNICAL SPECIFICATION SECTION-VI, SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	2.02.03 (11)		Additional 10% margin on cumulative Hydraulic pressure drop across LP & HP condenser shall be considered for CW (Cooling water) pump head selection. This will be exclusive of margin considered for frictional losses in CW pump sizing	Bidder proposes that additional margin of 2 mWC for condenser pressure drop is not required. In line with recent/past projects including NTPC Khargone project, Bidder shall consider 10% margin on friction drop in the entire CW system including condenser pressure drop. Please confirm.	Refer Amendment in this regard. (Amendment No : A-TG-7)
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	3.01.00	55 OF 101	Sum of static lift from minimum water level in CW pump house sump up to the centerline elevation of hot water distribution header at Cooling Tower + 110% of friction drop in the entire CW system + pressure drop across Condenser with 2 mWC margin (minimum).		
581	SUB SECTION- IIA-10 WATER TREATMENT PLANT	1.01.02 (d)	2 OF 12	Two (2) numbers of Potable water pumps(colony), its drives, associated suction pipes from filtered water sump, isolation valves, pump(s) discharge pipes (CS), nonreturn valves & isolation valves at the discharge etc.	As per referred clause, there is discrepancy in MOC of Potable water piping, As per sub-section- A-9 (low pressure piping) piping material for potable water system shall be galvanized carbon steel. Owner to check and confirm the material requirement for potable water supply pipes for colony.	It is clarified that MOC indicated in pump spection is upto pump header, further potable water supply pipe shall be galvanized carbon steel as per Low pressure Piping chapter (SECTION – VI, PART-B SUB-SECTION- A-9).
	TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB-SECTION- A-9 (LOW PRESSURE PIPING)	2.03.05	PAGE 4 OF 19			

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582	Technical specification Part-6	Flow diagram 4540-136-POM-A-001			Instead of providing common discharge header for air preheater pump, service water pump and HVAC make up pump. Bidder proposes to consider separate header for each system as flow and pressure requirement will be different for each system. Kindly confirm acceptance.	Bidder proposal is acceptable.
583	Technical specification Part-6	Flow diagram 4540-136-POM-A-006			Discrepancy found between sub section A-15 clause 2.03.00 and flow diagram 4540-136-POM-A-006. We understands that pumping system is not mandatory for CW makeup and as per specification, Bidder can select gravity makeup water line based on layout. Owner to confirm.	The flow diagram furnished is indicative only, however in case the bidder design the system without gravity, then bidder to provide pumps as specified under SECTION-VI / PART-A /SUB SECTION-IIA-11 CW SYSTEM Clause 1.05.00 (3) .
584	TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM	2.03.00		From the Clarified Water collection chambers of the Clarifiers, water shall be led up to a Clarified water storage tank. From the Clarified water storage tank, CW makeup shall be led up to the CW Channel. The makeup shall be conveyed to the CW Channel either through a pumping system or by gravity depending on plant layout. The pumps drives and associated valves, controls shall be located in a pump house i.e., Clarified water pump house to be located near the clarified water storage tank		
585	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-IB PROJECT INFORMATION	ANNEXURE-III	8 of 15	Raw water analysis	Turbidity mentioned in the water analysis is 2000 NTU, however, total suspended solid is not mentioned in the water analysis. Bidder requests NTPC to furnish the total suspended solid to design the pre-treatment plant.	It is clarified that the bidder shall design the Pre-Treatment plant on the basis of turbidity specified in Raw water analysis, for the guaranteed turbidity at the outlet of the clarifiers.

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586	SECTION-VI / PART-A /SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	5.07.00	40 of 120	Manual on sewerage and sewage treatment (published by Central Public Health Environment Engineering Organisation, Government of India) shall be followed for design purpose. Complete sewerage system including Sewage Treatment Plant for facilities within the plant is in bidder's scope. Bidder shall provide 'De-centralized Sewage Treatment' units. The capacity of the Decentralized Sewage Treatment' units should be as per the design requirements, subject to minimum combined capacity of 75 Cum/day.Design of Sewage treatment plant shall be as per CPHEEO manual. Primary,Secondary and Tertiary treatment to be provided	Bidder understands that STP shall be design as per the CPHEEO manual, Part A : engineering, Table 7.19, recommended norms for treated sewage quality for Horticulture / Gardening. However, as per the Sintex model PWTS-STBF or NBF or Ion-exchange model NGPSTP make or equivalent is not suitable for the treated water quality as per the CPHEEO manual for Horticulture / Gardening purpose. Sintex model PWTS-STBF or NBF or Ion-exchange model NGPSTP, treats the sewage upto secondary stage only. and outlet quality is as mentioned below. pH - 6.5 to 8.5, BOD- less than 30 ppm, COD- less than 150 ppm, TSS- less than 50 ppm, Oil and grease- less than 5 ppm. To achieve more stringent outlet parameters (BOD < 10 mg/lit , TSS <20 mg/lit, COD<50 mg/lit), Tertiary treatment at outlet of above specified model is required. In view of above, NTPC is requested to confirm which clause (6.03.15 or 5.04.00) is to be considered for design of STP. Also, Requests NTPC to provide usage of the treated water and required water quality at STP outlet. NTPC is requested to review the same and issue an amendment to keep all Bidders at par.	Manual on sewerage and sewage treatment (published by Central Public Health Environment Engineering Organisation, Government of India) shall be followed for design purpose. Sewage treatment plant shall be as per CPHEEO manual considering Primary,Secondary and Tertiary treatment to be provided. Refere clause 6.03.15 or 5.04.00 do not pertain to STP. Treated water quality shall be for use in Horticulture as per CPHEEO manual. Bidder to refer Amendment no. D1-27
587	SECTION-VI / PART-B /SUB SECTION-A-11 CONDENSATE POLISHING UNIT	2.02.00	1 of 16	Influent quality: Silica, ppb = 30	The Silica (as SiO2) addressed is reactive silica. Please confirm Bidder's understanding.	Bidder's understanding is correct.
588	SECTION-VI / PART-B /SUB SECTION-A-11 CONDENSATE POLISHING UNIT	2.02.00	1 of 16	Influent quality: Iron, ppb = 50	The iron addressed is 'Total ferrous iron (soluble)'. Please confirm bidder's understanding.	Bidder's understanding is not correct.Total Iron addressed means Total Iron (Soluble & Unsoluble)
589	SECTION-VI, PART-E	General Layout Plan, Dwg. No. 4540-999-POC-F-001 rev 0	10 of 35	CPU regeneration building (50X35 M)	Bidder understands that Size ((50X35 M) shown in referred clause is for CPU regeneration area and not for CPU regeneration building. Size and location of CPU regeneration building shall be as per system requirement during detail engineering. Please confirm.	Bidder's understanding is correct.
590	SECTION-VI / PART-A /SUB-SECTION-IIA-10 WATER TREATMENT PLANT	1.01.04	2 of 12	Chemical House Equipment Alum Solution preparation & dosing system consisting of required number of RCC Alum solution preparation tanks, agitators, alum solution dosing pumps complete with all necessary piping, fittings, feed piping, water supply piping, overflow and drain piping, sampling connections etc. FeCl3 preparation & dosing system consisting of required number of preparation tanks, agitators, dosing pumps complete with all necessary piping, fittings, feed piping, water supply piping, overflow and drain piping, sampling connections etc. (in case of PT-DM System Option-2)	We understand that alum solution for the PT-DM with option-1 system and FeCl3 for the PT-DM plant with option-2, both shall not required to dose in PT-DM as both are Coagulant, please confirm our understanding.	Bidder's understanding is correct.

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591	SECTION-VI / PART-A /SUB-SECTION-IIA-10 WATER TREATMENT PLANT	1.01.04	2 of 12	Chemical House Equipment PE dosing system consisting of required number of tanks, agitators, dosing pumps complete with all necessary piping, fittings, feed piping, water supply piping, overflow and drain piping, sampling connections etc. (in case of PT-DM System) PAC dosing system consisting of required number of tanks, agitators, dosing pumps complete with all necessary piping, fittings, feed piping, water supply piping, overflow and drain piping, sampling connections etc.	We understand that PAC solution for the PT-DM with option-1 system and PE for the PT-DM plant with option-2 only, both shall not required to dose in PT-DM as both are Flocculent, please confirm Bidder's understanding.	Bidder's understanding is correct for PT-DM. However, Bidder shall provide the PAC dosing system for PT-CW system in addition to Alum and other dosing system as specified.
592	SECTION-VI / PART-A /SUB-SECTION-A-22 SEPARATION OF PLANT DRAINS FROM STORM WATER DRAINS SECTION-VI / PART-B /SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A-2 EQUIPMENT SIZING CRITERIA	1.01.01 3.06.00	2 OF 3 62 OF 101	The effluent from the TG Area pit(s) /sump(s) shall be pumped to Waste Service Water Sump (WSWS) located in WTP area. Portable type oil skimmer(s) & portable oil centrifuge shall be provided in the TG Area pit(s) /sump(s) and purified oil shall be used either in non-critical units for lubrication purpose or the same shall be disposed of. One (1) number RCC waste service water sump (WSWS) in two (2) sections shall be provided for collection of waste service water. Service water effluents and other plant effluents from various areas of the plant shall be routed to this waste service water sump. Facility shall be provided to collect free oil from these sumps to MS Oil drum and oil skimmers (2 nos.), Portable oil Centrifuge (1x100%) of suitable capacity shall be provided for reuse of oil.	As per referred clauses, oil skimmers (2 nos.), Portable oil Centrifuge (1x100%) is already in the WSWS of WTP area, Hence, Owner is requested to confirm that Portable type oil skimmer(s) & portable oil centrifuge is also required at various pit(s) /sump(s) in TG area in addition to WTP area as effluent from the TG Area pit(s) /sump(s) to be pumped to Waste Service Water Sump (WSWS). Please confirm.	Bidder to provide separate Portable type oil skimmer(s) & portable oil centrifuge for each of the pit/sump in TG area. In addition to above, bidder shall also provide Portable type oil skimmer(s) & portable oil centrifuge for WTP area in line with specification requirement.
593	4540-136-POM-A-006 Single line flow & instrumentation diagram of pre-treatment plant				As per flow diagram it is shown that overhead storage tank (filtered water) inlet connection is shown from the filtered water pump discharge header, however we understand that this connection to be from the potable water pumps (colony). Request owner to check and confirm our understanding.	Bidder's understanding is correct.
594	4540-136-POM-A-006 Single line flow & instrumentation diagram of pre-treatment plant				As per flow diagram it is shown that overhead storage tank connection from the potable water pumps (colony) with motorized valve, however motorized valve is not required as float valve is already at the inlet of the overhead storage tank (filtered water). Owner is requested to check and confirm our understanding.	Bidder's understanding is not correct. Bidder to provide motorized valve in line with specification requirement.

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595	4540-001-POM-A-061 EPC package Scheme of makeup water system				Overhead tank for lubrication water pumps and back wash water pump as shown in flow diagram, can be placed above ground (over ground) at FGL. Kindly accept.	Bidder proposal is also acceptable in addition to specified requirement.
596	SECTION-VI / PART-A /SUB SECTION-IIA-20 CONDENSATE POLISHING UNIT	2.04.00	2 of 2	Two (2) numbers of DM water Storage tanks for CPU regeneration system.	Two separate tank for DM water storage tank for CPU regeneration system is required other tank the plant DM water storage tank. We request owner that shall we combined the both type of DM water storage tanks and provide common two number of DM water storage tank for plant normal usage and CPU regeneration system. Please confirm.	Provision for common DM water storage tanks is already specified in the tender. Bidder to refer Clause 5.10.00 of SECTION-VI / PART-B /SUB SECTION-A-11 CONDENSATE POLISHING UNIT.
597	4540-001-POM-A-037 Plant water scheme			As per plant water scheme, Excess CW blowdown water is transfer to the CMB and from CMB water will be transfer to the service water tank (4540-136-POM-A-001 P&ID and layout of liquid effluent treatment system).	As per the scheme provided, CW blowdown water after treatment is mixed with the clarified water from the PT-CW clarifiers. However, Owner to please note that CW blowdown water can't mix with the clarified water as CW blowdown water with COC 5 is not suitable for the HVAC makeup water system and FGD gypsum washing. Owner is requested to check the above requirement.	Bidder understanding for the specified scheme is not correct. It is clarified that Excess CW blowdown water is transferred to CMB, which shall further be utilised in service water system. Provision of technical specifications are clear and to be complied.
598	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	2.01.00	2 of 36	Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 3% of rated flow.	Due to the unavailability of the total suspended solid in the raw water analysis, sludge blow off percentage from water can't be confirmed. Owner is requested to note that sludge blow off rate varies with TSS. Hence, Kindly furnish the TSS in Raw Water Analysis.	Bidder to design sludge removal system in line with technical specification requirements.
599	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	2.02.00	3 of 36	Various equipment in the PT Plant will be sized for the following minimum Chemical Dosing Requirements: a) Alum b) Lime	We understand that this is the minimum dosing requirement for the PT plant, however Polyelectrolyte is not required to dosed if outlet turbidity can meet without Polyelectrolyte dosing. Also if WTP vendor can select RO-MB based DM plant then shall we dosed Ferric chloride instead of alum (aluminium sulphate) dosing as increase aluminium in water which may foul in RO membrane. Please confirm our understanding.	Bidder to note that the minimum dosing requirement for the PT plant have been mentioned in the referred clause however, bidder to refer SECTION-VI / PART-B /SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA Clause 3.06.00 and follow technical specifications details Requirement of Polyelectrolyte is to be provided as per bidders design.
600	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-IV FUNCTIONAL GURANTEES	1.03.14	38 of 73	Clarification plant Outlet water turbidity : 10 NTU	With inlet turbidity of 2000 NTU, it is difficult to achieve outlet guaranteed turbidity from the clarifier as 10 NTU. NTPC is requested to check inlet turbidity and guaranteed turbidity at outlet of clarifier.	Bidder to design the complete Pre-treatment system for the specified inlet turbidity of 2000 NTU while guaranting the outlet turbidity from the clarifier as 10 NTU in line with specification requirement. Bidder shall provide additional treatment system, if any, required to meet the guarantee.
601	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	2.00.00	2 of 36	Raw water temperature varies seasonally from 10 deg C to 36 deg C.	As per the raw water analysis in SECTION-VI / PART-A /SUB-SECTION-IB Project information, water temperature is between 20 to 35 Deg C. Request owner to clarify the maximum water temperature of raw water is 35 Deg C or 36 Deg C.	It is clarified water temperature of raw water is 10 deg C to 36 Deg C as specified under refer the Raw water analysis SECTION-VI / PART-A /SUB-SECTION-IB Project information.

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602	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	5.02.00	9 of 36	Ion Exchange Units Material of construction shall be mild steel with rubber lining (MSRL) and rubber covered (RC)	We understand that rubber cover (RC) is for the external protection of the vessel, however, in line with past NTPC projects, Bidder shall consider painting and coating for external surface. Please confirm acceptance.	Bidder to note that internal surface of the vessel shall be rubber lining (MSRL) , however for external surface of the vessel, rubber covered (RC) or suitable painting and coating may be provided.
603	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	5.10.00	12 of 36	Pressure filter design features	We understand that gravity filter is to be considered for the PT-DM system and PT-potable water system. However, in the referred clause 5.10.00 pressure filter is described is about the pressure filter for the makeup water pump lubrication water generation. Please confirm.	Bidder to provide the gravity sand filters for PT-DM & PT-Potable system as per SECTION-VI / PART-A /SUB SECTION-IIA-10 WATER TREATMENT PLANT Clause 1.01.02 & 1.01.03 respectively. Pressure filters for make-up water pump lubrication system shall be in line with clause no- 5.10.00 , sub section- A-14, part-B , section -VI (except pressure filter for make up water system shall be designed to handle an inlet turbidity of 50 NTU and outlet shall be less than 5 NTU).
604	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-14 WATER TREATMENT PLANT	12.00.00	22 of 36	Datasheet for equipment	Design capacity/design flow is indicated for all the major equipment, Bidder understands the design capacity/design flow shall be based on the actual water consumption requirement. Please confirm Bidder's understanding.	Bidder's understanding is not correct. Design capacity/design flow for various systems/equipment shall meet the sizing/design criteria etc. with design capacity/ design flow wherever specified, as a minimum.
605	SECTION-VI / PART-B /SUB SECTION-A-SUB SECTION-A-25 SOLAR P.V.	1	1 of 26	Providing a suitable Solar PV module cleaning & water washing system. Bidder shall also provide for water connection from the nearest service water line with necessary pumping arrangement and provide adequate number of water taps with isolating valves depending on the roof/sheds area.	Owner is requested to provide the water requirement for the cleaning and washing of the Solar PV module. Also, we understand that no separate service water pumping system is required if plant service water pumps are designed with required pressure at solar PV area is available. Please confirm.	Bidders understanding is correct. Owner will provide water for cleaning
606	Vertical pump			The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 15% or more than the design head for radial flow pumps and 50% more than the design head for mixed flow/ turbine type pumps	Bidder has considered shut off head of vertical turbine pump in range of 20% to 30% of rated head. Owner to please accept.	Bidder's proposal is not acceptable. Provision of technical specifications to be complied.
607	Horizontal pump TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB SECTION A-15 CW SYSTEM TECHNICAL SPECIFICATION SECTION – VI, PART-B SUB SECTION-A-17 AIR CONDITIONING AND VENTILATION SYSTEM	3.02.00 4 (b)	22 OF 31 PAGE 25 OF 30	3.02.00 Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head. The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability and with a minimum shut-off head of about 15% more than the design head.	Bidder request Owner to accept below proposal for pumps: "Total head capacity curve shall be continuously rising from the operating point towards shut -off without any zone of instability and with a minimum shut off head of 15% more than design head. However, for pumps with impeller specific speed, less than 1000 U.S.Units, minimum shut off head shall be minimum 10% more than rated head." Owner is requested to accept Bidder's proposal.	Bidder's proposal is not acceptable. Provision of technical specifications to be complied.

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608	Submersible Pump TECHNICAL SPECIFICATION SECTION – VI, PART-B Part-B, Mechanical, Sub Section A-15	Annexure-3, 5.00.00, b)	PAGE 30 OF 31	b) Pumps shall be able to pass through solids upto 100 mm and capable of handling waste water which may contain, sludge, plastic solids etc.	Solids particles size of 100 mm is on higher side. NTPC is requested to review the stated clause with respect to particle size to be handled by submersible pumps. Bidder understand that the maximum particle size can be passed through the pumps shall be as per Manufacturer's standard and design parameters of the respective pumps. Please confirm Bidder's understanding.	Bidder's proposal is not acceptable. Provision of technical specifications to be complied.
609	Section VI/ Part-A/ Sub section-IIA-12	4.00.00 (b)	5	19) Any other area/building required to be protected with hydrant system.	Scope of Fire protection and detection system for facilities proposed outside plant boundary i.e. make up water pump house, Ash Water recirculation (AWRS) area at Mine Void, External Coal Handling plant, laydown area & other facilities as applicable etc. is not specified in tender specification, hence, Bidder has not considered in scope of work. Kindly confirm.	Bidder to refer Sub-Section-A-12 (Plant Utilities), Part-A of Technical Specification.
610	SECTION-VI / PART-A /SUB-SECTION-A-12	4.00.00 (h)	7	e) Switchgear/MCC rooms/Battery Rooms/control rooms of Raw/Makeup water/other pump house (as applicable) located outside plant boundary.	As per specification, Bidder understands that apart from the scope specified in the clause, no other fire protection system like water based fire protection system, Panel injection system etc. envisaged for the pump houses which are located outside plant boundary, NTPC to confirm. Apart from the above, fire detection system shall be standalone and shall not be connected to the main plant fire detection system. Please confirm.	Bidder's understanding is correct.
611	Section VI/ Part-A/ Sub section-A-18	3.04.00	2	Criteria for taking two (2) spray pumps in service: While designing the HVW/MVW spray system for crusher house, LDO tanks , cable galleries TG Building & ESP Building where flow of one spray pump of 410m3/hr may not be adequate, operation of two (2) spray pumps shall be considered.	Bidder understands two spray pumps shall be considered to protect single LDO tank in the event of fire. NTPC to confirm.	Bidder's understanding is correct.
612	Section VI/ Part-A/ Sub section-IIA-12	4.00.00 (d)	6	MVWS spray system 7) All cable trestles of main plant area (from transformer yard to chimney)	Bidder understands that only main plant area cable trestles (transformer yard to chimney) shall be protected by MVWS system. Apart from main plant area Cable trestle shall not be envisage for MVWS system. NTPC to confirm.	Bidder's understanding is correct.
613	Section VI/ Part-A/ Sub section-IIA-03	-	1	The scope shall include the unloading, storage, transportation & feeding to coal bunkers along with all the associated systems. The storage area shall be provided with suitable firefighting system like fire hydrants and water monitors. The entire feeding system shall be provided with firefighting system including conveyors, storage silo, bunkers etc.	Since Biomass handling system is not in EPC Bidder scope, hence, the referred clause for fire protection system of Biomass handling system is not applicable for EPC Bidder.	Biomass shall be fed into the bunkers as per the specified scope. Accordingly the necessary fire fighting system in the bunker area shall be provided.
614	SECTION-VI / PART-B /SUB-SECTION-A-01/EQUIPMENT SIZING CRITERIA	3.06.04		Bladder tank Foam Protection System V) The minimum effective capacity of each foam concentrate tank and foam pumps shall be designed considering the following: a) Simultaneous protection of any of the fuel oil tank or LDO tanks and operation of two hydrants for 60 minutes. or b) Minimum capacity if specified elsewhere. ix) A design margin of at least 10% shall be considered over the calculated foam concentrate capacity, tank capacity and discharge capacity of the foam discharge pumps.	We are considering 100% foam concentrate tank as per the principle of fire case that is, one largest capacity tank internal fire protection on the common dike area and operation of 2 hydrants, along with that additionally 10 % margin will be included for selecting actual capacity of 100% foam concentrate tank. Duration of fire protection for tank internal protection will be 60 minutes and Duration of usage for fixed Hydrant will be used only for 30 minutes operation. The design philosophy is followed as per NFPA 2001. Portable foam monitor shall have its individual foam tank. Please confirm.	Bidder to comply with the specification requirements.

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615	SECTION-VI / PART-B /SUB-SECTION-A-01/EQUIPMENT SIZING CRITERIA	3.06.06	64 of 98	Total Flooding Inert Gas Extinguishing System Design, Installation & Testing f) The performance test of the system shall be carried out by releasing the agent gas in a selected area and design parameters shall be measured. All equipments, refilling of gas after test, instruments etc. shall be provided by the contractor for the same.	We understand the gas release testing shall be perform only for the smallest room, Owner to confirm.	Clean agent discharge test shall be done for smallest inert gas protected zone. Bidder to refer clause 3.12.06, g), Page-74 of 101, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification.
616	Section VI / Part A / SS-IIA-01 / STEAM GENERATOR & AUXILIARIES INCLUDING ESP & Section VI / Part A / SS-IIA-01 / STEAM GENERATOR & AUXILIARIES INCLUDING ESP & SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.21.00 & 9.03.00 & 15.01.02 (point v)	20 of 28 & 06 of 07 & 65 of 65	Two nos., adequately sized Air conditioners each having minimum cooling capacity of 2.5 Ton shall be provided for each elevator machine room to make it dust proof & One (1) nos. adequately sized, Air conditioners each having minimum cooling capacity of 2.5 Ton shall be provided for each elevator machine room to make it dust proof. & Machine room : Machine room shall be provided with Window air conditioner of minimum 2T capacity per elevator shall be provided by bidder.	Bidder understands that split AC for elevator machine rooms is envisaged. However with split AC, room pressurisation to avoid dust ingress (dust proof) is not feasible. This is applicable to all other clauses where similar requirement of dust proof and air conditioned machine rooms are mentioned. Please confirm.	The capacity of the air conditioner as the the requirement shall be considered subject to minimum specified capacity.
617	Section VI / Part B / SS-A-01 / EQUIPMENT SIZING CRITERIA	3.13.01 (Point 06)	77 of 101	The occupancy for general area shall be minimum one person per 10 Sq. M and for conference room the same shall be one per 3 Sq.M. In the control rooms, control, equipment rooms etc., the occupancy may be one person per 25 Sq.M (Minimum).	Occupancy in BOP control rooms, switchgear rooms are maximum 3 to 4 persons. Actual occupancy is determined from the Architecture layouts based on sitting arrangements shown. Please confirm Bidder's understanding and allow to show occupancy as per Architecture layouts.	Bidder to comply with the specification requirements.
618	Section VI / Part A / SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP & Section VI / Part A / SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM & SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.21.00 & 9.03.00 & 15.01.02 (point v)	20 of 28 & 06 of 07 & 65 of 65	Two nos., adequately sized Air conditioners each having minimum cooling capacity of 2.5 Ton shall be provided for each elevator machine room to make it dust proof. & One (1) nos. adequately sized, Air conditioners each having minimum cooling capacity of 2.5 Ton shall be provided for each elevator machine room to make it dust proof. & Machine room : Machine room shall be provided with Window air conditioner of minimum 2T capacity per elevator shall be provided by bidder.	Bidder proposes that one number of split AC unit of 2.5 TR for each elevator machine room shall be provided. Please confirm.	The capacity of the air conditioner as the the requirement shall be considered subject to minimum specified capacity.

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619	Section VI / Part B / SS-A-01 / EQUIPMENT SIZING CRITERIA vs Section VI / Part E / TENDER DRAWINGS	3.07.01 (Point 17) vs Dwg No. : 4540-001-POM-A-054, 55, 56 & 57	67 of 98 vs Dwg No. : 4540-001-POM-A-054, 55, 56 & 57	Valves at discharge of pumps, outlet of chillers and inlet of cooling towers or any other valve in the system shall be motor operated type for remote operation of the Air conditioning system. Vs Tender drawing indicates motorised valves at discharge of pumps, outlet & inlet of chillers and inlet of cooling towers.	Referring to tender drawings, motor operated valves are provided at discharge of pumps, outlet & inlet of chillers and inlet of cooling towers. All other valves in the chilled water and cooling water network are manual valve (lever or gear & handwheel operated). Bidder understands that valve requirement shall be as per tender drawings. Please confirm Bidder's understanding.	Bidder to comply with the specification requirements.
620	Section VI / Part B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA & SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	3.13.02 vs 4.02.18, 4.04.17 & 1.1.1, 2.01.03	79, vs 96 & 97, 101 of 101 & 69, 80 of 101	DESIGN PHILOSOPHY – Ventilation System 1. Minimum Air changes per hour in evaporative/ mechanically ventilated areas shall be as follows: i) For all evaporative cooled areas - 8 ii) General areas - 20 iii) Hydrogen generation plant/MCC/ Switchgear rooms and Battery rooms& other areas where gaseous fumes/ vapours are generated - 30 vs Ventilation System A Mechanical Ventilation System: i. Underground Areas: Minimum 15 supply air changes and minimum 7 exhaust air changes per hour. ii. Other Areas Minimum 10 supply air changes per hour. B. Pressurized Ventilation System: Minimum 15 supply air changes per hour	Bidder understands that for areas of material handling, Coal, Limestone, Gypsum Handling Plant design of Ventilation System shall be as follows, i. Underground Areas: Minimum 15 supply air changes and minimum 7 exhaust air changes per hour. ii. Other Areas Minimum 10 supply air changes per hour. B. Pressurized Ventilation System: Minimum 15 supply air changes per hour Please confirm.	Bidders' understanding is correct w.r.t Ventilation System of Coal, Limestone and Gypsum Handling Plant
621	SECTION-VI / PART-B / SUB SECTION-A-17 AIR CONDITIONING AND VENTILATION SYSTEM	3.01.00	01 of 32	b) For ESP control rooms, FGD control room, AHP control room, etc. of Unit # 1 & 2: i) Vapour compression type water cooled chiller units: 3X50% ii) Chilled water pumps: 3X50%. iii) Condenser water pumps: 3X50%. iv) Cooling Towers: 3X50%. v) AHUs: 2x100% AHUs for each control room of ESP/FGD/AHP Building.	Referring to Section VI / Part B / SS-A-01 / Equipment Sizing Criteria / Clause 3.13.01 / DESIGN PHILOSOPHY - Air conditioning system / Point-16 : # AC load 25-60 TR - DX air cooled condensing units with AHU; # AC load 5-25 TR - ductable split / packaged A/C; # AC load up to 5 TR - HI-wall Split/Cassette AC. AC system shall be provided as per above clause 3.13.01 / Equipment sizing and selection criteria. Please confirm.	Bidder to comply with the specification requirements.
622	Section VI / Part B / SS-A-17 / AIR CONDITIONING AND VENTILATION SYSTEM	4.01.01 vs 4.02.00	02, 03 & 04 of 32	Clause 4.01.01 : The screw/centrifugal compressor based chilling unit to be supplied shall be ARI /Eurovent/Equivalent standard certified (if applicable). vs Clause 4.02.00 : Design fouling factors shall be; Condenser : Not less than 0.0002 (in MKS units) Evaporator : Minimum 0.0001 (MKS units)	Referring to clause 4.01.01, fouling factors for chillers can be selected by manufacturer as per ARI approved limits. Bidder understands that fouling factors for chilling units as per chiller manufacturer and approved ARI conditions are acceptable. Please confirm.	Bidder to comply with the specification requirements.

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623	Section VI / Part B / SS-A-17 / AIR CONDITIONING AND VENTILATION SYSTEM	4.03.00	04 of 32	Condensing Unit -Air-Cooled (D-X type) Compressor Accessories : High/Low pressure cutouts, oil pressure switches, relief valves, pressure gauges at each stage, lube oil and control oil pressure gauges, suction & discharge stop valves, Muffler, Crank case heaters, oil filters, magnetic oil separators, temperature indicators for lube oil/heaters, oil level indicators, safety thermostat for crank case heater, vibration isolators, etc	Air cooled condensing units are standard products. Accessories as mentioned here are not all of it applicable to condensing units. Based on available model in market, accessories requirement differs with advancement in technology, however functional requirements are achieved. Bidder understands that accessories provided by manufacturers for standard product (ACCU) as per industry practice are acceptable. Please confirm.	Bidder to comply with the specification requirements.
624	Section VI / Part B / SS-A-17 / AIR CONDITIONING AND VENTILATION SYSTEM	4.04.05	04 of 32	Air Handling Unit (AHU) All filter plenum shall be provided with a walking platform inside the plenum chamber for filter cleaning purpose. Inspection door shall be provided at the plenum chamber and a removable type ladder shall be attached to plenum.	The pre filter and fine filter will be installed in the AHU cabinet itself for the ease of cleaning and maintenance, hence, separate filter plenum with walking platform and removable type ladder is not required. Please confirm acceptance.	Bidder to comply with the specification requirements.
625	Section VI / Part B / SS-A-17 / AIR CONDITIONING SYSTEM	4.05.03	07 of 32	PACKAGED AIR-CONDITIONERS (a) Packaged air conditioners shall be an encased assembly as a self-contained unit primarily for floor mounting, designed to provide free delivery of conditioned air to the conditioned space. It shall include a primary source of refrigeration for cooling and dehumidification, means for circulating and cleaning air and means for heating and humidifying air. Fresh air fan shall be provided in PAC Room.	For PAC Room, Bidder proposes wall mounted fresh air dampers with filters. Please confirm.	Bidder to comply with the specification requirements.
626	Section VI / Part B / SUB-SECTION-A-20 COAL, LIMESTONE, GYPSUM HANDLING PLANT	4.12.00	22, 23, 24 of 101	4.12.1 : Mechanical Ventilation system 4.12.2 : Pressurised Ventilation System 4.12.3 : Air Conditioning System 4.12.4, 4.12.5, 4.12.6, 4.12.7, 4.12.8, 4.12.9, 4.12.10 and 4.12.11	Requirement and selection criteria for ventilation and air conditioning system dedicated to Coal, limestone, gypsum handling plant as depicted in this section of specifications differs as compared to the sizing criteria mentioned in Chapter A-17 Air conditioning system, Chapter A-26 Ventilation system and Chapter A-01 Equipment sizing criteria. Bidder understands requirement depicted in SS-A20 shall be followed for all buildings of Coal, limestone, gypsum handling plant as per section under limestone and gypsum handling Please confirm the clause and criteria to be followed.	Bidders' understanding is correct i.e. requirement and selection criteria for ventilation and air conditioning system as per Sub-section A-20 shall be applicable for Coal, Limestone and Gypsum Handling Plan only.
627	Section VI / Part B / SUB SECTION- G-03 LAYOUT PHILOSOPHY	1.03.00	11 of 15	For Ventilation requirement from A-row side of TG building, space for installation of multiple modular type Air washer units along with pumps shall be considered in AB bay at suitable elevations. No separate room outside A-row for locating Air Washer equipment and no trestle outside A-row for routing Ventilation duct shall be considered. Further, for Ventilation requirement in BC bay, adequate number of multiple modular type Air washer units along with pumps in BC bay for each unit shall be considered. All fresh air ventilation louvers shall be 2500mm from floor level and directed downward at an angle.	It is understood that floor level mentioned in last line in this clause means ground floor/ paving level. Louver elevations shall be fixed as per layout feasibility, in coordination with equipment and other services. It may not be feasible to provide 2500mm from floor level. Please confirm.	Bidder understanding regarding floor level is correct . Bidder to follow specification requirement . However , Layout constraints, if any, will decided on case to case basis during detailed engineering .

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628	SECTION-VI / PART-B / SUB SECTION-A-17 AIR CONDITIONING AND VENTILATION SYSTEM	6.01.00 vs Annexure I	10 of 32 vs 26 of 32	Centrifugal pumps : ii) Impeller : Bronze IS:318 Gr-2 iii) Wearing rings : Bronze vs 5. DESIGN CONSTRUCTION d) Impeller/Casing Wearing Rings Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.	Bidder understands that impeller and casing wearing rings for pumps can be as per manufacturer's standard practice to suit impeller and casing materials as depicted under Annexure I. Bidder shall follows as per Annexure I Please confirm.	Bidder to comply with the specification requirements.
629	Section VI / Part A / FUNCTIONAL GUARANTEES	1.01.07.02	21 of 73	Station Auxiliary Power Consumption : b) Air Conditioning System Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of Chilling machines, Chilled water Pumps, Condenser water Pumps, Air handling unit (AHU) fans, for the Air conditioning system of main plant building, FGD control room, ESP control room of each units, AHP control room, service building, administrative building. Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of water system control building, switchyard control building and canteen building.	Since Administration Building and Service Building Air conditioning may not be running at full load during PG test, bidder will not consider air conditioning for the said buildings in Guaranteed Auxiliary Power Consumption. Since tender is not clear in this regard, bidder requests NTPC to categorically confirm inclusion or exclusion to bring all the bidders at par and issue amendment/clarification accordingly. Please confirm.	Aux. power consumption for A/C System of Service Building & Administrative Buildings as specified at referred clause is in the scope of Bidder. Bidder to comply with the specification requirements.
630	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	Pipe / cable trestle on both side of Boiler.	For an EPC package, Bidder understands that pipe / cable trestle mentioned in GLP is indicating only. Bidder will provide pipe / cable trestle as per their layout. Please confirm our understanding. Further for LHS/RHS side of Boiler, Fire pipes shall be routed through RCC trench with heavy duty cover and cable shall be routed through Cantilever taken from Boiler structure inline with Khurja Project.	Bidder understanding is correct. For RCC trenches as standard practise slope to be provided along with pits as required .
631	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	Wind rose and Magnetic North.	Bidder is considering the Wind rose diagram and angle between Plant North & Magnetic North (20 Deg.) as shown in the GLP, as a base for placing of various facilities / buildings in the GLP. Kindly confirm Bidder's understanding.	Confirmed
632	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	General	Bidder understands that pipe and cable trestles shown in the GLP are indicative only and Bidder can plan pipe & cable trestle layout based on final layout during detail engineering . Kindly confirm Bidder's understanding.	Confirmed
633	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	Note 3: ROUTING OF VARIOUS PIPES AS SHOWN ARE TENTATIVE. BIDDER MAY OPTIMISE & 4	Bidder understands that existing facilities shall be dismantled by Owner prior to construction of Ash slurry pipes (within Green fencing / existing power plant area) and Raw water pipe from reservoir to PT plant. Kindly confirm Bidder's understanding.	Bidder to refer CI 1.00.00 Section -VI Part-A sub Section IID. Dismantling of any fouling of new structures with existing facilities is in EPC scope

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634	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	Pipe conveyor-1 / 2, TP-10 and Conveyor from TP-10 to TP-1	Bidder understand that Pipe conveyor-1 & 2, TP-10 and Conveyor from TP-10 to TP-1 are not in bidder scope. As it is indicate in firm line in GLP. Kindly confirm Bidder's understanding.	Bidder's understanding is correct. Please refer revised GLP.
635	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	Existing overhead transmission line	Request Owner to provide detail of existing overhead transmission line (clear height, coordinates of tower, etc.) passing over Raw water pump house.	Approx. Coordinate can be ascertained from the GLP. Tentative height of stringer at bottom most portion is approximately 10m. However, bidder to visit site for getting the exact information
636	Section - VI, Part-E	4540-999-POC-F-001, Rev. 0	-	East side road of Turbine building	Bidder understands that alignment of East Side Road as shown in tender GLP can be suitably modified by Bidder to accommodate plant facilities. Please confirm Bidder's understanding.	Confirmed
637	SECTION – VI, PART-B; SUB-SECTION-A-24 SERVICE ELEVATORS CRANE, HOIST & MONORAIL	1.03.01 point (d)	PAGE 3 OF 6	Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio & visual)	There are two conditions which are envisaged for struck up of elevator. 1)If the elevator struck up b/w floor in power condition , the floor indicator will be visible with a message " out of service" 2) If the elevator struck up b/w floors in power off condition, the floor indicator will not be available. Once power is restored the lift moves to the nearest landing & indicator will get updated. In both scenario's struck up positioning of elevator cannot be indicated. Same shall be discussed during detail engineering on this requirement.	Bidder to comply specification requirement.
638	SECTION-VI, PART-A; SUB SECTION-II A-01	3.01.20	PAGE 26 OF 28	Passenger Elevators for ESP control room (if applicable) The Passenger elevators for ESP control room be as under: (2) nos. conventional type elevator having capacity of 10 persons	Bidder request owner to confirm whether owner required passenger elevator for ESP control room or not. If required please provide number of elevators required, capacity, no.of landings , total travel , no.of floors , rated speed etc.	Please refer Clause no 1.03.00 Sl. No 46 of Sub section G-03 Part-B of Technical specification regarding applicability of the same.
639	SECTION – VI, PART-B; SUB-SECTION-A-24 SERVICE ELEVATORS CRANE, HOIST & MONORAIL	2.01.00	PAGE 6 OF 6	Suitable EOT Crane/HOT Crane/Monorail beams with hoists/Chain Pulley Blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendor for the various areas/equipment. Some of the areas/equipment not covered by TG hall EOT cranes are indicated below. For balance areas/equipment, not listed hereinafter, the requirements of Specification shall be followed. (a) Feed water heaters & deaerator (Applicable Hoists/Chain pully block for maintenance purpose shall be provided). (b) Various pumps & Heat Exchangers. (c) Condenser Water Boxes (front & rear), (Applicable if hinged type water box not envisaged) (d) CW Butterfly Valves (e) Vacuum Pumps (f) Control Fluid Room (g) Auxiliary cooling water (clarified) pumps and DM cooling water pumps of ECW systems. (h) Central Lube Oil System room. (i) Any other equipment. The above requirement is indicative only, the requirement given in the respective chapter is to be adhered to.	Heaters are handled by TG Hall EOT in AB Bay & then dragged to their locations. As such no separate EOT/Hoist is required. Also, one time erection of De-aerator shall done by mobile crane from CD Bay. As such no separate EOT Crane / Hoist is required. Also, there is no other major equipment. Hence, no other EOT/ Hoist is envisaged. Please confirm.	EOT crane is not envisaged for Feed water heaters & deaerator. However, applicable Hoists/Chain pully block for general maintenance purpose shall be provided.

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640	SECTION-VI, PART-A; SUB-SECTION-I-A PROVENNESS	4.15	PAGE 11 OF 36	The Bidder/ its sub-vendor should have designed, manufactured, erected and commissioned EOT cranes of capacity 100T or more with minimum crane span of 28 meters, which is in successful operation in at least one (1) station for a minimum period of one (1) year.	Since DG EOT cranes supplied in power stations are designed based on similar IS Code IS 3177 and IS 807 as any other building viz. steel plants, workshop sheds, manufacturing units, cement factories, oil refineries etc. we understand that the word station indicated in provenness criteria includes cranes supplied in any said buildings and not only in power stations. Please confirm.	Bidder to note that the word "station" indicated in provenness criteria doesn't restrict any vendor for meeting the provenness criteria as long as it meets the crane specified parameters (i.e., Crane capacity and Span) in the provenness clause. Bidder to comply the specification requirement
641	SECTION – VI, PART-A, SUB SECTION-A-12	3.00.00	4 of 12	Electrically operated overhead traveling type crane of minimum 8 tonne capacity (capacity of crane shall be 25% above the weight of the heaviest equipment to be lifted during operation and maintenance work.) in air compressor building for handling of various equipments.	For compressor house EOT crane, bidder request to consider only 10% margin above the weight of the heaviest part to be lifted during maintenance instead of 25% margin and minimum 8 tonne capacity. Owner is requested to confirm bidder's understanding.	Bidder's proposal is not acceptable. Bidder to comply with specification requirements.
642	SECTION – VI, PART-B, SUB SECTION-A-07	7.01.00(xvi)	18 of 25	xvi) Storm Brakes: 2x50% storm brakes, one each at each end of the bridge, shall be provided for each crane. Storm brakes shall be designed for wind velocity as indicated in "Criteria for wind resistant design for structure and equipment", Sub-section – D-01 / Civil Works/ Part-B/ Section-VI.	Bidder understand that storm brakes are not envisaged in turbine building based on Indoor installation of EOT crane. Owner is requested to confirm bidder's understanding.	The storm brake requirement is based on safety and past experiences. Bidder to comply specification requirement.
643	SECTION-VI, PART-B, SUB SECTION-A-01 -- same as above -- SECTION-VI, PART-B, SUB SECTION-A-20 SECTION-VI, PART-B, SUB SECTION-A-05 SECTION-VI, PART-C, General technical requirement	4.02.09 4.04.09 2.1.0 14.09.00 7.02.00	94 of 101 94 of 101 48 of 101 25 of 28 5 of 114	Hoists Drive (i) More than 2.0 tonne or more than 10.0 m lift or hoists coming out-side the buildings Motor driven for both travel & lift. (ii) Other hoists including the hoists for handling takeup pulley and takeup weight -- same as above -- -- same as above -- Contractor shall provide motorized hoists and trolleys for all items requiring maintenance and weighing 500 kg or more. Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.	Discrepancy observed in referred clauses. Hence, Bidder understands that manual hoist to be considered for item weighing 500 kg to 2000 Kg and electrical hoist for item weighing more than 2000 Kg or more than 10.0 m lift. Owner is requested to confirm bidder's understanding.	Bidder to provide hoist as specified in respective clauses as per the scope of item in the corresponding chapters.
644	SECTION – VI, PART-A, SUB SECTION-B-01	3.11.00	69 OF 101	Common Technical Requirement for systems like CW System, MuW, ECW, WTP, Auxiliary Water pumps, etc. a) Cranes & Hoists should be sized to handle heaviest component to be handled with 25% margin (with minimum capacity if specifically indicated elsewhere for any system/equipment) and should comply to IS: 3177/IS: 3938 (as applicable).	Bidder proposed to consider 10% margin above the weight of the heaviest part to be lifted during maintenance instead of 25% margin. Owner is requested to confirm.	Bidder to comply specification requirement.
645	SECTION – VI, PART-D, ECC	44.21.00	PAGE 30 OF 72	I. Chain pulley block shall not be used for loads more than 2 (Two) tonne.	Bidder request owner to allow use of chain pulley blocks for loads upto 10T	Bidder to comply specification requirement.

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646	SECTION – VI, PART-B, SUB-SECTION- A-9	2.09.03	PAGE 8 OF 19	b. Alternatively, the anti-corrosive protection for buried pipes can consist of anticorrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total nominal thickness of the finished protective coating shall be 4.0 mm.	Bidder to allow to apply 4 mm thickness tapes in a single step to reduce application time. Please confirm.	Bidder's Proposal not acceptable. Requirement of Step by step application approach has been clearly elaborated in the Clause. Bidder to comply the specification requirements.
647	Part – B, Section – VI, Sub Section-A-09 Low pressure piping	2.09.02	Page 8 OF 19	"On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied."	Internal painting of 1000 NB is very difficult and hazardous. Hence owner to accept the internal coating for above 1000 NB pipes only. Piping 1000 NB & Below , internal coating is not required. - Kindly confirm the understanding.	Bidder's Proposal not acceptable. Bidder to comply the specification requirements.
648	SPECIFICATION SECTION-VI, PART-B, SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	5.18.01.01		The pump houses shall be provided with minimum two sets of stop-logs for each opening sizes	We understands that one stop log is required to isolate sump and other one is spare	Bidder's understanding is correct.
649	SECTION-VI, PART-A; SUB-SECTION-I-A PROVENNESS	4.17.04 4.17.05	12 OF 34	4.17.04 Supplier of joint / fitting coating material for 3LPE coated MS Pipes; The supplier of coating material for joints and fittings of 3 LPE (3 layer Polyethylene) coated pipes of this project should have supplied in at least one (1) installation for piping system having at least 1000 joints which should have been in successful operation for a period of at least one (1) year. 4.17.05 Joint / fitting coating material application agency for 3LPE coated MS Pipes. The coating material application agency for joints and fittings of 3 LPE (3 layer Polyethylene) coated pipes should have completed coating application activity in at least one installation for piping system having at least 1000 joints with the above coating material and such coating should have been in successful use for at least 1 year after completion of its application.	As per INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL, JOINT /FITTING COATING MATERIAL(SLEEVE) FOR 3 LPE PIPES, MAIN CONTRACTOR TO PROPOSED VENDOR FOR NTPC APPROVAL Owner to note that, supply and application agencies of joint/ fitting coating materials may not have direct contact with end user for arranging end user certificate by considering small quantum of works. Hence bidder requests Owner to approve EPC approved vendor sources for these works. or alternatively provide approved vendors list for this item.	Bidder to comply technical specification requirements.
650	General	-	-	Dewatering pumps requirements	In tender drawing, Dewatering pumps are not indicated to remove accumulated sediment from the pump-sump. - Kindly clarify the requirement and provide technical specification of the same.	Silt flushing pumps shall be provided by the bidder. Refer amendment in this regard.

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651	Part – B, Section – VI, Mechanical, Sub Section-A-09 Low pressure piping	1.04.00	1 OF 19	"The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions."	In the tender document Part – B, Section – VI, Mechanical, Sub Section-A-09 Low pressure piping, Clause No.1.04.00, Pg.No 1 of 19 (PDF Pg.No.1690 of 2672) it is indicated that the pipes need to be sized for the maximum flow. - In technical specification section-VI, PART – B, Mechanical, Sub Section-A-01 Equipment Sizing Criteria, pg.No 68 OF 101, at clause No.3.10.00 Each capacity of pump is indicated as 3000 cum/hr (2 working + 1 standby) - Bidder understands that Pipe needs to be sized for maximum water demand, not for design capacity of pump. - Kindly confirm the understanding.	Bidder to understand that, the referred Clause 1.04.00 of SUB-SECTION- A-9 (LOW PRESSURE PIPING) is applicable to the Scope of Low Pressure Piping mentioned in clause 1.01.00 of Sub Section II-A/08 of TECHNICAL SPECIFICATION SECTION-VI, PART-A. Bidder understanding is not correct. Bidder shall design each makeup water pipe with a flow of minimum 3000 m3/hr as specified.
652	Part – B, Mechanical, Section – VI, Sub-Section- A-09 (Low Pressure Piping) ,Pg. No 3 OF 19	2.02.09	3 OF 19	"Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes."	In the tender document Part – B, Mechanical, Section – VI, Sub-Section- A-09 (Low Pressure Piping) ,Pg. No 3 of 19 (PDF Pg.No.1692 of 2672), at Clause No.2.02.09 of Pipes and fittings, Inspection holes (Man holes) are indicated to be provided for suitable locations for pipes 800 Nb and above. - manholes size for Make up water intake pipeline is not specified in the tender. Kindly provide the same	Bider to note that manholes are not envisaged for MUW pipeline. Bidder to understand that, the referred Clause 2.02.00 of SUB-SECTION- A-9 (LOW PRESSURE PIPING) is applicable to the Scope of Low Pressure Piping mentioned in clause 1.01.00 of Sub Section II-A/08 of TECHNICAL SPECIFICATION SECTION-VI, PART-A.
653	Part – E section - VI Tender drawing No. 4540-001-POC-A-007	-	-	Nos of MuW Pipes	In Part – E, section - VI, Tender drawing No. 4540-001-POC-A-007 (Layout and details of Raw water reservoir), At section view 5-5, Four(4) Nos of Pipes are shown. - In technical specification section-VI, Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system, Page 1 of 3 (PDF Pg. No. 548 of 2672) at clause No.1.00.0 it is indicated to provide 2x50% capacity mild steel pipes only. - Kindly clarify the discrepancy.	Number of makeup water pipelines shall be as per Clause no. 1.00.0 Subsection II-A-09 Part-A Section-VI. Bidder to refer amendment no. D1-8 for Tender drawing No. 4540-001-POC-A-007
654	Part – B, Mechanical Section – VI Sub-Section- A-09 (Low Pressure Piping)	1.03.00	1 of 19	Velocity criteria for pump selection	In the tender document Part – B, Mechanical, Section – VI, Sub-Section- A-09 (Low Pressure Piping) ,Pg. No 1 of 19 (PDF Pg.No.1690 of 2672) at Clause No.1.03.00, it is indicated that allowable velocity for pump discharge line is indicated as 2.1 to 2.4 m/s. - In the tender document Part – B, Section – VI, Mechanical, Sub Section-A-01 Equipment Sizing Criteria) ,Pg. No 68 of 101 (PDF Pg.No.1507 of 2672) at Clause No.3.10.00, It is indicated that limiting velocity for pipe line is less than 2m/s. - Bidder understand that lower limiting velocity as per Part – B, Section – VI, Mechanical, Sub Section-A-01 Equipment Sizing Criteria) i.e. limiting velocity for pipe line is less than 2m/s shall be considered for pipe design. - Bidder shall confirm the same.	Bidder shall design the make up water pipe line with maximum velocity of 2 m/s as specified in the tender. Further, it is clarified that makeup water pipelines, equipment sizing criteria shall be in line with clause no. 3.10.00 subsection A-01 Part-B section-VI. Bidder to refer clause no - 3.11.00 (b), sub section- A-01 , Part -B of technical specification for design of system..

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655	section-VI Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system	1.00.0	1 of 3	Requirement of Pump model study	The Make water pump capacity is indicated as 3000 m3/h. If bidder selects proven model pump in that case, bidder understands that pump model study is not mandatory. Owner requested to confirm the same.	Bidder understanding is correct.
656	Part – B Mechanical Section – VI Sub-Section- A-09 (Low Pressure Piping)	1.13.00	2 of 19	"Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs)."	In tender document Part – B, Section – VI, Mechanical, Sub Section-A-09 Low pressure piping,Pg.No. 2 of 19 (PDF Pg. No 1691 of 2672) at clause No.1.13.0,It is indicated that Breakdown orifices requirements are shown in the PID. - However in tender drawing Part – E, section - VI, Tender drawing No. 4540-001-POM-A-061,Orifices are not indicated. - Bidder understands that recirculation control shall be done by inching operation of butterfly valve, hence orifices are not required at recirculation pipe line. - Kindly confirm the understanding.	The referred Clause is applicable to the Scope of Low Pressure Piping. For makeup water system, bidder to follow tender drawing 4540-001-POM-A-061.
657	General VI Part A/ A-1 Provenness	- 'Format	- -	Attachment 3K Format for filling the details of Provenness	As per bid submission schedule Attachment-3 does not specify the submission of Attachment 3K, However, separate formats are given for filling the provenness. In view of above, Bidder understands that Attachment 3K shall be submitted by the successful bidder after award stage in line with recent NTPC tenders for Singrauli & Lara Projects and not along with Bid. Please confirm bidder's understanding.	Bidder understanding is not correct. It is clarified that Bidder to submit attachment 3K along with project specific document for the approval of Sub QR/Provenness items along with the Bid.
658	-	-	-	-	Bidder request Owner to provide following documents for understanding EHS arrangements for the proposed plant and also to understands EHS requirements of Safety Control room: 1) NTPC latest EHS Manual & Policies 2) Plant security Plan & Policies 3) Fire & Emergency Plan (zones) 4) Environmental Plan/ EIA Recommendations 5) Traffic & Journey Management Requirements 6) Permit to work manual	Bidder is requested to refer Annexure-IV - HSE policy & HSE management manual in Part-D of the Technical Specification in this regard. Bidder is requested to comply the requirement as specified in Technical Specification.

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659	Part-6	4540-001-POM-A-040 (OPTION-01) 4540-001-POM-A-040 (OPTION-02)	47 of 73 48 of 73	Coal Flow diagram (Option-01 & 02)	There is a discrepancy for the following points in Option-01 & 02. Bidder requests owner to confirm. a. Bidder understands that TP-1 is the terminal point for bidder for incoming coal from mine. b. Bidder understands that TP-9 is the terminal point for bidder for biomass conveyor. c. Flow scheme from Track hopper to TP-3 is to be followed as shown in Option-01 . Option-02 is not correct. d. From TP-8 to TP-9, there is only one conveyor stream as shown in Option-01. e. From TP-9 to TP-2, there is only one conveyor stream as shown in Option-01. f. Biomass circuit from Truck tippler to TP-9 is not in bidder scope as shown in Option-02 g. Coal conveyor from mine silo to TP-01 is not in bidder scope as shown in Option-02 h. Number & Capacity of each equipment , belt width of conveyor is different in Option-01 & Option-2 . Bidder understands that Option-01 is to be followed for the same. g. Bidder understands that, provision for Only one number biomass conveyor is to be considered at TP-9 as shown in Option-01.	a. Bidders' understanding is correct. b. Bidders' understanding is correct. c. Bidders' understanding is correct. d & e. There shall be single stream conveyor from TP-8 to TP-9 and from TP-9 to TP-2. f. Bidders' understanding is correct. g. Bidders' understanding is correct. h. Bidder to refer revised Coal Flow diagram. i. Bidders' understanding is correct that provision for only one Biomass conveyor is to be considered. Please refer amendment in this regard.
660	Part-6 Part-4	4540-001-POM-A-040 4540-999-POC-F-001 General Plot Plan	PDF 47&48 of 73 PDF 10 of 35	Coal Flow diagram (Option-01 & 02) Note 4: The layout shown is suggestive & same may be further developed by the bidder at detail engineering stage	Bidder understands that there is a flexibility with bidder to optimize Layout compliance with functional & operational requirement.	Bidder can optimize the layout broadly in line with Coal Flow Diagram and scope of supply. The optimized layout should comprise of unloading section consisting of TH, Crusher House & associated system, Crushed Coal Stockyard & associated system along with pre & post crushed equipment & system in line with coal flow diagram.
661	General			Coal repose angle	Bidder has considered 37 degree repose angle for Coal. Bidder Requests Owner to confirm.	Confirmed.
662	SECTION-VI, PART-A., SUB-SECTION-IIA-15	1.00.01 (iii)	1 of 7	Conveyor 1A/1B shall feed coal to Crusher House via Pent house (PH-1). Suspended magnets (SM-1and SM-2) shall be provided on Conveyor 1A/1B at pent house for removal of tramp Iron pieces. Metal detectors MD-1 and MD-2 shall be provided on Conveyors 1A/1B to detect non-magnetic metallic materials present in the "as received" coal.	As per Flow diagram Tender Drg No. 4540-001-POM-A-040,there is no metal detector on Conveyor 1A & 1B. Bidder requests Owner to confirm the requirement if any.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-2

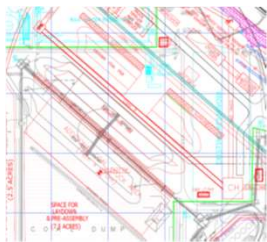
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
663	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.00.01 (iii)	1 of 7	Two (2) nos. In line magnetic separators (ILMS-1 & ILMS-2) shall be provided at discharge end of Conveyor 1A/1B for removal of metallic ferrous tramp from "asreceived" coal	As per Flow diagram Tender Drg No. 4540-001-POM-A-040, there is no ILMS on Conveyor 1A & 1B. Bidder requests to confirm the requirement if any.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-2
664	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.00.01 (iv)	1 of 7	Conveyor 1A/1B evacuating coal from Track Hopper shall feed coal to crusher house. Coal sampling unit (CSU-1) shall be provided to sample the coal of (-) 250 mm size. Further, a passenger cum goods elevator (EL-1) as specified elsewhere shall also be provided in Crusher House (CH). In Crusher house (CH), coal from incoming Conveyor 1A will pass through two (2) numbers (dedicated).....	System description not matching with Tender Drg No. 4540-001-POM-A-040. Bidder understands that Tender Drg No. 4540-001-POM-A-040 Option-01 is to be followed from Track hopper to TP-3 common for Option-01 & 02	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-3
665	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.03.00	3 of 7	Four (4) Nos. Paddle feeders, complete with all electrical, rails, supporting Structures, end stops, flexible cable carrier (Energy Chain System), trailing cables, and necessary arrangement for cabling on floor of track hopper along with accessories.	Bidder proposes cable reeling drum instead of energy chain system for paddle feeder. Requests Owner to accept the same.	Bidder to comply stipulation of Technical Specification.
666	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.16.00	4 of 7	One (1) number unidirectional Stacker cum Reclaimer machines having rated stacking and reclaiming capacity of 1760 TPH/1760 TPH complete with all equipment and conveyors,	Bidder requests to accept reversible stacker reclaimer as alternate option to unidirectional stacker reclaimer.	Bidder to provide unidirectional Stacker cum Reclaimer, as per the Technical Specification.
667	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.19.00	4 of 7	In both the cases, travelling Trippers shall be complete with all mechanical, electrical equipment, rails, chute work, rail supporting structure (along with structural stools, as required), cables, flexible cable carrier (Energy Chain System), thruster brakes, rail clamps, electric hoist, actuator flap gates etc.	Bidder proposes festooning cable instead of energy chain system for travelling tripper . Requests Owner to accept the same.	Bidder to comply stipulation of Technical Specification.
668	SECTION-VI, PART-A,, SUB-SECTION-IIA-15	1.30.00	5 of 7	One (1) No. belt vulcanizing machine for each Belt type (Steel Chord/Nylon etc) of adequate size complete with all mechanical, electrical, accessories and consumables for one year consumption. Further, belt jointing facilities as specified shall be provided	Bidder understands that one number Belt vulcanizing machine shall be considered for CHP, LHP & GHP. Please confirm Bidder's understanding.	One (1) Number of Belt vulcanizing machine to be provided for Coal Handling plant and another Belt vulcanizing machine to be provided for Limestone & Gypsum Handling plant, as specified.
669	SECTION-VI, PART-B; SUB SECTION-A-01	4.02.08	94 of 101	Minimum 2 no. sprinkler nozzles shall be considered per each stacker reclaimer for sizing of the pumps. For this purpose both stacker cum reclaimer shall be considered as working.	Bidder understands that only one stacker reclaimer is there in this tender. Hence, only 2 nos sprinkler is in operation for one number stacker reclaimer. Please confirm Bidder's understanding.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-11

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670	SECTION-VI, PART-B; SUB SECTION-A-01	4.02.19	97 of 101	Minimum clear cross section of chute: 1800 mm X 1200 mm (inside both ways) for Coal Handling plant	Bidder would like to clarify that belt width of conveyor is 1400 mm. Hence one side of chute is guided by skirt width i.e. 950 mm. Other side is decided based on lump size & flow rate of material. Considering this, chute cross section is coming around 1250 X 950 mm. Bidder would requests Owner to relook onto the same & confirm the clear cross section of chute.	Minimum clear cross section of chute : 1400mmx1000mm. Please refer amendment in this regard. Amendment No: A-MH-10
671	SECTION-VI, PART-B; SUB SECTION-A-20	4.1.2	5 of 101	The calculated life time of the Idler bearings shall be minimum 80.000 operating hours.	As per Previous project experience with NTPC & other customer, idler bearing life is 40000 hours. Bidder requests Owner to relook onto the same & confirm.	Bidder to follow stipulation of Technical Specification w.r.t bearing life of Idlers.
672	SECTION-VI, PART-B; SUB SECTION-A-20	4.1.4	5 of 101	Suitable guards marked up scale attached to the frame to monitor belt stretch and access/maintenance platforms with handrails all around etc. shall be provided	Bidder would requests to clarify the requirement which is not clear to the Bidder.	Marked up scales are to be provided to monitor belt elongation in the take-up tower. Access and maintenance platform with handrails are also to be provided to access these scales and for maintenance of take-up pulley & counterweight etc.
673	SECTION-VI, PART-B; SUB SECTION-A-20	4.1.5	6 of 101	The design lifetime of the bearing shall not be less than 80.000 operating hours.	As per Previous project experience with NTPC & other customer, Pulley bearing life is 60000 hours. Bidder requests Owner to relook onto the same & confirm.	Bidder to follow stipulation of Technical Specification w.r.t bearing life of Idlers.

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674	SECTION-VI, PART-B; SUB SECTION-A-20	4.4.1 2.1.2	8 of 101 49 of 101	Coal Chutes shall be fabricated from wear resistant steel plates, Hardox 400, 400 HBN or higher quality. However, Limestone/Gypsum chute may be fabricated from Tiscral or equivalent. The material selection shall assist the free flow of coal. The thickness of the chutes shall be 20 mm for the three sides where material slides/impacts the chute and 10 mm for the chute wall that is not subject to abrasion. Chutes shall be provided with 12 mm thick abrasion resistant wear plates at impact points and bolted with countersunk screws. Material : (a) Chute work (b) Sliding zones & adjacent sides : - 20 mm thk. Hardox 400, 400 HBN or higher quality for Coal - 20 mm thk. Tiscral or equivalent for Limestone/Gypsum (c) No striking/ Non sliding zones : 10 mm thk MS	Bidder understands that, material at impact zone 20 mm thick chute plate of Hardox (for Coal) & Tiscral / equivalent (for limestone & gypsum) shall be provided. However, specification asked for again 12 mm thick abrasion resistant wear plates at impact points separately. Bidder understands that 12 mm thick plate separately is not required. As referred two clauses are contradictory regarding chute plate material at non striking zone , Bidder is following as per Clause No. 2.1.2 (10 mm thick MS) Please confirm our understanding.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-6
675	SECTION-VI, PART-B; SUB SECTION-A-20	4.4.3	9 of 101	'Skirt Material' shall be of low friction, high tear resistance & abrasion resistant polyester based polyurethane/Rubber with Durometer Shore A Hardness of '65 (+/-) 5 and min thickness should be 15 mm. Chamfering to be done at one edge of the skirt. Skirt Plate of each side shall be in single piece.	Bidder understands that said clause is related to Skirt sealing rubber. Skirt top cover & side plate shall be as per SECTION-VI, PART B,SUB-SECTION-A-20, Clause No. 2.2.3 . Bidder requests Owner to confirm Bidder's understanding.	Confirmed.Bidder to refer Amendment for clarity. Amendment No: A-MH-8
676	SECTION-VI, PART-B; SUB SECTION-A-20	4.6.1	10 of 101	All buildings shall have sufficient space to accommodate all relevant equipment of Plants. Moreover, ample space shall be provided for maintenance purposes. Outside stairs to transfer points and crusher house shall be open type. However, a weather canopy shall be provided at the top.	Bidder understands that all transfer points , bulk storage silo, day silo, gypsum shed for CHP, LHP & GHP shall have only one staircase except crusher house. Bidder requests Owner to confirm Bidder's understanding.	Confirmed.

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677	SECTION-VI, PART-B; SUB SECTION-A-20 SECTION-VI, PART-B; SUB SECTION-A-20	4.9.2 1.1.0	14 of 101 52 of 101	The continuous motor rating at 50oC of the drive motor to be provided on each side of the yard conveyor shall be 120% of the actual power requirement at motor output shaft. For conveyors of belt conveyor systems : *110% of actual power at drive motor output shaft at specified design capacity	Referred Clauses are contradictory . Hence, Bidder understands that all conveyors including yard conveyor drive motor shall be design as per Clause No. 1.1.0 of SECTION-VI, PART-B; SUB SECTION-A-20. Please confirm Bidder's understanding.	Clause 4.9.2 (pg.14 of 101) is applicable for yard conveyor(s) whereas clause 1.1.0 (pg.52 of 101) is applicable for all conveyors except yard conveyor(s). Bidder to comply.
678	SECTION-VI, PART-B; SUB SECTION-A-20	4.9.2	14 of 101	Should the stacker reclaimer under go any structural distress/ failure during operation or in the anchored condition during the plant life of 30 years, apart from meeting the other contractual requirements specified elsewhere, the supplier shall have to furnish, to NTPC, the complete structural design document / calculations, pertaining to the equipment.	Bidder will provide drawing documents as per agreed MDL. However, OEM Proprietary calculations could not be shared. This practice followed in all executed NTPC projects. Please confirm acceptance.	As per Clause 4.9.11 of Technical specification ,the supplier shall have to furnish, to NTPC, the complete structural design document /calculations, pertaining to the equipment, in case of structural distress/failure.
679	SECTION-VI, PART-B; SUB SECTION-A-20	4.10.1	17 of 101	Mobile Trippers on Coal bunker conveyors/Gypsum Conveyor along with belt sealing arrangement shall be furnished and erected complete with rails, including necessary supporting structures, approach/ maintenance platforms with ladders and hand railings, trailing cables with Energy chain arrangement, all.....	Bidder proposes festooning arrangement instead of energy chain system . Requests Owner to accept the same.	Bidder to comply the stipulations of the technical specifications.
680	SECTION-VI, PART-B; SUB SECTION-A-20	4.11.10	20 of 101	Potable water connections are to be provided in all transfer points, wagon tippler top (if applicable), crusher house, all tripper floors, and all control rooms/MCC rooms and toilets etc.	Bidder understands that Wagon tippler is not envisaged for this tender. Please confirm Bidder's understanding.	Confirmed.
681	SECTION-VI, PART-B; SUB SECTION-A-20	4.16.3	26 of 101	The normal input feed size shall be considered as (-) 250 mm for coal & Limestone sampling unit before coal & Limestone crusher. However occasionally (-) 400 mm lumps may also arrive. Coal lump size after crusher (as fired coal) shall be (-) 20mm. However occasionally (-) 50 mm lumps may also arrive in as fired coal	Coal lump size after crusher is (-) 20mm only as it is crusher output. Hence, crushed limestone sampling unit is designed for input size (-) 20 mm only.	Bidder's query is not clear. Bidder to provide coal & limestone sampling unit as per stipulations of the technical specifications.
682	SECTION-VI, PART-B; SUB SECTION-A-20	2.2.1 (C)	40 of 101	Impact type (only for uncrushed zone) Normal troughing Idler for crushed zone	As per general practice, all CHP / LHP / GHP conveyor shall be provided with impact idler at loading point irrespective of Crushed / Uncrushed material. Bidder requests Owner to relook & confirm.	Bidder to follow stipulation of Technical Specification.

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683	SECTION-VI, PART-B; SUB SECTION-A-20	2.5.3	42 of 101	Take-up travel	Specification is silent on travel for Screw take up. Hence, screw take up shall be provided for conveyor less than 60 meter with travel of 1.5 % centre to centre distance of conveyor. Bidder requests Owner to confirm.	Bidder to provide minimum take-up travel to take care of belt elongation specified in the technical specifications. Please also note that all take up(s) shall be automatic/ gravity type . Screw take-up may be provided for Conveyors having length less than 25 meter with travel of 4% of the total belt length.
684	SECTION-VI, PART-B; SUB SECTION-A-20	4.01.00	82 of 101	Overall, operation of the following equipment of Coal, Biomass, Limestone & Gypsum Handling Plant shall be controlled from CHP DDCMIS located at main CHP control room	Bidder understands that Biomass is not in Bidders scope, hence not considered. Please confirm.	Future provisions for Biomass Conveyor shall be kept in respective Transfer point and in CHP DDCMIS.
685	Part-6	4540-001-POM-A-040	47 of 73	Coal Flow diagram	a. Bidder requests to provide detail of Conveyor 12A & 12 B (Tension values, drives loads which is to be considered for designing of TP-1 b. Bidder requests to provide detail of Biomass Conveyor (Tension values, drives loads which is to be considered for designing of TP-9. c. Bidder has not considered take up tower for Conveyor 12 A / 12 B & Biomass conveyor feeding to TP-9 in their scope. Please confirm.	a. Rated Conveyor capacity of 12 A/B shall be 1760 TPH, Belt width: 1400 mm, Belt speed shall be 3.8 m/s max. Other details may be assumed by the bidder for a typical trough coal conveyor based on the final Layout decided during Detail Engineering. b. Rated capacity for single Biomass conveyor shall be kept 350 TPH, other details may be assumed by the bidder for a typical trough biomass conveyor based on the final Layout decided during Detail Engineering. c. Bidders understanding is correct. Provisions inside Transfer points need to be kept for owner's Coal & Biomass conveyors. As per technical specifications, bidder can optimize the layout. In such situation, that other details shall be discussed & finalized during detailed engineering with the successful bidder.

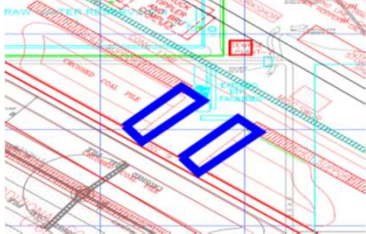
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
686	Part-4 SECTION-VI, PART-B, SUB-SECTION-A-01	4540-999-POC-F-001 General Plot Plan 4.02.12		 Stock Pile No. of days of crushed coal storage based on BMCR Design coal consumption at 100% PLF: Bidder to maximize the coal stockyard storage capacity by utilizing the available space. However, stockyard capacity in any case shall not be less than 8 days	a. Stockpile profile shown in the general plot plan is not correct at existing ETP area. Existing ETP facility at proposed stockpile is hindering the stockpile formation with covered shed. Bidder requests Owner to relocate the facility. b. Moreover, 8 days stockpile capacity could not be achievable at the given space. Bidder requests Owner to relook on the same by reducing number of days storage.	Bidder to provide minimum storage for 1,50,000 million tonne in the stockpile considering 800 T/cum bulk density of coal. Change in layout, if required to meet the above requirement, in line with technical specifications are in the scope of the bidder.
687	Section-VI/Part-B Subsection -A-20	4.1.3	5 of 101	The cleaning efficiency should be measured in periodic intervals with suitable instrument.	As per OEM, there is no specific instrument which can be fitted to scrapper for measuring cleaning efficiency. It shall be done manually by collecting material at load / no load condition. Hence, the same is not considered. Bidder requests Owner to check the requirement.	Bidder to make provisions and provide suitable arrangement so that cleaning efficiency (as specified) could be measured, as per the requirement.
688	TECHNICAL SPECIFICATION, SECTION-VI,PART-A, SUB-SECTION-IIA-15	1.00.01 (V) 1.00.01 (Xiii)	1 OF 7 2 OF 7	Coal feed by another set of Conveyors (owners' conveyors downstream of Crosscountry Coal Conveyor received Coal from Mines) shall terminate at TP-1. Bio-mass shall be blended at TP- 9 through employers' Bio-mass conveyor.	In TP-1 & TP-9, Bidder understands that Owners shall provide inputs of Owner's conveyor for DS connectivity with it during detail engineering. Please confirm Bidder's understanding.	Bidder's understanding is correct.
689	TECHNICAL SPECIFICATION, SECTION-VI,PART-A, SUB-SECTION-IIA-15	1.31.00, c.	6 OF 7	Complete Agglomerative dust suppression (Dry Fog / Cold Fog) system at all Transfer Points, Crusher House both at discharge and loading points including all electrical, instrumentation and accessories.	Bidder understands that dust suppression (Dry fog/ Cold Fog) system is not applicable for magnetic zone i.e conveyor discharge below ILMS. Please confirm Bidder's understanding.	Dust Suppression system shall be provided at suitable location of Conveyor discharge beyond the range of magnetic zone in the chute in case of ILMS mounting.
690	TECHNICAL SPECIFICATION, SECTION-VI,PART-A, SUB-SECTION-IIA-15 Coal flow diagram	1.31.00, d. 4540-001-POM-A-040(OPTION-01), Rev-A	6 OF 7	Water Pump houses & water tanks for dust suppression/ extraction, service water, cooling water and potable water system. CW-cooling water system indicated in TP-1, Crusher House, TP-3, Bunkers, TP-8,TP-9	If Bidder consider Air cooled type scoope coupling instead of water cooled scoope coupling, Cooling water system is not required in CHP area. Please confirm the same.	Confirmed.

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691	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	4.11.7	20 OF 101	Coal Stockyard Dust Suppression System Spray heads shall comprise of swiveling type spray units spaced at an interval of approximately 40 meters around each coal pile as shown in tender drawings .	The tender drawing referred in clause is not found. Owner is requested to furnish the same.	Coal Stockyard Dust Suppression System Spray heads shall comprise of swiveling type spray units spaced at an interval of approximately 40 meters around each coal pile. Please refer amendment in this regard. Amendment No: A-MH-9
692	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20 TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	4.11.19 2.01.02,d)	21 OF 101 79 of 101	The dust suppression system for the track hopper shall consist of fifteen (15) zone headers, each of 15 meters length, routed along the entire length of track hopper on each side. Each nozzle header shall be provided with adequate number of spray nozzles spaced at 500 mm interval. Further, at the track hopper the water spray shall be of fogging type with a minimum pressure of 2.5 kg/sq.cm(g) at spray nozzle inlet. It should be possible to operate maximum four (4) number of zones simultaneously on both sides of track hopper. Track Hopper Dust Suppression System (Plain water type) (1) Capacity of each nozzle : 2.0 lpm at 4.5 kg/ cm2	Discrepancy observed in the referred clauses regarding nozzle pressure for dust suppression of track hopper. Bidder understand that nozzle pressure [2.5 kg/sq.cm(g)] shall be as per clause 4.11.19, page 21 of 101. Please confirm Bidder's understanding.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-13
693	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	4.11.20	21 OF 101	Paddle feeder dust suppression : The tank on P/F trolley shall be filled through flexible hose tapings from a ring header , which will remain, flooded through a connection from ground storage tank. This storage tank shall have make up connection from the common dust suppression system.	In case of Pump House with storage tank located nearby Track hopper area , PF Ring header will be flooded by gravity through a direct connection from ground storage tank near Pump House instead of separate storage tank arrangement. Please confirm.	Bidder to note that dedicated ground storage tank shall be provided for the ring header.
694	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	4.12.1	22 OF 101	VENTILATION SYSTEMS ; Exhaust fans shall be provided for tripper floor,	For Tripper floor (coal bunker), DE System is not mentioned in the specification, Bidder understands that DE system in tripper floor is not envisaged for coal bunker inline with past projects of NTPC. Please confirm Bidder's understanding.	Bidder's understanding is correct. DE system in Tripper floor is not specified..
695	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.1.3	62 OF 101	DESIGN REQUIREMENT Pressure at inlet (dry fog) Min. 0.5 kg/cm2 for water Min 5 kg/cm2 for air	Bidder understands that Air & Water quantity shall be considered as per DFDS vendor during detail engineering as the same is not mentioned in the specification. Please confirm Bidder's understanding.	Confirmed. Any requirement of treatment of water for DFDS/CFDS are also in the scope of the bidder.

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696	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.2.0	62 OF 101	PLAIN WATER DUST SUPPRESSION : Nozzle spacing for Wagon tippler	The referred clause is not applicable as the Wagon Tippler is not envisaged in this tender. Please confirm.	Confirmed.
697	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.3.0 (iii)	62 OF 101	Dry Fog Dust Suppression (Air receivers of Compressor air system) : One no. of min. 2 cu.m capacity located near compressors & 200 litres capacity at various location	Bidder understands that requirement of 200 litres capacity air receiver shall be considered as per DFDS system requirement during detail engineering. Please confirm Bidder's understanding.	Technical specifications requirement are minimum. Bidder to comply.
698	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.6.0	63 & 64 OF 101	Service Water System Water connections (a) Conveyor Galleries and tunnels every 50 m (b) Transfer points & Drive house Min. 1 no. at every floor (c) Crusher House Min. 2 nos. at every floor	For CHP area, Bidder understands that service water connections are to be provided for the areas mentioned in the referred clause 2.6.0, page no. 63 & 64 of 101, part-B, section-A-20 only. Please confirm Bidder's understanding.	Bidder to provide Service Water connections to all buildings and facilities of Coal, Limestone & Gypsum Handling plant under this Pkg.
699	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.7.0	64 OF 101	Potable Water System Water connections a) Transfer points & Drive House Minimum one (1) no. at each floor (b) Crusher house Minimum two (2) no. at each floor (c) Tripper floor Minimum one (1) no. at every tripper bay. (d) Wagon tippler top Not applicable. (e) Control room Minimum one (1) no. at each floor (f) MCC rooms and toilets Minimum one (1) no. each	For CHP area, Bidder understands that potable water connections are to be provided for the areas mentioned in the referred clause 2.7.0, page no. 64 of 101, part-B, section-A-20 only. Please confirm Bidder's understanding.	Bidder to provide Potable Water connections to all buildings and facilities of Coal, Limestone & Gypsum Handling plant under this Pkg.
700	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.01.02 b)	79 OF 101	Stockyard Dust Suppression System; Maximum number of nozzles : Two (2) Nos. operating simultaneously for each stacker cum reclaimers	Bidder understands that Pump capacity of Stockyard Dust Suppression System shall be selected , considering 2 nos Sprinkler of 500 LPM operating at a time. Please confirm Bidder's understanding.	Confirmed.
701	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20 Part-A/ IIA-14 LIMESTONE & GYPSUM HANDLING PLANT	2.01.02 c) 1.01.06	79 OF 101 1 of 5	(i) Dust extraction system for Coal Crusher House - Type : Venturi scrubber type For Limestone storage shed and for all buildings, other equipment such as Dry type Dust Extraction system, ventilation system, drinking water system, drainage system etc. as specified elsewhere in the specification.	As per referred clause 1.01.06, Dry type DE system is envisaged for Lime stone buildings, Owner is requested to allow the same type Dry DE system in CHP crusher house also instead of Venturi scrubber type. Please confirm.	Bidder to comply the stipulations of the technical specifications.

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702	TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20 TECHNICAL SPECIFICATION, SECTION-VI,PART-B, SUB-SECTION-A-20	2.01.02 d) 4.11.19	79 & 80 OF 101 21 of 101	Track Hopper Dust Suppression System (Plain water type) No. of dust suppression nozzles that can be operated simultaneously on both side of Hopper : min. one zone or four (4) such zones (one zone means 20 mtr. Length of header on both sides) The dust suppression system for the track hopper shall consist of fifteen (15) zone headers, each of 15 meters length, routed along the entire length of track hopper on each side. Each nozzle header shall be provided with adequate number of spray nozzles spaced at 500 mm interval. Further, at the track hopper the water spray shall be of fogging type with a minimum pressure of 2.5 kg/sq.cm(g) at spray nozzle inlet. It should be possible to operate maximum four (4) number of zones simultaneously on both sides of track hopper.	Discrepancy observed in the referred clause regarding zone length and nos of operating zones at a time. Owner to confirm which clause to be followed.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-15
703	Coal flow diagram	4540-001-POM-A-040(OPTION-01), Rev-A		Ventilation system symbol indicated in TP-1 & TP-9.	Bidder understands that tunnel ventilation for TP-1 & TP-9 as shown in coal flow diagram is not applicable as both TPs (TP-1 & TP-9) are overground. Kindly confirm Bidder's understanding.	Confirmed.
704	Section-VI / Part-A / Sub section-IIA-15 SECTION-VI, PART-E	1.00.01 (viii) Drg. No. 4540-001-POM-A-040	2 of 7 -	At Transfer Point TP-3, Conveyor 4A/4B shall drop coal on to either Conveyor 5A or 5B. ... in Transfer Point TP-3. At TP-3 Future conveyor is indicated at discharge of Conveyor 4A and 4B along with additional flap gate.	Due to ambiguity between mentioned clause and drawing, Owner is requested to confirm the requirement for provision of future conveyor at TP-3.	Bidder to refer Amendment of Technical Specification, in this regard. Amendment No: A-MH-5
705	SECTION-VI, PART-A, SUB-SECTION-IIA-15 SECTION-VI, PART-A, SUB SECTION-IIA-03	1.00.01 -	2 of 7 1 of 1	Bio-mass shall be blended at TP- 9 through employers' Bio-mass conveyor. From TP-9, the reclaimed coal blended with Bio-mass can be conveyed to the raw coal bunkers through conveyors 4A/B, 5A/B, and onward conveyors The scope shall include the unloading, storage, transportation & feeding to coal bunkers along with all the associated systems. The storage area shall be provided with suitable firefighting system like fire hydrants and water monitors. The entire feeding system shall be provided with firefighting system including conveyors, storage silo, bunkers etc.	Discrepancy is found for scope of biomass handling in two clause. Bidder understands that Biomass unloading, storage, transportation up to TP- 9 will be in Owner's scope. Owner is requested to confirm Bidder's understanding.	Bidders' understanding is correct. Please refer Amendment No: A-SG-45

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706	Section-VI / Part-A / Sub section-III SECTION-VI, PART-E	1.04.00 List of Tender drawings	1 of 3 -	Employers Trough Conveyors (downstream of cross-country conveyors from Mine end) shall terminate at TP-1....Bidder to consider load for the employer's Coal Conveyor's drives and associated supporting structure. Similarly, Employers Biomass Conveyors shall terminate at TP-9. ...25 m span of employer's gallery may be considered by the bidder. Coal flow diagram : 4540-001-POM-A-040 Rev-A (Option -1) and (Option -2)	For design and sizing of TP-1 and TP-9, Owner is requested to furnish the following details for the feeding conveyor (Conv. 12A/B and Biomass conveyor) :- a) Conveyor capacity, Belt width, Belt speed. b) Centre distance between conveyors and Gallery cross-section. c) Drive arrangement of feeding conveyor. d) Load data to be considered in TPs (Drive, Belt tension, structural gallery load, Take-up arrangement)	Rated Conveyor capacity shall be 1760 TPH, Belt width: 1400 mm, Belt speed shall be 3.8 m/s max. As per technical specifications, bidder can optimize the layout. Therefore, other details shall be discussed & finalized during detailed engineering with the successful bidder.
707	Section-VI / Part-A / Sub section-III SECTION-VI, PART-E	1.04.00 List of Tender drawings	1 of 3 -	Employers Trough Conveyors (downstream of cross-country conveyors from Mine end) shall terminate at TP-1....Bidder to consider load for the employer's Coal Conveyor's drives and associated supporting structure. Similarly, Employers Biomass Conveyors shall terminate at TP-9. ...25 m span of employer's gallery may be considered by the bidder. Coal flow diagram : 4540-001-POM-A-040 Rev-A (Option -1) and (Option -2)	Bidder understands that dust suppression/dust extraction, Hoist along with monorail and Take-up supporting structure for Employer's conveyor at terminal point transfer tower are not in Bidder's scope. Owner is requested to confirm Bidder's understanding.	Technical specification is clear. As per the clause 1.04.00, Dust suppression arrangement at Head end, Handling arrangement (Hoist along with monorail) for drives, pulleys of employers' conveyors at TP-1 & TP-9 shall be in the scope of the Bidder.
708	SECTION-VI, PART-E	List of Tender drawings	-	General layout plan	Bidder understands that coordinates for TP-1, TP-9 and Elevation of receiving conveyors shall be finalized by bidder based on layout requirement during detail engineering. The same shall be followed by Owner's coal / Biomass handling system. Please confirm to Bidder's understanding.	Layout optimization in line with the technical specifications is in the scope of the bidder. Therefore, co-ordinates of TP-1, TP - 9 and elevations of the receiving conveyors shall be discussed & finalized during detailed engineering with the successful bidder.
709	Section-VI / Part-B / Sub section-D-1-5	5.24.00	112 of 120	CHP Workshop cum Office Building	We understand that equipments and EOT crane required inside CHP Workshop cum Office Building is not in Bidder scope. If required, Owner is requested to specify the type of EOT crane along with capacity, speed etc. In addition to the above, Owner is requested to also specify the list of equipments (if any envisaged) along with their detailed specification.	Bidder to consider minimum 5 Ton crance for workshop building. Refer Amendment No: A-MH- 31
710	TECHNICAL SPECIFICATION, SECTION-VI,PART-A, SUB-SECTION-IIA-15	1.00.01 (i)	1 OF 7	Indian Railways Coal rakes consisting of bottom discharge BOBR wagons shall transport ROM of (-) 250 mm size coal to the power plant. The coal received from BOBR type of wagons shall be unloaded in underground RCC track hopper	Tender specification is silent regarding compressed air system for BOBR wagon door opening during coal discharging to Track Hopper. Bidder understands that the same shall be in Owner's scope. Kindly confirm Bidder's understanding.	Complete compressed air system system for door opening of BOBR wagons are in the bidder's scope. Bidder to refer amendment of the Technical Specification.

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711	Part-6	4540-001-POM-A-040 (OPTION-01) 4540-001-POM-A-040 (OPTION-02)	47 of 73 48 of 73		Bidder understands that Conv.9 (Yard conveyor) shall be uni directional for unidirectional stacker reclaimer. In Flow diagram, Conv. 9 direction is showing Bi-directional. Bidder requests Owner to confirm.	Confirmed. Conveyor - 9 (Yard conveyor) shall be uni-directional as per the revised flow diagram. However, further optimization of the CHP layout by providing reversible yard conveyor and reversible Stacker cum reclaimer may be finalized provided it fulfills all the system requirement as per the tender specification. It may be noted that Crusher House shall not be located under-ground in any conditions.
712	Part-4	4540-999-POC-F-001 General Plot Plan			Bidder understands that there is no requirement of retaining wall to restrict stacked material at existing ETP area.(as marked in blue color) Bidder requests Owner to confirm.	Coal stackyard shall be continuous after dismantling of the existing ETP facility.

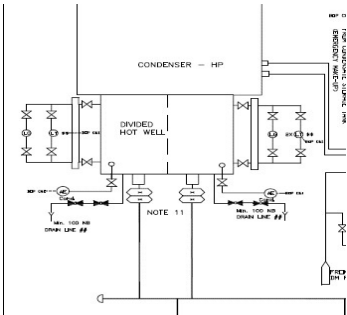
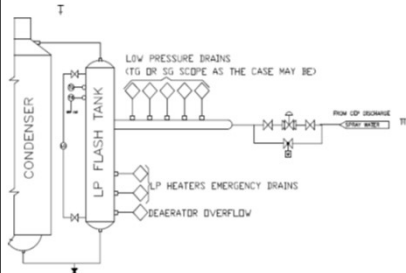
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713	Attachment-11, Auxiliary power consumption	Cl.no.5	2 of 4	Auxiliary Power Consumption for Unit Auxiliaries : Unit auxiliary power consumption for unit auxiliaries required for continuous unit operation at 100% TMCR i.e. 660 MW unit load shall not be more than 32000 KW.	Bidder understanding is as follows. Please confirm. Auxiliary Power Consumption for Unit Auxiliaries : Unit auxiliary power consumption for unit auxiliaries required for continuous unit operation at 100% TMCR i.e. 660 MW unit load at 77 mmHg(abs) condenser pressure with zero make up shall not be more than 32000 KW.	Bidder understanding is correct. Refer functional guarantee chapter clause 1.01.01/(x)/Sub-section IV/Part-A, Section-VI
714	Attachment-11, Auxiliary power consumption	6	2 of 4	Auxiliary Power Consumption for Station Auxiliaries Station auxiliary power consumption : comprising of all station Auxiliaries required for continuous station operation at 2X660 MW (i.e. 100% rated load of all the units) shall not be more than 16500 KW.	Bidder understanding is as follows. Please confirm. Station auxiliary power consumption : comprising of all station Auxiliaries required for continuous station operation at 2X660 MW (i.e. 100% rated load of all the units) at 77 mmHg(abs) condenser pressure with zero make up shall not be more than 16500 KW.	Bidder understanding is correct. Refer functional guarantee chapter clause 1.01.01/(xi)/Sub-section IV /Part-A, Section VI
715	SECTION-VI, PART-B, SUB SECTION-A-07	5.02.00 (a)	10 of 25	In case spray type Deaerator is provided, Bidders to provide cladding on internal surfaces of storage tank and/or Stainless Steel vessels to meet HEI requirements	Please clarify the exact requirement related to cladding as the tender specification is not clear in this regard. Bidder understands that half tank cladding as per ongoing projects (SJVN Buxar, UPRRVUNL Obra, Jawaharpur etc.) to be provided in case spray type Deaerator is offered. In case of STORK type deaerator cladding to be done near sprayer area as per OEM recommendation. Please confirm acceptance.	Refer amendment in this regard. (Amendment No : A-TG-2)
716	SECTION-VI, PART-B, SUB SECTION-A-07	5.02.00 (f)	10 of 25	All water spray valves, splash plates, trays, vent condenser and other elements in contact with undeaerated water or non-condensable gases shall be of stainless steel SS-304 or SS-410.	As per OEM standard & proven practice for Stork and spray type deaerator, only sprayer will be made from stainless steel. Please confirm acceptance.	Bidder to comply specification requirement.
717	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	5.02.00, DEAERATOR	PAGE 11 OF 25	(d) All pressure parts like shell, heads and nozzles shall be of carbon steel as per ASTM A-516 Gr. 70 . Shell plate min. thickness 15.8mm of welded construction.	Forged Nozzles shall be made by ASTM A -105. Plate Material (ASTM A 516 Gr.70) shall not be used. Please confirm.	Refer amendment in this regard. (Amendment No : A-TG-3)

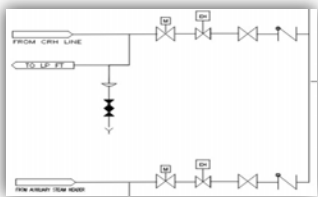
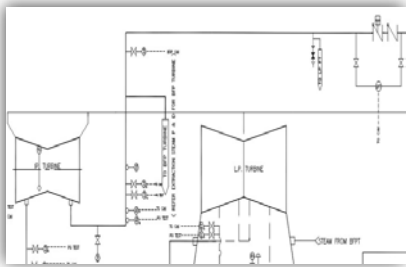
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718	SECTION – VI, PART-B, SUB SECTION-A-08	6.00.00	16 of 19	1) It is intended to chemically clean the following piping systems and equipments. (a) Boiler feed piping system (b) Heater drains piping (c) Main condensate piping (d) Extraction steam piping (e) Reheater spray piping (f) H.P. Heaters (g) L.P. Heaters (h) Deaerator (i) Gland steam cooler (j) Drain cooler	HP Heaters, LP Heaters, Gland steam cooler, Drain cooler etc. shall not be part of chemical cleaning system for piping. These equipments shall be connected to piping after cleaning of piping system. After installation of heater, during any other cleaning / during storage, heater shall be preserved under Nitrogen pressure.	Bidder to refer to the note mentioned in Clause 6.00.00 where it has been clarified, which states as below: "Note: In case chemical cleaning is not to be performed as per the standard practice of the bidder for any of the above-said equipment under bidder's scope, then suitable alternate measures are to be mutually discussed & agreed during detailed engineering after award."
719	SECTION-VI, PART-B, SUB- SECTION-G-02	9.1	3 of 5	1st TDBFP will come in service at around 20% load when required steam parameters as required for TDBFP is available	During start-up bidder proposes to take 1st TDBFP in service at around 30% load as per practice followed by Bidder in all executed projects based on OEM recommendation. Similarly during shutdown bidder proposes to take MDBFP into service at around load below 30%. Please confirm.	This is operational requirement. Bidder to comply specification requirement.
720	SECTION-VI, PART-B, SUB SECTION-A-07	6.05.06	14 OF 25	Each drive turbine shall be provided with a complete lubricating oil system which shall provide lube oil for drive turbine, main pump, booster pump and couplings and shall also cater the control oil of governing system and turning gear oil requirements	Alternately separate Lube oil & EH oil system for BFP Turbine should also be accepted as per OEM standard. Please confirm acceptance	The specified arrangement will optimise the scope & reduce the complexity. Bidder proposal is not acceptable. Bidder to comply specification requirement.
721	SECTION-VI, PART-A, SUB- SECTION- VI, MANDATORY SPARES	26	5 of 31	HP Bypass Valve complete assembly : 1 no.	Clarity to be provided regarding requirement is for bare stem valve or including actuator.	Bare stem valve is covered in point 26 page 5/31.. HP Bypass Valve Servomotor complete assembly including actuator, yoke and its control. is covered under point 27 of Page 5/31..

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722	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	4.00.00 (2)	23 of 31	a. Electro-Hydraulic Converter/Servo unit/proportional valve for LPBP b. Blocking unit for LPBP (as applicable) c. Position feedback transmitter for LPBP d. Positioner for LPBP 1 set	a) Please clarify LP BP means only LP bypass stop & control valve or it is inclusive of LP bypass spray control valve also. b) 1 set means to replace 1 valve? Please clarify.	a) LP BP means complete set of valves in LP Bypass system including stop valve, control valve & spray control valves. b) Bidder's understanding is not correct. 1 set shall include quantity of each items mentioned under referred clause for complete replacement in one stream of LP bypass system as applicable for the offered system.
723	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	4.00.00 (3)	23 of 31	a. Electro-Hydraulic Converter/Servo unit/proportional valve for HPBP b. Blocking unit for HPBP (as applicable) c. Position feedback transmitter for HPBP d. Positioner for HPBP 1 set	a) Please clarify HP BP means only HP bypass control valve or it is inclusive of HP BP spray control valve & HP BP spray block valve. b) 1 set means to replace 1 valve? Please clarify.	a) HP BP means complete set of valves in HP Bypass system including HPBP control valve, spray block & control valves. b) Bidder's understanding is not correct. 1 set shall include quantity of each items mentioned under referred clause for complete replacement in one stream of HP bypass system as applicable for the offered system.
724	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	4.00.00 (4)	23 of 31	High pressure hoses for HPBP, High Pressure LPBP etc : 2 complete sets	a) Please clarify HP BP means only HP bypass control valve or it is inclusive of HP BP spray control valve & HP BP spray block valve. b) 2 set means to replace 2 HP/ LP BP control valve? or to replace all hoses in 2 unit of HP/ LP BP system including HPU. Please clarify.	1 Set consist of complete hoses required for 1 X 660 MW unit. Bidder to comply specification requirement.
725	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	F	24 of 31	(i) Solenoid valves in the Electrohydraulic governing & protection circuit of main turbines, BFP turbines, HPBP & LPBP (ii) Solenoid valves to be used in extraction NRVs (as applicable)	a) Please clarify HP/LP BP means only HP/LP bypass control valve or inclusive of other valves like HP BP spray control valve, HP BP spray block valve & LP bypass spray control valve also. b) Solenoid valve is already requested under Sl. No. 3.00.00 control & instrumentation section (Page 29 of 31). Please clarify under which section Solenoid valves to be quoted?	a) HP/LP BP means complete set of valves in HP /LP Bypass system including stop valve, control valve & spray control valves. B) Solenoid valve to be used in extraction NRV are to be covered under under referred clause only i.e clause no 4.00.00 (C) (page 24 of 31), Part A. Bidder to note that Solenoid valve under Sl. No. 3.00.00 (Page 29 of 31) is for CPU area.

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725	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	VI.1	8 of 31	Drip pump : Complete drip pump assembly with coupling sets (Without Motor)	Please clarify whether Pump is required with Cannister and connecting coupling.	Cannister is not required, however coupling requirement is clear and shall be provided
726	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	VI.2	8 of 31	Drip pump : Complete Bearing assembly including bearing housing, thrust bearing, carrier, journal bearing, cooling coil & thrust collar, thrust pads etc)	Bearing housing is static component (not rotating & not subject to wear) hence not recommended to be considered in spares. Please confirm acceptance. Offered pump & motor are with Antifriction bearing for thrust load, hence thrust bearing, carrier, journal bearing, cooling coil and thrust collar, thrust pads etc. not applicable.	Complete bearing housing alongwith internals to be provided as per the design of manufacturer.
727	SECTION-VI, PART-A, SUB-SECTION- VI, MANDATORY SPARES	II.1	6 of 31	Condensate extraction pumps Complete Bearing assembly including bearing housing, thrust bearing, carrier, journal bearing, cooling coil & thrust collar, etc.)	Bearing housing is static component (not rotating & not subject to wear) hence not recommended to be considered in spares. Please confirm acceptance. Offered pump & motor are with Antifriction bearing for thrust load, hence thrust bearing, carrier, journal bearing, cooling coil and thrust collar, thrust pads etc. not applicable.	Complete bearing housing alongwith internals to be provided as per the design of manufacturer.
728	SECTION – VI, PART-B, SUB SECTION-II-B-02 MOTORS	7.10.00	3 of 4	3.3/6.6 KV motors shall be offered with dust tight phase segregated double walled (metallic as well as insulated barrier) Terminal box.	Alternately Elastimold type Terminal box should also be accepted as per OEM standard proven practice. Please confirm acceptance.	Bidder proposal is acceptable
729	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	2.02.02, Condenser air evacuation pumps	PAGE 44 OF 101	Condenser air evacuation pumps: Vacuum pump I.T.D = Saturation temperature corresponding to optimized condenser pressure for the respective condenser shell (which is considered for guaranteed condenser pressure) – specified cooling water inlet temperature to vacuum pump seal water cooler.	Bidder would like to clarify that, the design holding and hogging capacity of the vacuum pump shall be correspond to " specified cooling water inlet temperature to vacuum pump seal water cooler is 33 Deg C. only ". Please confirm acceptance.	Bidder to comply specification requirement.

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730	TECHNICAL SPECIFICATION SECTION-VI, PART-A SUB-SECTION-IIA-06 TURBINE GENERATOR AND AUXILIARIES TECHNICAL SPECIFICATION SECTION-VI, PART-B SUB-SECTION-IIA-06 TURBINE GENERATOR AND AUXILIARIES	7.00.00, BOILER FEED PUMPS 6.04.00, HYDRAULIC COUPLING	PAGE 6 OF 10 PAGE 14 OF 25	One thirty percent capacity (1x30%) motor driven boiler feed pump for each unit complete with booster pump along with it's drives, mechanical seals, flexible couplings, hydraulic coupling, gear box, base plate(s), forced oil lubricating system (including oil pumps, oil tank, lube oil coolers, working oil coolers, duplex oil filters etc.), regulating type low load recirculation flow control valve, mobile trolley, integral piping and valves, temporary and permanent strainers, local instrument racks/enclosures, instrumentation and control etc. shall be provided. One (1) number portable centrifuge of adequate capacity shall also be provided. 1x100% lube oil cooler, 1x100% Working oil cooler, one portable type oil purifier per station of adequate capacity to be included to form the centralized lubrication system for MDBFP set.	Bidder understands that one number common portable lube oil purifier for MDBFP will be provided for per station (i.e.. 2x 660 MW plant).	Refer amendment in this regard. (Amendment No : A-TG-4)
731	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	2.05.00, Condensate Extraction pump	PAGE 49 OF 101	c) Maximum Capacity: One pump capable of handling the flow and head corresponding to 65% unit load.	Bidder understands that 65% unit rated load means that 65% TMCR load with 0 % Makeup. Please confirm.	Please refer reference HBD (J) as per clause 1.18.01 in sub-section-A-07/Section-VI/Part-B.
732	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	2.06.00, Boiler feed pump	PAGE 50 OF 101	3) Runout point: One TDBFP shall be capable of handling flow and head corresponding to 65 % of unit rated load.	Bidder understands that 65% unit rated load means that 65% TMCR load with 0 % Makeup. Please confirm.	Please refer reference HBD (J) as per clause 1.18.01 in sub-section-A-07/Section-VI/Part-B.

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733	TECHNICAL SPECIFICATIONS PART-6	4540-999-POM-A-009 Condensate P&ID / Rev A			Tender P&ID shows 2 numbers CEP suction from each hot well along with individual standpipe for level measurement and conductivity analysers. As per our condenser OEM design both the hot well (Condenser 1 and condenser 2) are interconnected and water levels for both hot well will be same. Hence, Bidder proposes to provide one suction pipe from each hot well and a common level measurement and conductivity analysers.	Bidder to comply specification requirement.
734	TECHNICAL SPECIFICATIONS PART-6	4540-999-POM-A-012 STEAM DRAIN SYSTEM P&ID / Rev A		LP Heater Emergency drains are connected to condenser via LP drain Flash tank 	Bidder proposes to transfer LP feed water heater emergency drains directly to condenser. Our condenser design is capable of handling LP Drains directly. Hence, separate LP drain flash tank is not required. The total number of flash tanks shall be as per bidder's standard proven practice accepted in previous NTPC project. Please confirm acceptance.	Bidder to comply specification requirement.

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
735	Section-VI / Part-B / Sub-Section A-2-8 (Boiler Feed Pumps) Dwg. No. : 4540-999-POM-A-008	6.05.09 (d)	15 of 25	In case bidder offer extraction steam to BFPT arrangement as per BOX-B of tender P&ID of extraction steam to BFPT then the pressure regulating valves in the CRH and Auxiliary steam line shall necessarily be electro hydraulically operated. 	As per tender P&ID, separate electro hydraulically operated control valves in auxiliary steam and CRH steam line to BFPT. Bidder wants to clarify that a common control valve will be provided in Auxiliary steam and CRH steam line to BFPT as per OEM standard practice followed in all earlier projects. Accordingly, bidder will provide the scheme for Auxiliary / CRH steam supply to BFPT. Please confirm acceptance.	Bidder to comply specification requirement.
736	Dwg. No. : 4540-999-POM-A-007	-	-		As per tender P&ID, extraction steam tapping for BFPT prior to power operated NRV. Bidder proposes to take extraction steam tapping for BFPT after power operated NRV as per their standard practice followed in past executed projects. Accordingly, bidder will provide updated scheme for extraction steam supply to BFPT. Please confirm acceptance.	Bidder to comply specification requirement.
737	SECTION-VI, PART-A, SUB-SECTION-I-A, PROVENNESS	3.1, q	4 of 36	Provenness criteria for critical equipment(s) and bought out items : q) Name of equipment : HP Bypass system Type of equipment : HP Bypass system for supercritical steam turbine generator sets Equipment rating : Capacity of each valve not less than 650 Ton/hr at 270 Kg/Cm2(abs) & 600 deg.C Main Steam pressure and temperature at Turbine inlet	Bidder/Sub vendor should be allowed to meet the referred steam parameters & Flow requirement through multiple projects (i.e multiple/different project references can be considered for meeting individual parameters (i.e Pressure, Temperature & Flow) provenness). Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply specification requirements

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
738	SECTION-VI, PART-A, SUB-SECTION-I-A, PROVENNESS	3.1, r	4 of 36	Provenness criteria for critical equipment(s) and bought out items : q) Name of equipment : LP Bypass system Type of equipment : LP Bypass system for steam turbine generator sets Equipment rating : Capacity of each valve not less than 650 Ton/hr at pressure corresponding to 100% TMCR condition reheat pressure (abs) & 600 deg.C reheat temperature at Turbine inlet.	Bidder/Sub vendor should be allowed to meet the referred steam parameters & Flow requirement through multiple projects (i.e multiple/different project references can be considered for meeting individual parameters (i.e Pressure, Temperature & Flow) provenness). Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply specification requirements
739	SECTION-VI, PART-A, SUB-SECTION-I-A, PROVENNESS	14	36 of 36	HP Bypass System are generally supplied as per Provenness clause specified above at 3.1/(q). However, to promote make in India, HP Bypass valves is also identified for Indigenous manufacturing. In case the bidder wants to supply it from Indigenous sources who does not meet the specified criteria then the bidder to make sure the requirements specified at clause 14.1 below are met. However, supply of HP Bypass system shall be limited to only one unit from such indigenous sources and HP Bypass valves for other unit shall be supplied only from approved sources meeting provenness requirement as specified.	Bidder requests NTPC to allow supply of HP Bypass system from such indigenous sources for both the units instead of limiting it to only one unit. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply specification requirements
740	SECTION-VI, PART-A, SUB-SECTION-I-A, PROVENNESS	14.1	36 of 36	The bidder will source HP Bypass system from Indian manufacturers who are regular manufacturer of HP Bypass system for at least 500 MW or higher size supercritical unit having minimum flow of 650 Ton/Hr for each valve at Main Steam pressure and Temperature of 247 Kg/Cm2(abs) and 565 deg.C respectively at Turbine Inlet.	Bidder/Sub vendor should be allowed to meet the referred steam parameters & Flow requirement through multiple projects (i.e multiple/different project references can be considered for meeting individual parameters (i.e Pressure, Temperature & Flow) provenness). Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply specification requirements

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741	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIC CONTROL & INSTRUMENTATION	17 of 18	21.00.00	a. IIoT Solutions for Real-time Equipment and Process monitoring and for condition monitoring	a) Bidder wish to clarify that Owner has already indicated that all major equipment shall be provided with Vibration/ temperature measurement and this information shall be connected to DDCMIS. Bidder request Owner to specify additional equipment where IIOT sensors are required to be provided and also type of IIOT sensors (Vibration/ temperature) to be provided for such equipment. b) Bidder request Owner to clarify the purpose and objective of the IIOT sensors viz. Monitoring or predictive maintenance or any other purpose. c) Bidder request Owner to clarify if any interface is required between IIOT system and DDCMIS/Vibration Monitoring & analysis system/ any other system.	a) IIoT sensors are required for condition monitoring of major drives in Main Plant Area. Exact drive details shall be finalised during detailed engineering. b) The purpose of additional IIoT sensors is for condition monitoring of major drives. c) No such interfacing is required.
	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIIC-18 IIOT, DIGITAL HELMET AND AR/VR MODEL	1 of 2	1.1	IIoT Solutions: IIOT solutions will include providing additional measurements for continuous/ periodic condition monitoring of equipment. This solution shall include both permanently mounted wireless devices and portable wireless devices as per the application requirements. Real-time Equipment and Process Monitoring: This shall include wireless sensors/transmitters provided with fixed mounting arrangement including. These sensors shall be located at various locations in main plant area.		
742	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	-	-	Smart Project Management system (SPMS) shall be valid up to the COF of last Unit	Since Vendors for SPMS are not specified in Vendor list included in Tender, Bidder understands that no vendor approval from NTPC is required for SPMS and its sub-components. Please confirm.	Bidder understanding is correct.
743	TECHNICAL	Annexure-B to	1 of 4	2.00.0	Contractor shall ensure all its OEM/suppliers must affix	Bidder request Owner to clarify the High Value items and Low value items	Bidder to meet the specification requirement
744	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	1 of 4	2.00.0	Contractor is required to supply Real Time Location Tracking System (RTLS) to track the near real time location of operator/ worker in the plant based on 802.11 active RFID tags or similar other technology e.g. LPWAN LoRa that serves the intent of the specifications here.	Bidder understand that the technology required to meet the intent of the specification requirement for SPMS shall be selected by Bidder and same may not necessarily be based on LPWAN LoRa. Please confirm.	Technology used for RTLS should be as per bidder standard practice subject to Employer approval during detailed engineering meeting the intent of specification
745	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	2 of 34	2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS For HART transmitter SIL 2 certification is required.	a) Bidder understands that SIL-2 transmitters are not required for all applications inline with past NTPC projects. Bidder proposes to provide transmitters inline with past NTPC project (Khargone). b) Bidder request NTPC to clearly specify applications where SIL-2 certified transmitters is required. Please confirm.	Bidder's understanding is not correct .Bidder to comply the technical specification

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746	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION - IIIC-12 SWAS	3 of 6	3.02.00	Minimum specifications of analysers Chloride : Range - 0-1000 ppb freely programmable	Bidder wish to clarify that the Chloride analyzers with minimum detection limit of 0 ppb is not available. As per SWAS measurement points indicated in Part-A, Chloride analysis is not required for SWAS. However, incase Chloride analyzer is required as per Bidder's design, then Bidder proposes to consider Chloride analyzer with minimum detection limit of 5ppb as per Bidder's requirement. Please confirm.	Bidder 's proposal is noted for chloride measurement only for SWAS requirement.
747	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION- IIIC-02 DDCMIS	2 of 17	12.00.00	Measurement Functions of Control System: Input / output modules in the Control System shall be separate from controller hardware.	Bidder wish to inform that the referred clause requirement is for DDCMIS. This requirement is not applicable for proprietary control systems (PLC/Microprocessor based/ Relay based) supplied by equipment OEMs. Please confirm.	The referred clause is for DDCMIS. Bidder to comply the specifications requirement.
748	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION- IIIC-02 DDCMIS	3 of 17	14.00.00	Binary inputs shall be wired either in form of changeover type contacts (i.e. 'NC' + 'NO' together) or non-changeover type Contact ('NC' or 'NO') depending on the requirement, as defined in Part-A of specification.	Bidder could not find requirement in Part-A of specification. Bidder request Owner to please specify the requirement for selection of changeover type & non-changeover type contacts.	Binary inputs shall be wired either in form of changeover type contacts (i.e. 'NC' + 'NO' together) or non-changeover type Contact ('NC' or 'NO') depending on the requirement, as indicated in Part-E of specification.'
749	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02C	1 of 5	1.01.07	Large Video Screen (LVS) 1. 80 inch, Laser illuminated Large video screens with Digital Light Processing (DLP) technology.....	Bidder would like to clarify that 80 inch LVS is available in square shape. However, DCS OWS screens are in rectangular shape. Therefore, Bidder suggest to consider LVS size of 70 inch.	Bidder's understanding is not correct. 80 inch LVS are available in 16:9 aspect ratio. Bidder to comply specification requirement.
750	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02C	1 of 5	1.01.08	Graphical Interface Unit: GIU shall be installed in a suitable enclosure complying IP-55 protection class (IP-65 for extremely dust prone areas).	Bidder wish to clarify that GIU are installed on the Panels which are located indoor (either AC environment or Pressurized ventilated environment). Hence, GIU shall not be exposed directly to any dust. In view of above, IP-65 protection is not required if GIU is located indoor as specified above.	IP 65 is required for extremity dust prone area only. Bidder to comply specification requirement.

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751	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure C to IIC Contract quantity	13 of 24	2.03.00	Common Plant Areas - Coal Handling Plant/Lime Stone Handling Plant/Gypsum Handling Plant: Raw Coal Bunkers (each Unit)	Since Coal bunkers are located in the Unit Zone, Bidder proposes to interface Each unit Bunker Area CCTV cameras in respective Unit Generating zone. The details of these cameras shall be available in CHP Zone workstation also. Request Owner to confirm the same.	Bidder to comply the specification requirement.
752	TECHNICAL SPECIFICATION SECTION VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION - IIC-02 DDCMIS ANNEXURE IIC-02D	3 of 4	7.00.00	Automatic Unit Start-up & Shutdown with Single command It shall be possible to perform automatic unit start-up & shutdown by issuing single command from the LVS/OWS.....	Implementation of Automatic Unit start-up and shutdown with single pushbutton is not feasible and also not proven. Therefore, Bidder would like to clarify , Automatic Unit start-up and shutdown shall be implemented with minimum possible manual interventions. Request Owner to accept the same.	Bidder to comply the specification requirement.
753	TECHNICAL SPECIFICATION SECTION VI, PART-B BID DOC. NO.: CS-4540-001A-2	SUB-SECTION - IIC-02 DDCMIS ANNEXURE IIC-02F	4 of 5	1.11.04	The total no. of IMC modules in one Profibus DP segment and their response time shall be governed by Process requirement..... However the total no. of IMC modules per segment shall in no case exceed 24.	As per specification, the IMC modules Profibus DP interface is envisaged for only monitoring purpose. Therefore, Bidder proposes the maximum number of IMC modules per segment shall be limited to meeting the response time/update time requirement of specification.	Bidder's understanding is not correct. Refer clause no 1.06.02, Subsection IIC, Part A for its applicability. Bidder to comply the specification requirement.
754	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION- IIC-03 MAIN EQPT INST SYSTEM	1 of 2	1.00.00.(ii)	It shall be possible to do vibration analysis simultaneously at site as well as corporate centre.	Bidder would like to clarify only remote view of Vibration analysis results is possible. However, conducting remote Vibration analysis using raw data is not possible with major Vibration analysis system OEMs. Therefore, Bidder request to recheck the requirement of remote vibration analysis.	Bidder to comply specification requirement.
755	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION- IIC-08 CONTROL VALVES, ACTUATORS & ACCESSORIES	1 of 5	1.02.02	Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel.	Bidder would like to clarify, for certain applications like BFP recirculation control valves; it is not feasible to meet the requirement mentioned in specification under referred clause. Therefore, Bidder would like to confirm that this requirement shall be met to the extent possible subject to controllability confirmation by valve OEM.	Bidder to comply specification requirement.
756	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION- IIC-08 CONTROL VALVES, ACTUATORS & ACCESSORIES	2 of 5	2.08.00	Extension bonnets shall be provided when the maximum temperature of flowing fluid is greater than 280 deg. C.	Bidder would like to clarify, final requirement of extension bonnet/Finned type Bonnet shall be as per Valve OEM bonnet maximum design temperature.	Bidder to comply specification requirement.

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757	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-08 CONTROL VALVES, ACTUATORS & ACCESSORIES	3 of 5	3.00.00.(4)	Service: DM Water, Body Material: SS 316	Bidder understand the DM water referred in specification clause shall be application for pure DM water (i.e. Non passivated DM water) Request Owner to confirm the same.	Bidder's understanding is correct.
758	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-09 PROGRAMMABLE LOGIC CONTROLLER SYSTEM	3 of 6	14.03.00	24 V DC power supply system for PLC shall comprise of 2 x 100% power supply unit (power pack) along with 1 x 100% sealed maintenance free lead acid batteries for 30 minutes back up and DC distribution board,.....	Bidder request to clarify whether incoming feeder to PLC cabinet shall be 24VDC or 230VAC UPS. Bidder understand, if incoming feeder will be 24VDC then 2 x 100% power pack units will not be required. Request Owner to confirm the same.	Bidder's understanding is not correct. Bidder to comply specification requirement.
759	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-09 PROGRAMMABLE LOGIC CONTROLLER SYSTEM	3 of 6	16.00.00	Less than 100 msec. from input signal to output signal including logic processing. Display response of maximum 1 sec for control related displays. 2 to 3 secs for other displays	Bidder understand 100 ms is applicable for fast open loop only e.g. electrical breakers. Request Owner to confirm the same.	Bidder's understanding is correct.
760	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-11 CONTROL DESK & PANELS	3 of 5	3.01.00	An arc shaped Large Video Screen (LVS) panel shall be supplied for mounting large video screens in number of tiers in various Control rooms as specified at Part-A of specification	Bidder could not locate number of tiers for LVS installation in Part-A. Bidder shall consider 2 tier installation as per "SUB-SECTION-IIIC-20 CCR Design Guidelines". Request Owner to confirm the same.	Bidder understanding is correct. Please refer Clause no. 1.01.07, Subsection IIIC-02 DDCMIS, Annexure IIIC-02C, Section VI, Part B of technical specification.
761	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-4540-001A-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4540-001A-2	1 of 6	2.01.00	Unit-wise SWAS panels viz. Primary Sample conditioning rack (at Boiler Floor and Deaerator Floor),.....	Bidder request to clarify which samples to be considered for primary sample conditioning rack at Deaerator floor. Alternatively Bidder proposes to take these samples directly to Wet panels in SWAS room. Primary coolers for these samples shall be part of SWAS Wet panel. Please confirm.	Deaerator water outlet samples to be considered for primary sample conditioning rack at Deaerator floor. Also refer clause G, Contract Quantities for SWAS, Annexure C to IIC, Part-A, Section-VI of Technical Specifications. Bidder alternate proposal is not acceptable. Bidder to comply specification requirement.

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762	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIIIC-20 CCR Design Guidelines SUB-SECTION-IIIIC-01 BASIC DESIGN CRITERIA	1 of 3 6 of 6	2.00.00.b 9.03.00 (2)	Programmer's room and PC rooms – Required quantities of PCs and workstations and network devices with associated furniture Programmer Room :Programmer Room is envisaged to be located near the CER. This shall house the servers/ other workstations & Engineer station for DDCMIS (SG,TG and BOP C&I systems), various PCs and PADO hardware.	Bidder understands that the relevant workstations and engineering workstation shall be located in Programmer room. Separate PC room is not required. Request Owner to confirm the same.	Bidder's understanding is correct.
763	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIIIC-20 CCR Design Guidelines	1 of 3	2.00.00.b	Documents room, spares room, Locker room, pantry, toilets, small offices alongwith lobby, visitor room, conference room etc.	Bidder request to finalize rooms to be considered at Main control room. Bidder understands that the Offices with Lobby will be provided in Service building, hence the same is not required in Main control room. Request Owner to confirm the same.	Please refer Clause no 1.02.00 ,sub section - G-03, Section VI , Part B for rooms to be considered at main control room / CCR at operating floor.
764	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO. CS- 4540-001A-2 TECHNICAL SPECIFICATION SECTION – VI, PART-E BID DOC. NO.CS-4540-001A-2	SUB-SECTION-IIIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY) SUB-SECTION-IIIIC-06 PROCESS CONNECTION AND PIPING 0000-999-POI-A-064	2 of 34 1 of 2 3 of 3	2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS: Transmitter shall have.....and rack with canopy In case grouping is not possible and these are to be installed individually, canopy with suitable mounting arrangement shall be provided. LIR with 4/6/8 maximum number transmitters without purging.	Bidder would like to clarify,incase transmitter density is not available in a particular area and instrument grouping is 2 or less than 2 then suitable mounting (stanchion) shall be considered with canopy as mentioned in "SUB-SECTION-IIIIC-06, clause 1.01.00". Request Owner to confirm the same.	Bidder's understanding is not correct. Bidder to comply the specification requirement.
765	TECHNICAL SPECIFICATION SECTION – VI, PART-E BID DOC. NO.CS-4540-001A-2	0000-999-POI-A-065	4 of 14	-	Interface from LIE/ LIR integral JB to Marshalling/ Termination cabinet is indicated in drawing.	Bidder would like to clarify , intermediate junction box shall be used after LIE/LIR integral JB for interfacing with Marshalling/Termination cabinet. Request Owner to confirm the same. Cable between LIE/LIR integral JB to intermediate JB shall be min 2 Pair.	Bidder proposal is not acceptable. Bidder to comply specification requirement.

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766	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO.CS-4540-001A-2	0000-999-POI-A-022	-	Note-5	Gauges shall not be mounted on pipe. It will be mounted on a channel or Frame or Rack	Bidder would like to clarify, gauges which are installed at accessible location shall be directly mounted on pipe. Request Owner to accept the same.	Bidder proposal is not acceptable. Bidder to comply specification requirement.
767	TECHNICAL SPECIFICATIONS SECTION – VI, PART-E BID DOC. NO.CS-4540-001A-2	0000-999-POI-A-035	13 of 14	-	4 inch ANSI matching flange attached with flush diaphragm of Level transmitter	Bidder proposes the size of flange shall be 2/3/4 inch depending on measurement range of Level transmitter. Also Bidder would like to clarify this type of Level transmitter can be considered for Atmospheric tank level measurement. Request Owner to confirm the same.	Bidder proposal is not acceptable. Bidder to comply specification requirement.

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768	Section-VI/Part-B	D-1-5	106 OF 120 98 OF 120 99 OF 120	5.23.19 5.23.04/5.23.05	<u>Roof slabs for CHP, LHP and GHP buildings shall be minimum 150 mm thick(in case of metal decking thickness shall be measured from crest top)</u> and shall have minimum 10 dia HYSD reinforcement bars placed at 200 mm center both ways at top and bottom. <u>The roof of crusher house/transfer house shall be provided with pre-fabricated insulated metal sandwich panels.</u> Pre-Fabricated Insulated Metal Sandwich Panel for Roofing shall be laid to specified slope.	The said clauses are contradictory. Bidder shall consider pre-fabricated insulated metal sandwich panels laid on the roof for all CHP steel buildings including Crusher House & Junction Tower. Kindly confirm the same.	Clause 5.23.19 is generic and shall be followed unless noted otherwise for specific structure/buildings/facilities as mentioned in Cl 5.23.04/5.23.05 etc.
769	Section-VI/Part-B	D-1-6	4 OF 24	6.02.02 (G)	Underground Structures such as Channels, Sumps, Underground Pump House, Tanks, Trenches, Reservoirs, C.W. ducts etc. In addition to earth pressure and ground water pressure, the surcharge load of 2T/sq. m. shall also be considered for design of all underground structures.	Bidder understands that foundations of the buildings (isolated/strip/raft) are not considered as underground structures. Hence a surcharge load of 2T/sq. m. shall not be applicable for such foundations. Kindly confirm the same.	Bidder's understanding is not correct. Foundations are underground structures.
770	Section-VI/Part-B	D-1-6	8 OF 24 2 OF 6	D-1-6, 6.03.03 D-1-12(E)	Design of steel structures shall be done by the working stress method. Design shall be as per provisions of IS 800:1984 and other relevant IS standards. Design/Detailing for Ductility for Structures :- The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.	As per D-1-12(E) we understand that since the site specific design acceleration spectra has an in-built allowance for ductility, the design of steel structure as per IS 1984 by working stress method will impart the said ductility to the relevant steel structure. Hence we do not need to engineer and detail those structure with any additional ductile check separately since the said code does not talk about ductile design of steel structure. Kindly confirm the same.	Bidder to follow technical specifications. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.
771	Section-VI/Part-B	D-1-5	41 OF 120	5.08.00	The inside drain dimension at any point should not be less than 0.45m (height) x 0.75m(breadth).	Bidder proposes to adopt minimum 0.3 m (breadth) x 0.3 m (depth) drain and subsequent sizing as per hydraulic and discharge requirements. The same has been adopted in other NTPC projects. This is because it shall be very difficult to provide 750 mm wide drains due to ~~space constraints and land utilization~~	Bidder to comply the Specification Requirements
772	Section-VI/Part-B	D-1-9	2 OF 31	9.03.00	All buildings shall have minimum one toilet block each. The facilities provided in the toilet block shall depend on the number of users.	Please mention the list of buildings in CHP area which requires toilet facilities. Kindly also share no of users building wise in CHP area (where toilet facilities needs to be provided) and the volume of waste generated (m3/day).	Bidder to follow technical specification
773	Section-VI/Part-B	D-1-6	10 OF 24	6.03.08.08	Factor of safety against overturning and sliding The structure shall be checked for minimum factor of safety of 1.5 against overturning conditions (ratio of stabilizing moment to overturning moment) and 1.4 against sliding conditions as per IS: 456.	As per IS 456 clause 20.1, Factor of safety against overturning is 1.2 due to characteristic DL and 1.4 due to characteristic LL which is at variance from the provisions of the said clause. Kindly clarify.	Bidder to comply the Specification Requirements
774	Section-VI/Part-B	D-1-6	11 OF 24	6.03.08.11	Minimum diameter of Distribution Reinforcement / Stirrups/ ties/ Anchor Bars is 12 mm for foundation.	Bidder proposes to use minimum 8mm diameter bar for shear links in foundation. Please confirm.	Bidder to comply the Specification Requirements

Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
775	Section-VI/Part-B	D-1-6	9 OF 24	6.03.08	Horizontal bracing system shall be provided at floor levels around the openings for plan area greater than 2 sqm.	Bidder understand that horizontal bracing system shall be provided at floor levels only around openings having plan area greater than 2 sqm. Beside these opening areas, the balance portion of RCC floor systems shall be considered as Rigid diaphragm. Structural floor beams supporting RCC slab in that portion shall be designed as laterally restrained. Kindly confirm the same.	Bidder shall adhere to Technical specifications. Please refer CI 6.03.18 of SectionVI/Part-B Sub Section D-1-6
776	Section-VI/Part-B	D-1-5	104 OF 120	5.23.17.01	Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the owner's coal slurry settling pond.	a)Kindly share drawings of Owner's coal slurry settling pond. Bidder needs the same to plan drainage of coal stock pile area and stacker reclaimer area (around rails). b)Also the location of the existing coal slurry settling	Bidder to refer Amendment no. D1-10
777	Section-VI/Part-B	D-1-6	9 OF 24	6.03.08	Minimum thickness for rolled/ built upsection shall be 6mm.	Bidder understand that minimum thickness of member means flange thickness irrespective of web thickness for a rolled / built up section. Please clarify.	Minimum thickness of web or flange which ever is lesser shall be 6mm.
778	Section-VI/Part-B	D-1-5	107 OF 120 47 OF 120	5.23.20.2 5.13.01	The grade slab shall consists of 230 mm thick rubble soling (63 mm downgraded hard stone..... overlaid by 75 mm thick <u>P. C. C. M-7.5</u> and 100 mm thick RCC of grade M-20 with minimum 8 mm dia bars placed at 200 mm C / C in either direction respectively. There will be minimum 50 mm thick metallic hardener finish over the RCC slab. <u>In all buildings including main plant building, the ground floor slab shall consist of minimum 150mm thick RCC M25 grade base slab over an under bed as specified below.</u>	The said clauses are contradictory. For grade slab of all buildings bidder shall follow clause 5.23.20.2. Kindly confirm the same.	Bidder to refer Amendment no. D1-11
779	Section-VI/Part-B	D-1-5	107 OF 120 46 OF 120	5.23.20.2 5.13.00	The paving construction shall be as per specifications for the grade slab at ground level. However, 50 mm thick <u>metallic hardener finish is not required to be provided in paved area.</u> Paving areas <u>shall be provided with the metallic hardener floor</u> finish as specified elsewherein the specification.	The said clauses are contradictory. Bidder shall consider to proceed with clause 5.23.20.2 for all CHP structures. Please confirm.	Bidder to refer Amendment no. D1-11
780	Section-VI/Part-B	D-1-5	96 OF 120	5.23.02	Cross beams at floor level supporting conveyor stringer beams shall be made of single rolled steel beam or single channel section (ISMB or ISMC) or plate girder.	Bidder proposes that in addition to ISMB, ISMC or plate girder , Jindal sections(NPB or UB) can also be used for cross beams & end portals in conveyor galleries as well as floor beams and columns in steel buildings in coal handling plant area. Please confirm.	Rolled steel sections confirming to relevent IS codes are already envisaged in the mentioned Clause.
781	Section-VI/Part-E (TENDER DRAWINGS)		1 OF 8	Sl. No:1	Drawing no. 4540-999-POC-F-001 titled "General Layout Plan" - Structural shed over stock pile area.	It is difficult to support the structural shed by not providing any column foundation supports in the existing ETP facility area (as shown in the plot plan). Bidder proposes to dismantle existing ETP facilities (Refer the attached PDF)in order to support the shed. Request you to revisit the arrangement.	Dismantling of existing ETP has been included in EPC vendor's scope. Bidder to refer Amendment no. D1-4

Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
782	Section-VI/Part-A	IID	2 of 13	1.00.00	All existing foundations/below ground facilities interfering with new facilities are to be dismantled upto minimum 10m or technical/system requirement, whichever is greater, from the extreme outline of the new underground foundation/ structure. No drawing for substructure are available.	Bidder understands that Owner is referring to horizontal clearance of minimum 10 m between the extreme outline of new and existing foundation/below ground facilities. Please confirm.	Bidder's understanding is correct.
783	Section-VI/Part-E (TENDER DRAWINGS)		1 OF 8	Sl. No:1	TIN SHED shown in the additionally proposed coal stockpile area as per General Layout plan (4540-999-POC-F-001)	As per General layout plan (4540-999-POC-F-001),a tin shed has been shown in additional coal stock area while the same is missing in Annexure -P. Please clarify whether dismantling of the said structure shall be in bidder's scope or not ? if yes then please provide the plinth area and M.O.C of this facility with scope of dismantling.	The list in Annexure-P is only indicative. Please refer , Clause 1.00.00, para-3 S.NO.-4 of Part-A, Section-VI, Sub-Section IID of Technical Specifications.
784	Section-VI/Part-E (TENDER DRAWINGS)		1 OF 8	Sl. No:1	Stage-I Raw water reservoir & Stage-II Raw water reservoir as per General Layout plan (4540-999-POC-F-001)	Please confirm the depth of Stage-I Raw water reservoir & Stage-II Raw water reservoir. Since the reservoir plinth area is high and we require the depth of these existing facilities to arrive at the filling quantities.	Dismantling of existing reservoir of St-I & II are in bidders scope. Depth of existing reservoir is approx 4m (+/-1m) from surrounding area.
785	Section-VI/Part-B Section-VI/Part-B Section-VI/Part-B	D-1-5	104 OF 120 63 OF 101 649	5.23.17.01 3.06.00 Annexure-P	Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the owner's coal slurry settling pond . For all coal Conveyor.... Crusher House, pent house, transfer house Wagon Tippler & transfer houses Control rooms and MCC buildings, Pump houses, etc water / coal slurry coming from down comers shall discharge into peripheral drains (Brick drains with steel gratings provided around the building) which will lead the water / coal slurry into contractor's RCC drain, which will lead the discharge finally into coal slurry settling pond . 4. Coal handling plant run-off water treatment system a) Two (2) numbers of Coal Slurry Settling (CSSP) Ponds (minimum size of 40m x 8m x 3m deep) of RCC Construction shall be provided. Annexure - P - Details of facilities to be dismantled. Sl no. 80. Coal Slurry Settling pit	From these 3 clauses bidder understands that there are total 4 nos. coal slurry settling pond out of which , i) Two nos. are to be constructed by bidder. ii) One CSSP is existing to which the drainage of the complete coal stockpile around the stacker-reclaimer/ stockpile shall be discharged. iii) One no. need to be dismantled by bidder. Please confirm whether bidder's understanding is correct or not.	Existing CSSP is to be dismantled (ref Annex-P, Part-A, Section VI/IID) Bidder to refer Section-VI/Part-B SUB-SECTION-A-01, EQUIPMENT SIZING CRITERIA, Clause 3.06.00 C (4). Two (2) numbers of Coal Slurry Settling (CSSP) Ponds (minimum size of 40m x 8m x 3m deep) of RCC Construction shall be provided. Bidder to refer Amendment no. D1-10

Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
786	Section-VI/Part-B	D-1-5	99 OF 120	5.23.06	Stacker Reclaimer Foundation: Stacker – Reclaimer (S/R) foundation shall be in RCC and shall provided at a regular interval of approx. 3.0 m center. Conveyor short posts shall be supported on RCC beams at grade level..... RCC retaining wall on both sides of the S/R foundation shall be provided as shown in the tender drawing	Bidder could not find Stacker Reclaimer Foundation drawing along with the tender documents. Kindly share the relevant details of stacker reclaimer foundation along with retaining wall.	Refer tender drawing no. 4540-XXX-POC-A-0016. Detail engineering is in bidder's scope
787	Section-VI/Part-B	D-1-5 D-1-9	102 OF 120 1 OF 31	5.23.12 9.02.01	All stairs of over ground portion of transfer houses & crusher house shall be of steel (minimum 1200 mm wide) and maximum rise should not be more than 180 mm and <u>minimum tread width 250 mm.</u> All stairs shall have a maximum riser height of 180mm and a <u>minimum tread width of 275 mm.</u>	The said clauses are contradictory. Bidder shall consider minimum tread width 250. Kindly confirm the same.	Bidder to refer Amendment no. D1-17
788	Section-VI/Part-B		6 of 101	4.1.7	Pavement of minimum <u>8 m width, all along the Ground conveyor</u> shall be provided. For single stream conveyor, <u>width of the pavement may be 4 m minimum.</u>	Bidder understands that - 1. For Double Stream conveyor <u>4m wide paving shall be provided on each side.</u> 2. For single stream conveyor <u>2m wide paving shall be provided on each side.</u> Kindly confirm bidder understanding.	Bidder's understanding is correct.
789	Section-VI/Part-B	D-1-9	6 OF 31 1 OF 31 98 OF 120	9.07.02 9.02.01 5.23.04	For initial height <u>up to 1 metre in buildings one brick thick masonry wall shall be provided</u> wherever metal cladding is specified. All buildings having <u>metal cladding shall be provided with 1M high brick wall</u> at ground floor level. <u>The lower portion of side cladding, at ground, for a minimum height of 0.9 m above the finished floor level</u> shall be one brick thick wall plastered on both side. Grade slab with brick cladding of 0.9 m height, plastered on both sides shall be provided for all transfer houses	The said clauses are contradictory. Bidder shall consider minimum height of 0.9 metre single brick thick masonry wall in buildings wherever metal cladding is specified. Kindly confirm the same.	Clause 5.23.04 is specific to CHP, LHP and GHP area
790	Section-VI/Part-B	D-1-5	97 OF 120 Page 1 of 15	5.23.02 1.01.02	At the location where the overhead conveyor gallery crosses road / rail line, <u>minimum clearance of 8.0m above the road crest / rail top</u> shall be provided. PLANT LAYOUT PHILOSOPHY :In case of rail track minimum 3m horizontal clearance between face of adjacent structure to center line of rail and <u>8.5m vertical clearance between bottom of structure to top of rail shall be maintained.</u>	The said clauses are contradictory. Bidder shall consider minimum clearance of 8.0m above the rail top. However 3m horizontal clearance between face of adjacent structure to centreline of rail will be maintained. Kindly confirm the same.	Bidder to refer Ammendment no. D1-9

Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
791	Section-VI/Part-B	D-1-9	13 OF 31 97 OF 120 98 OF 120	9.11.01 5.23.02 5.23.04	For Mill Bunker Building, transfer points, crusher house, <u>conveyor gallery, steel louvered windows shall be provided.</u> <u>Overhead / Ground Conveyor Galleries and Trestles : Windows shall be provided with wire mesh</u> as specified elsewhere in this specification. Transfer Houses : Adequate steel doors and windows for proper natural lighting and ventilation shall be provided.	Bidder proposes the following - For mill building, Transfer points and crusher house steel louvered windows shall be provided. For conveyor galleries windows shall be provided with wire mesh. Kindly confirm the same.	Bidder to comply the Specification Requirements
792	Section-VI/Part-B	D-1-6	1 OF 24	6.01.03 5.23.04 5.23.05	All the buildings shall have framed super structure. If the superstructure of building is a steel structure, the framed superstructure shall be moment resisting sway frame in the lateral direction and axially braced in the orthogonal direction.	Bidder understands that vertical bracings shall be provided on four sides along the periphery in Transfer Points & Crusher House. Being a braced frame in both directions, moment resisting sway frame is not required. Kindly confirm bidder understanding.	Bidder's understanding is correct.
793	Section-VI/Part-B	D-1-6	11 OF 24	6.03.08.20	2.0m wide walkway with concrete paving shall be provided connecting all structures, buildings and facilities. The top of walkway shall be minimum 200mm above FGL.	All buildings/structures/facilities within the coal handling plant are interconnected with road network. To access each buildings/structures/facilities approach road will be provided from main road. In this connection separate 2.0m wide concrete paving will not be required. Kindly confirm.	Bidder's understanding is correct.
794	Section-VI/Part-B	D-1-5	106 OF 120 14 OF 24	5.23.20.2 6.03.11 (f)	Mild steel flats/angles of suitable size shall be welded to the bottom portion of chequered plates at a designed spacing to stiffen chequered plates to restrict deflection within span/200. Permissible deflection for all purlins, cladding runners, roofing/cladding sheets and grating / chequered plates shall be span/250.	The said clauses are contradictory. Bidder shall consider permissible deflection limit span/200 for chequered plates. Kindly confirm the same.	Cl 5.23.20.2 is specific to CHP, LHP and GHP.
795	Section-VI/Part-B	D-1-6	9 OF 24 102 OF 120	6.03.08 5.23.12	For all underground structures like wagon tippler , tunnels and underground transfer points crack width shall be restricted to 0.2 mm. Stairs of MCC/control room, wagon tipplers/track hopper and underground TP's shall be of RCC construction.	Bidder understands that Wagon Tippler is excluded from EPC scope of work. Bidder request Owner to delete Wagon Tippler structure from tender specification.	Refer ammendment no. D1-12

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
796	SECTION –VI, PART-B	SUB SECTION B-06 LT SWITCHGEAR S & LT BUSDUCTS	2.15.00	8 of 18	Dry type / 100 KVA(Welding TRF),	The referred clause is not legible. Owner may please provide the details which is not readable.	Please refer amendment no B-9
797	SECTION – VI, PART-B Section-VII-Book 2 of 3 Price Bid	SUB-SECTION-B-17 SWITCHYARD PRICE SCHEDULE-8A AND SCHEDULE-8B Sr.no.2	1.06.02 a) Sr.no.2	5 of 60 -	TYPE TEST REQUIREMENTS FOR GIS & 400KV AIS CIRCUIT BREAKER: The Contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Bidder shall indicate the charges for each of these type tests separately in the relevant schedule of BPS and the same shall be considered for the evaluation of bids. The type test charges shall be paid as per the charges quoted for each of these type tests separately in the relevant schedule of BPS (Bid Proposal Sheet) & no qty variation is allowed. only for the test(s) conducted successfully under the contract and upon certification by the Employer's engineer. GAS INSULATED SUBSTATION (A) The following type test on typical 400kV (As applicable) GIS bay module as per IEC 62271-203. The components forming parts of the GIS which are covered by other standards shall comply with and shall be type tested according to those standards.	The Gas Insulated Substation is already type tested based on IEC guidelines. Since the type testing of GIS consumes lot of time and the type testing charges are extremely high, bidder propose to accept the type test certificate and not to repeat type test for GIS. Accordingly, bidder request Owner to delete the requirement of quoting type testing charges at Sr.no.2 of Schedule-8A and 8B of Bid Price Schedules.	Bidder to comply the clause no: 1.06.02(a) and bidder to quote the type test charges as per schedule-8A and 8B of price schedules.
798	SECTION – VI, PART-E TENDER DRAWINGS	-	DWG. NO. 4540-001-POC A-011, REV.A	1	Dimensions of Electrical Building and rooms are indicated	Bidder understand that Electrical building and room dimensions shown in referred drawing are indicative only and same shall be provided as per actual requirement.	Bidder's understanding is correct
799	SECTION – VI, PART-A SECTION – VI, PART-B	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS SUB-SECTION-B-17 SWITCHYARD	1.16.05 (iii) 19.03.05	10 of 17 44 of 60	At locations of canal crossing, road crossing, submergence area, low corridor width etc., Cable is to be used. Minimum cable size is 19/33kV, 1c 150sqmm 4KA conductor/screen fault current. One Spare core shall be provided for each line wherever cable is used. Tower Spotting c) Road Crossing: d) Railways Crossings:... .. e) River Crossings:... .. f) Power Line Crossing: g) Telecommunication Line Crossing:... ..	The referred clause 1.16.05 (iii) specifies various crossing by cable whereas clause 19.03.05 specifies various crossing by overhead conductors. Bidder understands that bidder shall choose either Cable or overhead conductor as per site specific feasibility while crossing canal/road/rail/river/submergence area/power lines/telecommunication lines etc. Owner may please confirm bidder's understanding.	Bidder's understanding is not correct. Bidder to comply the clause 1.16.05(iii) & 1.16.05(iv) for canal crossing, road crossing, submergence area, low corridor width etc . For river crossings / power line crossings/telecommunication line crossings bidder to comply the clause no: 19.03.05.
800	SECTION – VI, PART-B	SUB-SECTION-G-03 LAYOUT PHILOSOPHY	1.02.00	5 of 15	Bidder as a safety requirement shall provide Fire wall on A-row of TG building in front of power transformers as per the statutory and safety requirements.	Bidder understand that, If the power transformers are separated from A-row more then required distance indicated in Section-VI, Part-B, Subsection-B10, clause 9.00.00, then fire wall is not required at A-row. Owner may please confirm bidder's understanding.	Bidder's understanding is incorrect. fire wall shall be provided on A-row as per clause no 1.02.00 of sub-section G-03 Layout philosophy.

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
801	SECTION – VI, PART-B,	SUB-SECTION-IIIC-19 ROBOTICS BASED CLEANING OF CABLE TRAYS	1.00.00	1 of 2	Robotics Based Cleaning of Cable Trays Intent of the Specification: The specification intends to identify and procure an automatic solution based on Autonomous robotics for inspection and cleaning of cable trays.	Detailed technical specification for "Robotics Based Cleaning of Cable Trays" is not available in tender. Further, we have checked with manufacturer for present installation of any such system in thermal power plant, however we could not find any such references. Hence, bidder proposed to exclude scope related to "Robotics Based Cleaning of Cable Trays".	Presently this item may be considered as deleted from the scope. However, owner may like to get this item supplied and commissioned at a later date. Accordingly, bidder to indicate the price of this item as an optional item in schedule 12 of the bid.
			4.00.00 (ii)	1 of 2	The centralized master control system shall be designed and engineered by the contractor meeting the complete project requirements and will be finalized during detailed engineering .		
			4.00.00 (v)	1 of 2	Type of robotic solution may vary considering the location and length of the cable trays and the same is to be assessed by the contractor during detailed engineering . For other arm configurations sufficient justification shall be provided by the vendor during detailed engineering .		
			4.00.00 (x)	1 of 2	Suitable robot end-effectors shall be provided for various types of mechanical and compressed air based cleaning jobs to be decided during detailed engineering .		
			4.00.00 (xi)	1 of 2			

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
802	TECHNICAL SPECIFICATION SECTION-VI, PART B	A-07, STEAM TURBINE AND AUXILIARIES SYSTEM	15 OF 25	6.05.09	Operational Requirement (b) During low unit load conditions, turbine bypass operation, shutdown operation when extraction pressure of the normal motive steam source is insufficient to operate the drive turbine, steam from alternate source, from the same unit i.e. CRH, shall be admitted through a separate set of stop and control valves. Both sets of control valve to be controlled by electro hydraulic governing system . Bidder can offer single admission turbine with an external control valve (to be operated from the governing system).	Control Valve will be either electrohydraulic or pneumatic type as per OEM standard practice. Please confirm acceptance.	The requirement of EHC based control system is based on operating experience and requirement of quick response. Bidder proposal is not accepted and bidder to comply the specifications requirement.
803	TECHNICAL SPECIFICATION SECTION-VI, PART A	SUB-SECTION-VI MANDATORY SPARES	-	-	MANDATORY SPARES	Mandatory spares which are duplicated at different clauses in Mech/Elec/C&I sections, Bidder will consider the spare as per the section where higher qty is specified. Other sections shall be ignored for the same spares. Please confirm acceptance.	Bidder's understanding is not correct. Bidder is requested to supply the mandatory spares as specified.
804	TECHNICAL SPECIFICATION SECTION-VI, PART A	SUB-SECTION-VI CHAPTER-02 STEAM TURBINE GENERATOR	1 to 31	-	MANDATORY SPARES - STEAM TURBINE GENERATOR	Please refer our comments on the Mandatory spares related to Steam turbine generator package as an Annexure-1. Request your acceptance for the same.	Bidder to refer NTPC reply as per referred Annexure.
805	SECTION-VI, PART A	IV, FUNCTIONAL GUARANTEES	2 of 73	1.00.01, i), 1	For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conductance of Performance test, the test results shall be calculated automatically by the server/software provided by the contractor. The correction curves shall be fed/inbuilt in the PG test program/software. Provision of manual entry of offline data which cannot be captured online (such as Relative humidity, Atmospheric pressure etc.) and necessary for calculation of PG Test result shall also be provided	Bidder clarifies that there is no such software/server provided for online computation of test results. PG test shall be performed by using special test instruments required for PG test and shall be separate from the process instruments. After conductance of the test, dataloggers shall be used to retrieve the data and the same shall be used for performance evaluations. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply with specification requirements

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
806	SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	44 OF 114	26.02.00 b)	The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.	Bidder requests NTPC to specify the load at which plant will run during 'Initial Operation' except 72 hours of full load operation.	The requirement of NTPC during the period of initial operation to operate continuously at full load for a period not less than 72 hours. The load except 72 hours of full load operation will depend on bidders readiness, Technical constraints and other conditions at that time.

ANNEXURE-1_ STG MANDATORY SPARES

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	MANDATORY SPARES			
	LIST OF MANDATORY SPARES GROUP-A: MANDATORY SPARES			
A	GROUP-A: MANDATORY SPARES			
S.No.	ITEM DESCRIPTION	QUANTITY	Comments	NTPC's Clarification
807	Complete HPT module -Includes inner bladed casing and bladed rotor including all internals in assembled condition and fitted in outer casing along with inlet pipe Breach nuts (if applicable).	1 No.	Inner & outer casing of HPT is not required and not recommended, hence Only HP Rotor complete assembly has been offered against this clause.	Bidder to comply specification requirement.
	Or			
	If design is such that stationery blades is provided in diaphragms, then full set of bladed diaphragms/ carriers and nozzle along with mounting arrangement (as applicable) for all stages of HP turbine, bladed HP Rotor, inner and outer casing with applicable sealing, diaphragm packing's, stationary gland seals, pipes/casing sealing rings along with casing fasteners for complete HP turbine assembly.	1 No		
808	Complete IPT module-Includes inner bladed casing and bladed rotor including all internals in assembled condition, along with full set of both ends of stationery gland seal segments (Finned).	1No	Inner & outer casing of IPT is not required and not recommended, hence Only IP Rotor complete assembly has been offered	Bidder to comply specification requirement.
	Or			
	If design is such that stationery blades is provided in diaphragms, then full set of bladed diaphragms/ carriers and nozzle along with mounting arrangement (as applicable) for all stages of IP turbine, bladed IP Rotor, inner and outer casing with applicable sealing, diaphragm packing's, stationary gland seals, pipes/casing sealing rings along with casing fasteners for complete IP turbine assembly.	1No		

ANNEXURE-1_ STG MANDATORY SPARES

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	MANDATORY SPARES			
	LIST OF MANDATORY SPARES GROUP-A: MANDATORY SPARES			
A	GROUP-A: MANDATORY SPARES			
S.No.	ITEM DESCRIPTION	QUANTITY	Comments	NTPC's Clarification
809	LP turbine rotor last two stage moving blades along with fastening material (Clamping pieces, Rivets, snubbers ,sleeves, springs, locking strips, locking pins etc. whichever are applicable) Note: a) If configuration has one LP Rotor, two sets for each stage of last two stage moving blades of both side flow is required (Total=8 sets) b) If configuration has two LP Rotors (Identical or non-identical) then one set for each stage of last two stage moving blades of both side flow is required (Total=8 sets)	Please see note in the description	As in both LP1 & LP2 rotor, Last two stages blades are identical, hence one set of one LP rotor each stage of last two stage moving blades of both side flow shall be supplied and offered.	It is clearly indicated in item description that If configuration has two LP Rotors (Identical or non-identical) then one set for each stage of last two stage moving blades of both side flow is required (Total=8 sets). Bidder to comply specification requirement.
810	Aux oil pump/startup oil complete assembly for Main Turbine along with complete coupling (Mounted on oil tank)	1 No.	Not applicable in our design,hence no spare offered against this clause	Bidder to offer one number motor driven oil pump complete assembly for Main Turbine along with complete coupling.Bidder to also refer General note 3 in page-30 of 31 of Part-A/Sub-Section-VI, Chapter-02/Section-VI regarding not applicable item.
811	Main oil pump complete assy (Turbine shaft Driven). (If turbine driven MOP is not there then no requirement).	1 No.	Turbine shaft Driven Pump is not applicable in our design,hence no spare offered against this clause	It is clearly mentioned in the specification that the referred line item is to be supplied if bidder offer design envisages turbine shaft driven main oil pump.
	Generator & Auxiliaries			
	Seal Oil System			
02.3.22	Vacuum pump assembly (If applicable)	1 set	Not applicable in our design,hence no spare offered against this clause.	Bidder to refer General note 3 in page-30 of 31 of Part-A/Sub-Section-VI, Chapter-02/Section-VI in this regard.
	Group-B: Mandatory Spares:			
	TG Items			
813	Electro-hydraulic convertor assembly of Main turbine Governing system	One no of each type	Servo valve is applicable & the same has been offered against this clause.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder

Clarifications No. 01 to Technical Specifications Section-VI

ANNEXURE-1_ STG MANDATORY SPARES

ANNEXURE-1_ STG MANDATORY SPARES				
	MANDATORY SPARES			
	LIST OF MANDATORY SPARES GROUP-A: MANDATORY SPARES			
A	GROUP-A: MANDATORY SPARES			
S.No.	ITEM DESCRIPTION	QUANTITY	Comments	NTPC's Clarification
	Generator & Auxiliaries			
814	Exciter bearings / slip ring stabilizer (as applicable) including oil guard (complete with torous, intermediate pieces and all other fixing/assembly/ insulating material required to complete one TG unit except housing)	1 Set	Since static excitation system has been offered, refered spares are not applicable in our design, hence no spare offered agaistn this clause	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder
815	Motors			
i)	AC AOP motor for main turbine	1 No	AOP is not applicable in our design, hence no spare offered against this clause.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder
	Group C: Mandatory Spares			
816	MAIN TURBINE			
xx.)	Basket strainer/ Filter for Lube oil / Control Fluid system in tank - if applicable	1 set (Requirement for one Unit)	For MOT applicable, hence the same will be offered against this clause.	Bidder to refer General note 3 in page-30 of 31 of Part-A/Sub-Section-VI, Chapter-02/Section-VI in this regard.
817	Blade Vibration monitoring system (if applicable):		As per OEM design free standing blades have not been envisaged accordingly Blade Vibration monitoring system is not applicable to our design	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be offered and supplied by the bidder. However, in case these items are found applicable at a later date, these shall be supplied by Bidder at no extra cost to the owner.
	Description of items	Unit of items	Quantity	
i	Sensors	No.	20 % of full set or minimum 2, whichever is more	Not applicable in our design, hecne no spare offered against this clause.
ii	Brackets, Fixtures	No.	20 % of full set or minimum 2, whichever is more	Not applicable in our design, hecne no spare offered against this clause.
iii	Internal cabling	Length, M	20 % of full set or minimum 1 run of each type, corresponding to maximum <u>length</u> used in the <u>system</u> .	Not applicable in our design, hecne no spare offered against this clause.

ANNEXURE-1_ STG MANDATORY SPARES

ANNEXURE-1_ STG MANDATORY SPARES					
	MANDATORY SPARES				
	LIST OF MANDATORY SPARES GROUP-A: MANDATORY SPARES				
A	GROUP-A: MANDATORY SPARES				
S.No.	ITEM DESCRIPTION		QUANTITY	Comments	NTPC's Clarification
iv	External cabling	Length, M	20 % of full set or minimum 1 run of each type, corresponding to maximum <u>length</u> used in the <u>system</u> .	Not applicable in our design, hence no spare offered against this clause.	
v	Special conduits/ vacuum pass through or equivalent	Length, M	20 % of full set or minimum 1 run of each type, corresponding to maximum length used in the system.	Not applicable in our design, hence no spare offered against this clause.	
vi	Input card	No.	10 % of full set or 1 number, whichever is more	Not applicable in our design, hence no spare offered against this clause.	
vii	Output card	No.	10 % of full set or 1 number, whichever is more	Not applicable in our design, hence no spare offered against this clause.	
	Full set means, Quantity corresponding to Integrated system for L-0 stage and L-1 stage (Turbine and Generator end)			Not applicable in our design, hence no spare offered against this clause.	
818	Generator & Auxiliaries				
c)	Hydrogen seals rings TE, EE		1 Set each	Already covered in above clause 4 of IX. Generator & Auxiliaries, Hence no spare has been offered against this clause.	Bidder's understanding is not correct. Bidder has to supply all the specified mandatory spares
e)	Brush- holder assembly for shaft earthing		1 set	Already covered in above clause 6 of IX. Generator & Auxiliaries, Hence no spare has been offered against this clause.	Bidder's understanding is not correct. Bidder has to supply all the specified mandatory spares

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
819	Dwg no. 4540-001-POM-A-025 Sec-VI, Part-A,	' Sub Section-IIA-16	4 of 18	-	2W+1S eco pumps are shown common for two units. Two (2) numbers (1 working + 1 standby) economizer ash water pumps along with valves, pipes & fittings for both the units.	There is contradiction for number of Eco pumps in specification and flow diagrams as mentioned beside. Bidder understand total three (2W+1S) Eco pumps for both units shall be provided. Kindly confirm Bidder's understanding.	Confirmed. Bidder to refer Amendment of the clause. Amendment No: A-MH-22
820	Dwg no. 4540-001-POM-A-027 Sec-VI, Part-B, Sec-VI, Part-B,	- Sub Section-A-21 Sub Section-A-01	- 25 of 40 81 of 101	- 3.06.00 3.14.02.01	As per flow diagram, Two nos. (1W + 1S) IA compressors are shown for each unit for complete air requirement of ash handling system. Instrument air compressors and air drying plant (if applicable) 5. For each Unit of Ash handling system, Silo Utility & its auxiliaries (Continuous) : E 5. Instrument air requirement for 1 unit (Z) = [1.3x1.1x(A+B+C+D+E)] NM3/min	Due to the contradiction in the specification for the instrument air compressor of ash handling system. Bidder understand that Two nos. (1W + 1S) IA compressors for each unit dedicated to ash handling system shall be provided and same shall not be considered in plant instrument air compressor sizing. Kindly confirm Bidder's understanding.	Instrument air requirement for Ash Handling system shall be catered from Unit air receiver for Ash handling as specified in Sub-section-IIA-16, Part-A. Bidder to refer revised Single line diagram for Ash Handling system.
821	Dwg no. 4540-001-POM-A-027 Sec-VI, Part-A,	Dwg no. 4540-001-POM-A-027 Sub Section-IIA-16	- 6 of 18 9 of 18	- 1.01.06 1.01.07 f h)	intermediate FA silos are not shown in AHP flow diagram. Dry Fly Ash Conveying System Three (3) nos. (two working + one standby) fly ash storage structural steel intermediate silos of 250 MT effective storage capacity each , for switching to ash slurry (for subsequent disposal) and complete with an aeration system, dust separators, manual hoist over silo top for handling and all other accessories as required and as specified. The silos shall be complete with all fittings, accessories and supporting steel structures, access staircases, platforms, as required for safe and reliable operation and maintenance. Four (04) numbers (two working + two standby) Feeder ejector below each intermediate Silo with expansion joints, vertical pipe connections, cylinder operated valve, slurry discharge piping up to slurry sump, and necessary fixing clamps, and structural steel as required.	Owner to note that various options for dry fly ash conveying system are specified in the Cl. No. 1.01.06 of Sec-VI, Part-A, Sub Section-IIA-16, Where in any option Intermediate FA silo provision is not specified whereas same is shown in flow diagram of pressure conveying as well mentioned in the scope of supply. In this regard, Bidder understands that intermediate FA silos are only applicable for pressure conveying system. Kindly confirm.	Confirmed.
822	Sec-VI, Part-B, Sub Section-A-21	Sub Section-A-21	30 of 40	5.01.00 4)	Conditioning Water pumps: (i) 1 Working for both BA IM silo + 1 Common standby. (ii) 2 Working common for both main HCSD (if applicable) cum storage silo and Main Bottom ash silo + 1 Common standby	BA IM silo, Main BA silo and HCSD silo are not envisaged in this project. Hence, Bidder understands that these conditioner water pumps is not applicable. Kindly confirm Bidder's understanding.	Ash conditioner water pumps shall be applicable for FA Main storage Silos as specified elsewhere.

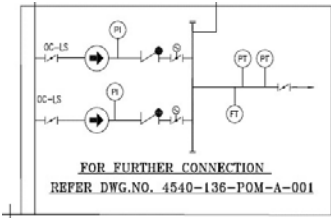
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
823	Sec-VI, Part-B, Sub Section-A-21	Sub Section-A-21	22 of 40	3.02.00	II Air pipes, Type of pipe: ERW pipe as per IS:1239, heavy grade with galvanising as per IS: 4736...	Bidder understands that galvanizing pipe shall be applicable for instrument air piping only. However, galvanizing is not envisaged for conveying air, fluidizing air line etc. Kindly confirm Bidder's understanding.	Bidder to comply stipulation of Technical Specification.
824	Sec-VI, Part-B, Sub Section-A-01	Sub Section-A-01	89 of 101	4.01.22 (M) (II)	Static lift to be considered for Pontoon/Barge mounted Pumps- 30 meters Static lift to be considered for Ash Slurry Pump - 80 meters	Static Lift for pontoon/Barge mounted and ash slurry Pumps seems to be on higher Side. Owner is requested to further check and confirm.	Bidder to comply stipulation of Technical Specification.
825	SECTION – VI, PART-A	SUB-SECTION-IIA-16	10 of 18	1.01.07	Bidder may further optimize and convey dry Fly Ash up to Intermediate Silo or main Storage silo or classifier block directly from ESP Hopper by Pressure conveying system in single stage.	For the single stage conveying system, Owner is requested to provide the technical specification and flow diagram indicating various equipments like as piping, ash vessels, buffer hoppers, jet pumps, fluidizing blowers, compressors etc. However, the tentative scheme of single stage pressure conveying is enclosed herewith. Owner is requested to issue this scheme with amendment to keep all Bidders at par.	Bidder to refer Scheme for single stage pressure conveying system, issued as amendment.
826	SECTION – VI, PART-A	SUB-SECTION-IIA-16	10 of 18	1.01.07	Bidder may further optimize and convey dry Fly Ash up to Intermediate Silo or main Storage silo or classifier block directly from ESP Hopper by Pressure conveying system in single stage.	For single stage conveying system, Bidder proposes jet pumps/feeder ejector below each main fly ash silos for disposing fly ash slurry to combined ash slurry sump for further disposal to mine voids as an alternative to fly ash slurry preparation via intermediate silos. In such case, there shall not be any intermediate silo and associated system. Please confirm acceptance.	Jet pump/feeder below main FA Silos shall not be allowed. Bidder to comply stipulation of Technical specification.
827	Dwg No. 4540-001-POM-A-025, SECTION – VI, PART-A, SECTION – VI, PART-Part-B,	- Sub Section-IIA-16 Section-A-21	- 12 of 18 12 of 18 40 of 40	- 1.02.00, iv 1.02.02.02 9.02.00, 1)	Overgrond ash water tank Overflow transfer pipes to transfer clear water from surge tank to over ground water sump of ash water pump house, by gravity flow. For the purpose of water supply to the ash handling system, water pumps taking suction from over-ground RCC sump shall be installed in the ash water pump house. Water supply to ash water pump house shall be tapped from following sources BA overflow transfer hopper / tank level measurement, Seal water tank level measurement, Silo level measurement, over ground water tank.....	Ash water sump location based on layout feasibility (i.e. semi over ground or above ground) as the clarified ash water from settling tank to surge tank and from surge tank to ash water sump shall be transferred by gravity. Hence, Bidder understands that ash water sump shall be semi overground. Kindly confirm Bidder's understanding.	Bidder to comply stipulation of Technical Specification.
828	Dwg No. 4540-001-POM-A-030	-	--	--	As per Y-Y section ash slurry piping and ash water recovery pipe indicated	Owner to note that steel structure shall be designed for ash slurry pipes and ash water recovery pipes and no other load shall be considered for the design of steel structure. Request Owner to confirm.	Confirmed.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
829	Dwg No. 4540-999-POC-F-001	-	-	-	GLP shows "Pump house (Typ), BA slurry TPT".	Request Owner to clarify the purpose of "Pump house (Typ), BA slurry TPT" as shown in furnace area of GLP.	Bidder to refer Amendment No D1-34
830	Section - VI, Part-E	-		4540-999-POC-F-001	General Layout Plan: Location of FA silo	As per silo location shown in GLP, there is only 320 m of outhaul length is available which is sufficient to accommodate half rack. Bidder understands that the same is acceptable to NTPC. Kindly confirm.	Confirmed.
831	Section - VI, Part-E	-		4540-999-POC-F-001	General Layout Plan: Location of FA silo	As per plot plan, there is a space restriction to shift ash silos and to accommodate the associated facilities i.e truck loading, ash bagging system, silo utility building, hence, Bidder understands that silo location shown in GLP is fixed for design of Ash Handling System. Kindly confirm.	Silo location shown in GLP is indicative, may be finalized during detail engineering based on the final Railway layout and location of other associated facilities.
832	Sec-VI, Part-A, Dwg No. 4540-001-POM-A-025	Sub Section-IIA-16 -	5 of 18	1.01.05 C (viii)	In case of intermittent type bottom ash handling system, two lengths of APH and duct hopper ash slurry transportation MS pipelines with basalt lining (One no. independent pipe line for each intermediate ash slurry tank) complete with basalt lined pipe bends, fixtures, elbows, gaskets, nuts, bolts, structural steel supports and other accessories as specified and as required, from the outlet of Coarse ash slurry transportation pumps to the main Ash Slurry Sump. Necessary fittings, valves etc. shall be provided as specified and as required. Individual pipes from coarse ash pump is indicated in the flow diagram.	There is mismatch in the specification and flow diagram regarding the pipe quantity from coarse slurry pumps to main ash slurry pump. In this regard, Bidder understands that there shall be One no. independent pipe line from each intermediate coarse ash slurry tank to main ash slurry sump. Kindly confirm Bidder's understanding.	Confirmed.
833	Sec-VI, Part-A, Sec-VI, Part-B, Dwg No. 4540-001-POM-A-025	Sub Section-IIA-16 Sub Section-A-21 -	13 of 18	1.02.01.02 € 5.01.00	The water requirement for disposal of fly ash in slurry form shall be met by one (1) number working and one (1) number standby fly ash water pumps. FAHP Water pump: 2 working + 1 standby Total three (2W + 1S) Fly ash water pump indicated in flow diagram.	There is mismatch in the specification and flow diagram regarding the fly ash water pumps. In this regard Bidder understands that total three (2W+1S) pump shall be provided for both the units. Kindly confirm Bidder's understanding.	Confirmed. Bidder to refer Amendment of the clause. Amendment No: A-MH-23
834	Sec-VI, Part-A, Dwg No. 4540-001-POM-A-028	Sub Section-IIA-16 -	6 of 18	1.01.06 (A) (a) (iv)	Six (6) nos. fly ash surge-cum-collection buffer hoppers (3 working + 3 Standby) complete with structural steel structures, platforms, stairs, aeration system, primary collector and secondary collector (if applicable) along with bag filter, target box etc for each unit. As per the Tender Flow diagram, there are 06 Nos. FA Conveying Pipeline/ Unit and terminated to independent FA Surge cum-Collection Buffer Hoppers	In absence of clarity between specification & flow diagram, Bidder understands that total six (6) numbers (all working) fly ash surge-cum-collection buffer hoppers shall be provided for each unit. Kindly confirm Bidder's understanding.	In this context, Bidder to refer amendment of clause & respective tender drws. Amendment No: A-MH-24
835	Sec-VI, Part-A,	Sub Section-IIA-16	15 of 18	1.04.13	The bagging plant shall be sized for 50 % of the fine ash (Classified fine ash). The bagging plant shall have provision for mechanized bagging of this fine ash. Fine ash shall be bagged in 50 kg cement bags. The quantity of fine ash shall be 35 kg in cement bag of 50 kg. Suitable numbers of such bagging streams shall be provided. No standby stream shall be required	Owner to note that the quantity of Fly Ash in these bags (i.e. 50 kg cement bags) will be approx. 30-35 Kg depending upon the bulk density). Kindly confirm.	Confirmed.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
836	Sec-VI, Part-A,	Sub Section-IIA-16	15 of 18	1.04.14	The bags shall be stored in suitable closed storage area having a provision to store bags filled in 8 hours. Mechanized transportation of fly ash bags from bagging machine up to the storage shed and from bagging machine to load into Truck directly. Adjustment to load bags in all types of Trucks shall be provided.	Owner is requested to provide the detail & Type of mechanized transportation system of fly ash bags from bagging machine up to the storage shed and from bagging machine to load into Truck.	Bidder to provide suitable conveying system along with associated arrangement so that ash filled bags shall be shifted from Bagging machines up to the Bagging shed and loads into the open Truck directly without any manual intervention.
837	Sec-VI, Part-B, Sec-VI, Part-B,	Sub Section-A-21 Sub Section-A-01		1.01.00 i) 4.01.04 Annexure-I	i) Temp. of bottom ash for calculating cooling water requirements : 1050 ⁰ C temperature of bottom ash in hopper =1050 ⁰ C (1922 ⁰ F)	Owner is requested to allow Bidder to consider bottom ash temperature as per boiler OEM recommendation for BA overflow cooling water pump capacity selection. However, MOC of BA hopper refractory shall be selected considering 1050 Deg C temperature as specified. Kindly confirm.	Confirmed.
838	Sec-VI, Part-B,	Sub Section-A-21	20 of 40 36 of 40	3.01.00 7.12.00 F)	DATA SHEET: HOISTS AND MONORAILS (AS APPLICABLE) To handle (i) vacuum pumps, buffer hopper aeration blowers and its drives located near the first row column of ESP of each unit. iii) Monorails and hoists for vacuum pumps (if applicable) and Buffer hopper aeration blowers and its drives shall be located near first row of ESP.	Owner to note that vacuum pumps, buffer hopper aeration blower are located in open, hence, Bidder understands that Hoist is not required for the same. Kindly confirm Bidder's understanding.	Hoist shall not be required but proper access/approach for movable Crane (Hydra etc) up to the equipment shall be ensured.
839	Sec-VI, Part-B, Dwg No. 4540-001-POM-A-027 & 028	Sub Section-A-21	27 of 40	3.08.00	Dry Ash unloader, Conditioned Ash unloader, Telescopic chute: Capacity range : 40-100 TPH during open Truck/Bulker loading through Condition ash unloader / Dry Ash unloader 40-300 TPH for Rail Wagon Loading through Dry Ash unloader Single Unloader is shown in flow diagram for dry ash unloading in to rail/Truck.	Owner to note that being a single unloader for rail/ truck, Capacity range shall be decided by OEM during detail engineering based on their proven practice. Kindly Confirm.	Capacity range (i.e. lower limit) may be decided during detail engineering but bidder to comply rated capacity (i.e. upper limit) as specified.
840	Sec-VI, Part-B,	Sub Section-A-01	86 of 101	4.01.02 (A)	Duct Hopper Ash 5%	Owner to note that this duct hopper shall be considered as per Boiler OEM design, if applicable. Kindly confirm.	Confirmed.
841	Sec-VI, Part-B,	Sub Section-A-01	87 of 101	4.01.02 (E)	Bottom ash Overflow water The overflow water from shall be pumped to minimum one (1) number settling tanks and one (1) no. surge tank, by BA overflow water pumps. The diameter and thickness of mild steel settling tanks shall be minimum 15 meters and 10 mm respectively. recycled to ash water pump house where the ash water pumps are proposed to be located.	Owner to note that diameter of settling tank and surge tank shall be decided by AHP OEM in line with tender specification based on their proven design. Kindly confirm.	Confirmed.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
842	Sec-VI, Part-B,	Sub Section-A-01	89 of 101	4.01.02 (K) 3.	The fly ash storage silos shall be at a pitching suitable for filling of ash into BTAP and DCFC wagons.	Owner is requested to provide the sketch / GA drawing with dimensions of ash loading point, total length, height etc. of the wagon, which needs to be followed for the finalization of silo pitching.	Provisions shall be made so that simultaneous loading into BTAP or BCFC or BCCW type Wagon could take place. Necessary space provisions in the layout or equipment for this area are in the scope of the successful bidder. Bidder may collect Sketch/GA drw of Wagons easily available in Railway catalogue.
843	Sec-VI, Part-A, Dwg No. 4540-001-POM-A-029	Sub Section-IIA-16 -	14 of 18 ---	1.04.02 ---	Suitable numbers of ash classifier as required shall be provided to meet the requirement as specified. Classifier 1 no./ Unit	Bidder understands that total two no. (both Working) classifier along with accessories for both the units shall be in Bidder's scope. Kindly confirm Bidder's understanding.	Confirmed.
844	Dwg No. 4540-001-POM-A-031,	-	-	-	MOV shown in ash water recirculation line near to ash water sump (plant area)	Being single disposal point near to ash water sump, MOV at ash water recirculation line at discharge point is not envisaged. Request Owner to revisit and accept manual operated butterfly valve at discharge point of ash water recirculation pipe.	Bidder may provide manual operated butterfly valve.
845	Dwg No. 4540-999-POC-F-001	-	-	-	Ash classification & Additional area required for ash utilization facilities	Owner to note that additional area for ash utilization facilities as shown in the GLP can be compromised for ash classification during detail engineering. Kindly confirm.	Confirmed.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
846	TECHNICAL SPECIFICATION SECTION – VI, PART-A	SUB SECTION IIA-11 CW SYSTEM	PAGE 1 OF 4	1.01.00	Minimum twenty (20) nos of Automatic air release valves (ARVs) of 200 mm NB (minimum) size along with its isolation valves for CW system. Necessary stub connection in CW duct for mounting ARVs	Bidder understands that number of air release valve shall be decided based on transient analysis only . Owner to confirm.	Bidder shall note that though the number of ARVs shall be decided based on recommendations of transient analysis, the number of ARVs to be installed in CW system shall not be less than 20 nos.
847	TECHNICAL SPECIFICATION SECTION – VI, PART-A TECHNICAL SPECIFICATION SECTION- VI, PART-B	SUB-SECTION – IIA-09 MUW SYSTEM SUB SECTION A-15 CW SYSTEM	PAGE 1 of 3 PAGE 27 of 31 PAGE 3 of 31	1.00.0 4.07.03 4.00.00	1) Forced water lubrication system consisting of two numbers (2 X 100%) of horizontal centrifugal type lubricating water pumps & its drives, pressure sand filter (2 X 100%), air blower (2 X 100%), backwash pumps (2 X 100%), Overhead tank , all associated piping and fittings, valves etc. along with all required accessories to complete the system. 2) Lubricating water pumps shall be provided to supply lubricating water for bearings. These lubricating water pumps shall get supply from the overhead water storage tank . 3) Contractor shall provide the necessary vibration monitoring system. instruments shall be provided as per control philosophy for Circulating water pumps & pump system, however, the instruments like Pressure gauge(s), Temperature gauges, level gauges, RTDs (Pump, motor bearings, motor windings) temperature, Pressure transmitters, Ultrasonic type level transmitters (Pump sump, forebay, Overhead tank, drainage pit (for CV pump), reverse rotation indicator, Electronic flow meter (CW pump, discharge & seal/lub water pumps) shall be provided for each pump/ system as a minimum.	Instead of overhead type tank, location of tank shall be decided by bidder (i.e overground or overhead) during detail engineering based on layout requirements. Owner to confirm.	Bidder's suggestions based on proven design may be considered during detailed engineering.
848	SECTION-VI, PART-B	G-04, Standard PG test proedure	5 of 224	1, VI	CW pumping power in kW for design CW flow and the pressure drop in CW side being measured in terminal points as per specification. (Pumping power shall be computed based on overall efficiency of ---% of CW pump and drive.	CW pumping power is not applicable for this project. Accordingly bidder proposes to delete this clause from standard PG test procedure. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
849	TECHNICAL SPECIFICATION SECTION – VI, PART-A	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA & SUB-SECTION- A-9 (LOW PRESSURE PIPING	2) PAGE 55 of 101 3) PAGE 56 of 101 4) PAGE 1 OF 19	2) CW : 3.01.00 3) NDCT: 3.02.00 4) LP piping: 1.03.00	2) Design velocity not to exceed 2 m/sec 3) Internal Diameter of pipes: To suit the design velocity of maximum 2 m/sec 4) Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following 	CW piping categorized under LP piping. Discrepancy found in the specified tender clauses regarding velocity inside pipes. Owner to clarify which one to follow.	Bidder to follow clause no - 3.11.00 (b), sub section- A-01 , Part -B of technical specification for CW system and NDCT, piping shall be designed inline with equipment sizing criteria clause no- 3.01.00 & 3.02.00 respectively, sub section- A-01, Part-B.

850	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION- A-9 (LOW PRESSURE PIPING)	PAGE 1 OF 19	1.03.00	WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value: (i) Carbon steel pipe : 100 (ii) Ductile Iron.: 140 (iii) Rubber lined steel pipe: 120 (iv) Stainless steel pipe: 100	In WILLIAM & HAZEN formula, C value shall be taken as 140 for SS pipe. Owner to please update.	Bidder's Proposal not acceptable. Bidder to comply the specification requirements.
851	4540-136-POM-A-006 Single line flow & instrumentation diagram of pre-treatment plant					Owner is requested to allow to remove these pumps if gravity flow can be possible between tank to tank transfer. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
852	SECTION-VI / PART-B	/SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A-2 EQUIPMENT SIZING CRITERIA	68 of 101	3.09.00	All liquid effluents shall be collected and treated to meet the latest effluent norms prescribed by SPCB/CPCB. The treated effluents conforming to the prescribed standards only shall be recirculated and reused within the plant and the complete plant shall be designed by the contractor as a Zero Liquid Discharge (ZLD) Plant.	Bidder understands that all liquid effluents shall be collected and treated with Flash mixer/tube settler and lamella clarifier. We do not envisaged any Reverse osmosis (RO) treatment in the ZLD. Please confirm Bidder's understanding.	The bidder shall design the complete Plant as ZLD compliant meeting the technical specification requirement as a minimum. Bidder shall further consider and provide any other system as required for meeting ZLD compliance.
853	SECTION-VI, PART-B / vs Drg No. 4540-001-POM-A-027	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	81 OF 101 vs 01 OF 01	3.14.02.01	5. For each Unit of Ash handling system, Silo Utility & its auxiliaries (Continuous) vs Two (2) Nos. Instrument air compressor (IAC)	Due to the contradiction in the specification for the instrument air compressor of ash handling system. Bidder understand that Two nos. (1W + 1S) IA compressors for each unit dedicated to ash handling system shall be provided and same shall not be considered in plant instrument air compressor sizing. Kindly confirm Bidder's understanding.	Bidder to refer amendment revised Drw. No.issued as amendment No-A-MH-029
854	SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 SECTION- VI, PART - B BID DOC. NO. CS-4540-001A-2 General Requirements	SUB SECTION- G-04 STANDARD PG TEST PROCEDURE SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA SUB SECTION-II-B-02 MOTORS SUBSECTION-B-11 STATION LIGHTING General Requirements	Page 60 of 224 Page 79 of 101 Page 2 of 4 Page 9 of 18 Page 1 of 6	b) 3.13.02 7.02.00 4.00.00, 14. & (x) 1.00.00, 3.	Hydrogen Generation Plant: One third (33%) of power consumption of one stream of hydrogen generation plant. DESIGN PHILOSOPHY – Ventilation System Hydrogen generation plant/MCC/ Switchgear rooms and Battery rooms& other areas where gaseous fumes/ vapours are generated Hydrogen generation: Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034) In the hazardous areas like Hydrogen generation plant, fuel oil handling areas or any other gas/ liquid fuel storage/ handling areas in bidder's scope, lighting shall be flame proof. Hydrogen Plant Building: Explosion proof HPMV/ Fluorescent fittings suitable for class-I and Division –IIC All electrical devices like switches/ transmitters/ controller/ analyzer/ solenoid valves which are located in the hydrogen generation plant shall be made intrinsically safe by providing suitable type of transformer isolated....	Bidder understands that Hydrogen Generation Plant is not envisaged in this tender, hence, the referred clauses are not applicable. Kindly confirm Bidder's understanding.	Bidder's understanding is correct that Hydrogen Generation Plant is not applicable in subject tender.

855	Section VI, Part A,	Sub Section IV, Performance Guarantees & Liquidated damages	1 of 73	1.00.01	The guaranteed performance parameters indicated in furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.	Tolerance of 0.3 deg C in the cold water temperature shall be allowed to take care of instrument inaccuracies with reference to other NTPC executed projects like Tanda, Darlipalli and Lara projects. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
856	Section VI, Part B,	Sub Section A-01, Equipment sizing criteria SUB SECTION A-15 CW SYSTEM	56 of 101 10 OF 31	3.02.00 3.05.00	Quantity of water to be cooled by cooling tower of one unit shall be CW pumps flow/unit + 10 % margin The water distribution system, basin and cold-water discharge channel shall be designed in such a way that it can handle 120% of rated water flow without any overflow in basin	Please note that hydraulic design of the cooling tower is already provided with 20% margin as per cl.no. 3.05.00 of Sub section 15. Hence no additional margin of 10% will be considered in the thermal design of cooling tower & accordingly cooling tower capacity will be same as per rated capacity of CW pump. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
857	Section VI, part B,	sub section D-1-5 Sub-Section – A-15 (Cooling Towers-Mechanical) SUB-SECTION-D-1-5 CIVIL WORKS	64 of 120 PAGE 11 OF 31	5.17.05.07 5.00.00 3.10.06 (d)	The tower shall be provided with two numbers external FRP Staircase,..... Staircase is RCC. The design of staircase, pipe trestle foundation, and peripheral water drain shall be designed as per IS: 456 (2000).	Discrepancy in both tender clauses for staircase. Bidder understands that RCC staircase to be considered as per clause 5.00.00 Constructional Features of Sub-Section – A-15 (Cooling Towers-Mechanical). Owner requested to confirm.	For Cl 5.17.05.07 Bidder to refer amendment no. D1-6 Stair case shall be RCC inline with clause no- 5.00.00 , Sub section-A-15, Part-B.
858	Section VI, part B,	sub section D-1-5	64 of 120	5.17.05.08	A FRP platform of 1500 mm clear width shall be provided around the tower periphery which will be a means of access to next walkways and all end valves...	Since generally peripheral platform is provided from tower shell it will be easier to provide it with RCC than the FRP. Please confirm.	Bidder to refer amendment no. D1-7
859	Section VI, Part A,	Sub Section IV, Performance Guarantees & Liquidated damages	1 of 73	1.00.01	If the cold water temperature is less than or equal to predicted cold water temperature as detailed above the tower is deemed to have met the guarantee.	Since the test will be conducted as per CTI ATC-105, the acceptance criteria shall be the tower capability calculated as given in CTI. If the tower capability is found to be equal to or more than 100% then the tower is acceptable. Please Confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
860	General		-	-	Colour of Fill	The colour of fills shall be black as per bidders consideration. Kindly confirm.	Bidder query is not clear. Bidder to comply technical specification requirement.
861	Section VI, Part B,	Sub sec- A-15, CW system	Page 13 of 31	11.00.00	The maximum drift loss shall be limited to 0.001% of total water in circulation. Contractor shall demonstrate during performance test as per relevant test codes that drift loss is limited to 0.001%.	Kindly confirm whether certification of drift eliminator for drift loss by CTI approved laboratory/ fill supplier is acceptable. Owner requested to confirm.	Bidder's proposal is not acceptable. Bidder to comply technical specification requirements.
862	SECTION – VI, PART-A	SUB-SECTION-I	5 of 8	4.02.00	Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose.	1) To bring fair competition among the Bidders, NTPC has fixed all the guarantees and no evaluation benefit is provided except only for coal and LDO consumption. 2)Coal consumption during commissioning is highly dependent on the factors like quality of coal, shutdown or backing down of unit due to reasons not attributable to EPC Contractor. The quantification of exact requirement of coal is highly uncertain. 3) Owner gets compensated for the "infirm power" supplied to grid after unit is synchronised. 4) As this requirement has asked by Client first-time, Bidder doesn't have any record of coal quantity used in past projects during commissioning stage. In view of the above and to bring parity among the Bidders,NPTC is requested to remove the evaluation and provide coal for pre- commissioning/commissioning activities free of cost till completion of Initial Operation.	Requirements as per Amendment No. G-03 to be complied with.

863	SECTION – VI, PART-A	SUB-SECTION-I	5 of 8	4.02.00	Regarding, coal & fuel oil, the Contractor shall quote the total maximum quantity of the coal and fuel oil as required upto the successful completion of "Initial Operation" (as defined in General Technical Requirements, Part-C, Section-VI of Technical Specification) for both the units which shall be issued to it free of charge by the employer for such operation during execution. These quantities for both coal and fuel oil shall be compared with the respective quantities as quoted by various bidders. The quantities over & above the base value (minimum among the quoted figures for coal & fuel oil) shall be used as a loading factor and corresponding computed price (total for coal & fuel oil) shall be added to the quoted bid price for deriving the total bid price. The cost of coal & fuel oil shall be used as Rs. 2108/Ton (Rupees Two Thousand One Hundred and Eight only per ton of coal) Rs. 40,000/KL (Rupees Forty Thousand per KL of fuel oil) for such purpose.	1) To bring fair competition among the Bidders, NTPC has fixed all the guarantees and no evaluation benefit is provided except only for coal and LDO consumption. 2) Fuel oil (LDO) consumption during commissioning is highly dependent on the factors like quality of coal, shutdown or backing down of unit due to reasons not attributable to EPC Contractor. Thus, the quantification of exact requirement of LDO is highly uncertain. 3) Owner gets compensated for the "infirm power" supplied to grid after unit is synchronised. In view of the above and to bring parity among the Bidders, NTPC is requested to remove the evaluation and provide LDO for pre- commissioning/commissioning activities free of cost till completion of Initial Operation.	Requirements as per Amendment No. G-03 to be complied with.
864	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	7 OF 15	ANNEXURE- IV-1	LIGHT DIESEL OIL CHARACTERISTICS	NTPC is requested to specify LDO density.	Bidder to note that relative density value is approx. 880 Kg / m3 at 15 °C.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
865	SECTION - VI /PART – B	SUB-SECTION-E-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION	PAGE 1 OF 1	-	Various standards referred in this document shall be the latest revisions.	Bidder requests to follow clause 5.02.00 CODES & STANDARDS of GENERAL TECHNICAL REQUIREMENTS which mentions that the latest editions (as applicable as on the date of bid opening), of the codes and standards shall be applicable.	Bidder Understanding is correct.
866	SECTION - VI /PART – B	SUB-SECTION-E-2 ELECTROSTATIC PRECIPITATOR	Page 1 of 1	1.03.00	(ii) For plates of 25mm < thickness < 32mm - 10% RT and 100% MPI. (iv) All fillet welds of structural members shall be inspected 100% by MPI.	(ii) Bidder proposes to carry out RT/UT as same permitted in NDT of Boiler Structure clause no. 1.02.11, c, ii, page 11 of 13 under Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries. Bidder also proposes to perform MPI/PT in lieu of MPI. (iv) proposes to perform MPI/PT in lieu of MPI	II) For RT,Boiler structure specification may be followed. II&IV)For MPI , Bidder to meet the specification requirements. Refer Amendment No : E-QA-01
867	SECTION - VI /PART – B	SUB-SECTION-E-4 FLUE GAS DESULPHURISATION SYSTEM	Page 3 of 5	1.08.03	ii) For plates of 25mm<=thickness<32mm-10% RT and 100% MPI.	(ii) Bidder proposes to carry out RT/UT as same permitted in NDT of Boiler Structure clause no. 1.02.11, c, ii, page 11 of 13 under Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries. Bidder also proposes to perform MPI/PT in lieu of MPI in ii and iv	II) For RT,Boiler structure specification may be followed. II&IV)For MPI , Bidder to meet the specification requirements. Refer Amendment No : E-QA-02
868	SECTION - VI /PART – B	SUB-SECTION –E-05 LP PIPING PACKAGE (MECHANICAL)	2 of 3	Note 1	100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.	Bidder requests to provide option for performing 100% RT/UT/PAUT in lieu of Hydraulic Test	Bidder to meet the specification requirements
869	SECTION - VI /PART – B	SUB-SECTION –E-05 LP PIPING PACKAGE (MECHANICAL)	2 of 3	3	RT / UT by (TOFD/PAUT) Technique	Bidder proposes to include manual UT in addition to RT / UT by (TOFD/PAUT) Technique as an option for NDT	Bidder to meet the specification requirements

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
870	SECTION - VI /PART – B	SUB-SECTION- E-06 POWER CYCLE PIPING	Page 1 of 5	1.01.00	(f) All butt welds in alloy steel piping of P-91, X -20, X-22 & material P15E group & above shall be checked for RT/ UT/PAUT+TOFD & MPI after SR.	(f) All butt welds in alloy steel piping of P-91, X -20, X-22 & material P15E group & above shall be checked for RT/ UT/PAUT/TOFD. Both PAUT as well as ToFD have higher probability of detection as compared to RT & conventional UT. Bidder requests to accept the same.	Bidder to meet the specification requirements
871	SECTION - VI /PART – B	SUB-SECTION- E-06 POWER CYCLE PIPING	3	Page 2 of 5	(4) ... Further, 10% of butt welds of underground piping shall be subjected to RT.	Bidder requests for alternative Volumetric NDT Examination including UT/PAUT/TOFD	Bidder to meet the specification requirements
872	SECTION - VI /PART – B	SUB-SECTION- E-06 POWER CYCLE PIPING	Page 2 of 5	2	(2) Temperature > 175 Deg. C upto 400 Deg. C or pressure exceeding 17 bar and upto 71 bar. ... (iii) 100% MPE.	Bidder proposes to perform MPE on grade 91, 92 and MPE/PT for other grades of material where MPE mentioned in Sub section E 06	MPI can not be substituted by LPI. However in the inaccessible area where MPI is not possible LPI can be accepted.
873	SECTION - VI /PART – B	SUB-SECTION- E-06 POWER CYCLE PIPING	Page 2 of 5	1.01.00	(c) The edge preparation for shop and site welds in stainless steel /alloy steel shall be subjected to a dye penetrate check	Bidder has not envisaged PT for the edge preparation for shop and site weld in SS and alloy steel. Bidder uses 100% UT tested pipes and at shop WEP is carried out at machining followed by visual inspection. No gas cutting is used for preparation of WEP.	Bidder to meet the specification requirements
874	SECTION - VI /PART – B	SUB-SECTION- E-06 POWER CYCLE PIPING	3 of 5	1.05.00	(b) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check.	Hardness testing on seat/disc may be performed on a sample test coupon (PTC) instead of actual seat. The Sample test coupon will undergo same process as that of actual seat material and the hardness of this test coupon will be measured. As the hardness test on actual seat creates indentation on seat, which may become a leak path in the feature during the valve operation. (inline with Sub section E-08 1.07.01).	If it is not possible to carry out the test on job the same may be tied up during detailed engg.
875	SECTION - VI /PART – B	SUB-SECTION- E-08 STEAM TURBINE & INTEGRAL AUXILIARIES	1.10.02	Page 22 of 23	(c) All welds between condenser neck and LP turbine shall be subjected to 100% radiographic and magnetic particle examination.	Bidder proposes to perform MPI/PT in lieu of Magnetic Particle Testing as there is very limited access available for performing NDT	Since, the weld joints between condenser & LP Turbine are critical & linked to vacuum system,hence the present practise to continue.Bidder to meet the specification requirements.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
876	SECTION - VI /PART – B	SUB-SECTION-E-10 CONDENSATE EXTRACTION PUMP	1.00.00 CONDENSATE EXTRACTION PUMPS	PAGE 2 OF 2	TABLE CONT'D ON NEXT PAGE	Request you to remove the clause as there is no other details available in next page	Table refers to the General Notes mentioned in the subsequent section.
877	SECTION - VI /PART – B	SUB-SECTION-E-12 BOILER FEED PUMP	2 of 4	1	(a) Performance Tests on each Boiler Feed Pump to determine the characteristic curve (Head, Capacity, Efficiency & Power) at Design Speed and to ensure compliance with design requirements specified in the specification. Measurement shall be carried out at 10%, 25%, 50%, 65%, 80%, 100% & 125% of Design Flow with loop water at design temperature. Performance Test at other specified Conditions shall be carried out on all Boiler Feed Pumps at their respective Speeds at design temperature.	Many manufacturers does not offers / recommend to conduct performance test below recommended flow, therefore performance tests at 10 % , 25 % flow will not be done. It's more like pump running in dry conditions which may damage the pump internals Performance test is performed at reduced speed and temperature meeting HIS guidelines and Note 5 of Sub Section E-12	Pump performance at lower flow(10% & 25%) done to verify Pump internal conditions, in case of no flow & less flow conditions and for very short duration only.Hence, the present practise will continue.Bidder to meet the specification requirements.
878	SECTION - VI /PART – B	SUB SECTION-E-13 MAKE UP WATER (MECHANICAL)	Page 2 of 4 Page 4 of 4	B.	ix. 5% RT/ 5% UT by TOFD/PAUT techniques on those butt weld joints which can be 100% hydro tested. x. 100% RT / 100% UT by TOFD/PAUT technique of the butt weld joints of pipeline shall be carried out which cannot be Hydro tested. viii. 5% RT/ 5% UT by TOFD/PAUT techniques on those butt weld joints which can be 100% hydro tested. ix. 100% RT / 100% UT by TOFD/PAUT technique of the butt weld joints of pipeline shall be carried out which cannot be Hydro tested.	Bidder requests to perform 100% RT/UT / PAUT/TOFD in lieu of Hydrotest	Bidder to meet the specification requirements
879	SECTION - VI /PART – B	SUB-SECTION-E-20 CHP	1.09.03	Page 6 of 9	b) For Plates of 10 mm < thickness < 32 mm - 10% RT On butt welds.	Bidder proposes to carry out RT/UT as same permitted in NDT of Boiler Structure clause no. 1.02.11, c, ii, page 11 of 13 under Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries.	Bidder to meet the specification requirements

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
880	SECTION - VI /PART – B	SUB-SECTION E-59 CIVIL WORKS	1.0 a	1 of 5	Before execution of any civil work the contractor shall conduct full-scale suitability tests on various onstruction and building material such as fine and coarse aggregates, cement, construction chemicals, supplementary cementitious materials and construction water to ascertain their suitability for use and the concrete mix designs conducted from reputed institutes such as NCB-Ballabgarh, CSMRS-Delhi, selected IIT's, etc. as agreed by the Employer. The test samples for such full-scale testing shall be jointly sampled and sealed by the Employer and contractor, thereafter these shall be sent to the concerned laboratory through the covering letter signed by field quality assurance department (FQA) representative of the Employer. Format for sampling and testing of cement, coarse aggregate, fine aggregate, chemical admixture, fly ash, water, oncrete mix design is enclosed at Annexure-I.	Bidder proposes the following: Before execution of any civil work the contractor shall conduct full-scale suitability tests on various construction and building material such as fine and coarse aggregates, cement, construction chemicals, supplementary cementitious materials and construction water to ascertain their suitability for use and the concrete mix designs conducted from reputed institutes such as NCB-Ballabgarh, CSMRS-Delhi, selected IIT's, NABL accredited Laboratories and in-house lab at site etc. as agreed by the Employer. The test samples for such full-scale testing shall be jointly sampled and sealed by the Employer and contractor, thereafter these shall be sent to the concerned laboratory through the covering letter signed by field quality assurance department (FQA) representative of the Employer. Format for sampling and testing of cement, coarse aggregate, fine aggregate, chemical admixture, fly ash, water, concrete mix design is enclosed at Annexure-I.	Bidder to meet the specification requirements
881	SECTION - VI /PART – B	SUB-SECTION E-59 CIVIL WORKS	2.0 a	1 of 5	The field laboratory for QA and QC activities shall be established and installed with the adequate facilities to meet the requirement of envisaged day to day tests during execution of the work. Temperature and humidity controls shall be available wherever necessary during testing of samples. The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for Employer acceptance/ approval. The contractor shall mobilize the requisite laboratory equipment and QA&QC manpower in well advance prior to the planned test activity. The tests which cannot be carried out/do not have facilities for testing in the field laboratory shall be done at Employer acceptable testing laboratory.	Bidder proposes the following: The field laboratory for QA and QC activities shall be established and installed with the adequate facilities to meet the requirement of envisaged day to day tests during execution of the work. Temperature and humidity controls shall be available wherever necessary during testing of samples. The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for Employer acceptance/ approval. The contractor shall mobilize the requisite laboratory equipment and QA&QC manpower in well advance prior to the planned test activity. The tests which cannot be carried out/do not have facilities for testing in the field laboratory shall be done at any NABL accredited laboratories or Employer acceptable testing laboratory	Bidder to meet the specification requirements

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
885	SECTION - VI /PART – A	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	PAGE 3 OF 4	6.04.0	6.04.00 Computed Radiographic Testing (RT)– Computed RT shall be used as an advanced Engineering Practice. Main contractor to ensure minimum 10% computed radiography of weld joint to be performed in construction phase. Main contractor to ensure the transfer & storage of these records in Server	Bidder request to perform computed RT on 10% joint for scope agreed in FWS for boiler pressure parts only.	Bidder Understanding is correct. Refer Amendment No : E-QA-03

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)

Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S/N.	Section / Part	Clause No.	Page no.	Bid Specification Stipulation	Bidder's Query	NTPC Clarification
886	Section VI, Part-A, Sub-Section IV Functional Guarantees	1.01.02 Note iv	8 of 73	Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed Fifteen percent (15%) of the Contract Price.	We request NTPC to keep the cap of Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee at ten percent (10%) of the Contract Price.	Bidder's proposal is not acceptable. Bidder is requested to comply with the stipulation of tender documents.
887	Section-VI, Part-A Sub-Section-IID Civil Works	2.03.00	13 of 13	DEVELOPMENT OF LAYDOWN AREA IN ABANDONED ASH DYKE	1. We understand that the supply payment linked with "receipt of equipment/material" shall be released to the Contractor after receipt and physical verification of equipment/material at laydown area to be provided in abandoned ash dyke outside the plant boundary. Kindly confirm. 2. We understand that power shall be provided by NTPC for laydown area provided in abandoned ash pond. Kindly confirm.	1. Bidder's understanding is correct. 2. Bidder to refer Cl. 2.02.00 of Section VI/Part-A, Sub-Section-IID along with amendment (D1-5).
888	Section-VI, Part-A, Sub-section-I	4.09.00	7 of 8	The Contractor shall be responsible to undertake some activities related to its Corporate Social Responsibility (CSR) in the immediate vicinity of the project. The Contractor shall undertake such activities after prior consultations with the Employer to ensure that the efforts	This clause specifies carrying out of CSR activities as per relevant provisions of Companies Act 2013. We would like to draw your attention that implementing such provision will lead to inequality amongst	CSR activities as per the provision (Rules) under section 135 of the companies Act 2013 relating to CSR and other circulars / instructions of various government departments viz MoEF etc. are to be carried out by the contractor, being statutory in nature.

Doc. No.: CS-4540-001A-2-TECH-CLRF. 01	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Clarifications No. 01 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)

Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S/N.	Section / Part	Clause No.	Page no.	Bid Specification Stipulation	Bidder's Query	NTPC Clarification
				of the Employer and Contractor are complemented. The vendor / contractor is expected to carry out the CSR activities as per the provision (Rules) under section 135 of the companies Act 2013 relating to CSR and other circulars / instructions of various government departments viz MoEF etc. The share of CSR expenditure to be incurred by the vendor / contractor for this project in the total CSR expenditure incurred by the vendor/contractor as a company will be in the same proportion as the turnover of the project concerned to the total company turnover. This will be certified by the chartered accountant once every fiscal year. Such activities will be undertaken by the contractor / vendor in consultation with the Employer.	bidders in terms of absolute value to be considered towards CSR activities. We therefore request NTPC to specify a fixed value which is to be considered individually by all bidders in their Price Bids for CSR activities to be carried out in the immediate vicinity of the project site. Such a provision will be fair & equitable to all bidders and will also bring in parity during bid evaluation.	
889	Section-VI, Part-A, Sub-section-I	4.10.00	7 of 8	The Contractor shall also jointly facilitate in resolution of Land Acquisition issues related to the Project. Any due payments arising out of the Land Acquisition process shall however be paid by NTPC to the appropriate Authorities.	Land acquisition is linked to R&R issues, grievances redressal of land losers, socio political issues etc. which should be out of EPC Contractor's purview.	No major land acquisition issue is envisaged for the project and further envisaged role of the contractor is only facilitation in resolution of the issues. Bidder is requested to comply with the stipulations of tender documents.

Doc. No.: CS-4540-001A-2-TECH-CLRF. 01	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Clarifications No. 01 to Technical Specifications Section-VI

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)

Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S/N.	Section / Part	Clause No.	Page no.	Bid Specification Stipulation	Bidder's Query	NTPC Clarification
				The vendor / contractor shall visit the site to ascertain the position of land acquisition etc. and it is presumed that the contractor submitted his bid after considering the facts on the ground and that once vendor / contractor is successful in his bid, he will work in cooperation with the client for smooth execution of the project.	We request Employer to exclude the same from bidder's scope of work.	
890	Section-VI, Part-A, Sub-Section-IV Functional Guarantees	1.01.02	5 of 73	AMOUNT OF LIQUIDATED DAMAGES APPLICABLE FOR CATEGORY-I GUARANTEES (Table of Guarantee Parameter, Rate of Liquidated Damages, Limiting Value)	We understand, the stipulated "Limiting Value" is to be understood as Rejection Condition at bidding stage only. e.g., Heat Rate higher than the Limiting Value will lead to bid rejection. Best Heat Rate among bidders (lower than the Limiting Value) will not be used for loading on quoted price using "Rate of Liquidated Damages (LD)".	Bidder understanding is correct. Bidder to please refer note (vi) mentioned in Sub-section-IV/Part-A/Section-VI page 8 of 73 in this regard. No Bid evaluation factor has been envisaged for Heat Rate in specification. No evaluation credit will be provided in case of improved heat rate (lower than the Limiting Value).

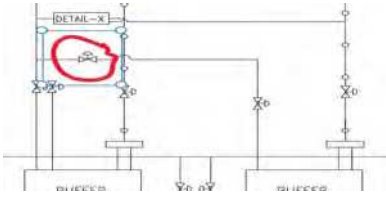
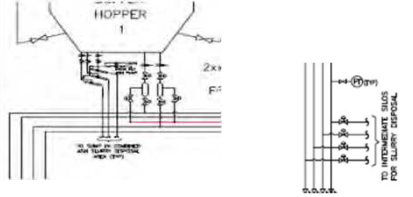
Doc. No.: CS-4540-001A-2-TECH-CLRF. 01	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Clarifications No. 01 to Technical Specifications Section-VI

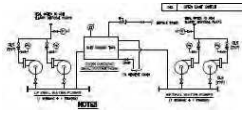
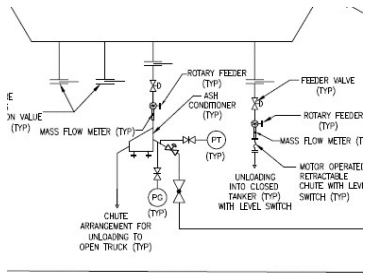
EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)

Clarification No. 01 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S/N.	Section / Part	Clause No.	Page no.	Bid Specification Stipulation	Bidder's Query	NTPC Clarification
					The LD rate mentioned will be used on shortfall during performance test only.	Bidder to comply specification requirement.
891	Section-VI, Part-A, Sub-Section-IA	Attachment-3K	410 to 411 of 411	Format for Letter of Support	We request Employer to specify the value of liability for QFGDM in the format of Letter of Support for Flue Gas Desulphurization (FGD).	The bidder to give the Letter of Support in the format which is attached alongwith the Technical Specifications. The liability is based on the letter of support requirements. The respective responsibility is indicated in the letter of support which need to be ensured by the bidder.

Doc. No.: CS-4540-001A-2-TECH-CLRF. 01	EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)	Clarifications No. 01 to Technical Specifications Section-VI

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
892	TECHNICAL SPECIFICATION SECTION – VI, PART-E	4540-001-POM-A027				Owner to confirm that the marked valve is redundant or valve type shall be manual. Please confirm.	Confirmed. Bidder to refer revised Single Line Diagram. Amendment No: A-MH-29
893	TECHNICAL SPECIFICATION SECTION – VI, PART-E	4540-001-POM-A028				As per referred flow diagram of pressure conveying system, Bidder understands that fly ash slurry directly from Buffer Hopper is not applicable as fly ash slurry shall be below intermediate silos. Kindly confirm Bidder's understanding.	Bidder to refer revised Single Line Diagram. Amendment No: A-MH-29
894	TECHNICAL SPECIFICATIONS SECTION-VI, PART B TECHNICAL SPECIFICATIONS SECTION – VI, PART-A TECHNICAL SPECIFICATIONS SECTION – VI, PART-A	SUB-SECTION: A-21 ASH HANDLING PLANT SUB-SECTION-IV FUNCTIONAL GUARANTEES SUB-SECTION-IIA-16 ASH HANDLING SYSTEM	Page 3 of 40 PAGE 34 OF 73 PAGE 10 of 18	1.03.00, b) 1.03.09 1.01.08	Jet Pumps: Rated Capacity (M3/hr): Three (3) nos. pumps shall evacuate 4 hr. collection of bottom ash in 65 minutes , incl. 5 minutes time for start/stop/changeover/flushing etc. Total time for evacuating four (4) hours of ash collection from all the hoppers of (APH +SCR +Duct Hoppers) of a unit corresponding to collection rates specified shall not exceed 45 mins (including change over time. The total time for evacuating four (4) hour collection of bottom ash from a unit corresponding to collection rates specified shall not exceed 85 minutes including five (5) minutes time required for starting, stopping, sequential change over from one unit to second unit Four (04) streams of horizontal combined ash slurry disposal pumps complete with drive motors, variable speed hydraulic coupling for first stage pumps and fixed belt drive arrangement for subsequent stages, base plate, foundation bolts, inserts, embedment and accessories as specified and as required, out of which two stream will be working, one stream will be normal standby and other stream will act as maintenance standby	There is a discrepancy in the referred clauses regarding BA Ash evacuation time. In view of two (2) combined slurry disposal lines are working out of four (4) lines for disposal of Bottom ash, Coarse ash and Fly ash in wet mode, Bidder requests Owner to confirm the evacuation time for Bottom Ash and Coarse Ash system to design the ash slurry disposal system.	Bidder to refer amendment of clause w.r.t Ash evacuation time. Bidder to comply stipulation of Technical specification w.r.t Ash slurry disposal Pumping stream. Amendment No: A-MH-27 Amendment No: A-MH-28
895	SECTION-VI, Part-A	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM	PAGE 15 of 18	1.04.06	Eight (8) nos. Pump tanks/Air lock tank for each coarse ash silo and four (4) nos. of pump tanks/air locks tank for fine ash hopper for transportation of coarse fly ash and fine fly ash respectively, to silos provided for dry fly ash storage silos meant for Road and Rail loading.	Bidder understands that instead of coarse ash silo, it should be coarse ash hopper. Please confirm Bidder's understanding.	Confirmed. Bidder to refer amendment of respective clause. Amendment No: A-MH-26
896	SECTION-VI, Part-B	SUB-SECTION: A-21 ASH HANDLING PLANT	Page 20 of 40	3.01.00 3.07.00	To handle bag filter, vent filter, vent fan etc for intermediate silo, Main storage silo, HCSD cum FA Silos of the classifier block, BA Crushers and drives, BA metallic conveyor drives To transfer silo (BA & FA) area (with 30% ash by weight) upto HCSD system mixing tanks.	HCSD pump is not applicable for this tender. Please confirm.	Confirmed.

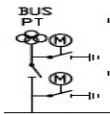
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
897	SECTION – VI, PART-E	4540-001-POM-A-25				Bidder proposes that HP Seal water can be made by boosting taking output from LP Seal water pump discharge, instead of supply from tank. Please confirm acceptance.	Not accepted. Bidder to comply Technical Specification.
898	SECTION-VI, Part-A SECTION – VI, PART-E	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM 4540-001-POM-A-25	PAGE 11 of 18	1.02.00 c)	Seal water pumps (one working + one standby) for meeting the seal water requirement of Combined slurry disposal pumps and drain water pump of Combined slurry pump house, etc. These pumps shall be located in the Combined ash slurry disposal pump house. As per P&ID: Seal Water Pumps: 2 LP + 2 HP	Discrepancy observed for numbers of LP & HP Seal Water Pumps. Owner is request to confirm the numbers of seal water pumps are to be considered.	Bidder to refer amendment of respective clause. Amendment No: A-MH-25
899	SECTION-VI, Part-A	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM	PAGE 14 of 18	PART A, 1.04.01	In case fine ash and coarse ash is coming through same pipelines to the classifiers, Classification of 40 % of ESP ash (40% of ash conveying capacity) in ash classifiers is to be provided. The remaining unclassified ash shall be taken directly to the coarse fly ash hopper.	Owner to note that exact 40% of ESP ash can not be transferred to classifier with given nos of ash conveying piping. If two lines considered then the capacity of ash classification system will be more than the 40% of ESP ash. Owner to review the same and confirm the basis of classification system sizing.	Classification requirement specified as 40% (minimum) of the ash conveying capacity. Bidder to comply.
900	SECTION-VI, Part-A	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM	PAGE 16 of 18	1.04.17	Two staircase shall be provided for ash classifier to the topmost working platform.	Bidder understands that staircase only upto operating floor shall be provided and silo top will be connected only by elevator. Please confirm Bidder's understanding.	Bidders' query is not clear as elevator is not envisaged in ash classifier. However, proper approach to be provided to all the working floors, as specified.
901		GENERAL			Slurry tank internals	Bidder understands that no liner specified for any sort of slurry tanks, so will not be considered. Please confirm Bidder's understanding.	Liner with material, suitable for the application to be provided for Slurry tank.
902	SECTION – VI, PART-E	4540-001-POM-A-28				Multiple discharge point mentioned for silos. Owner to confirm whether simultaneous unloading of open & closed tanker are to be considered for sizing of vent filter.	Simultaneous unloading of open & closed tanker to be considered in absence of Railway Wagons. During Railway Wagon loading, simultaneous loading of rail Wagon along with either open or closed tanker shall be considered.
903	SECTION-VI, Part-A SECTION – VI, PART-E	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM 4540-001-POM-A-28		1.01.07	Two (2) nos. (one at entry and another at exit) Pitless type Weigh Bridge shall be provided at dry fly ash silo area for Truck/Baulker loading complete with all electrical, controls, civil and structural works for weighment of trucks/baulkers before and after filling. Mass flow meter/Solid flow meter (Two numbers below each silo) complete with all electrical, controls etc to be provided for measurement of ash quantity (total or part, as required) during filling of ash to the road tanker/Rail Wagons.	As per referred clause, weigh bridge for rail loading is envisaged , however, the same is not shown in flow diagram. Owner is requested to check and confirm whether rail loading is envisaged or not.	Rail loading is envisaged. Bidder to refer revised Flow diagram of Ash Handling system. Amendment No: A-MH-29

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
904	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIC CONTROL & INSTRUMENTATION	17 of 18	21.00.00 (2)	Bidder is to provide an Augmented reality/virtual reality-based training model along with all its hardware, software components and required licenses (5 Nos.). The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for major equipment's of Boiler, Turbine, Generator, AHP, CHP. The individual equipment models shall be true to the scale to all its sub-component level. Details of equipment to be covered shall be finalized during detail engineering.	a) Requirement of Augmented reality/virtual reality-based training model is not clear. Bidder request Owner to clarify the exact requirement for hardware and software. Bidder also request Owner to provide detailed technical specification for AR/VR training model to keep all Bidders at-par. b) Bidder request Customer to inform if AR/VR based training model is to be viewed with VR glass or without VR glass as a normal view in PC. Incase VR glass is required then Owner to specify the quantity of the same. c) There are multiple components/ items/ machines in Boiler, Turbine, Generator, AHP and CHP. Bidder request Owner to inform for which major components/ items/ machines this training model is required. d) Bidder understand that this training model is a standalone training package and doesn't have any interface with any other system. Please confirm. e) Bidder understands that one workstation with 5 user license (One each for Boiler, Turbine, Generator, AHP, CHP) is required which shall be used based on respective area authorization. Please confirm. f) As indicated above, requirement of AR/VR based training model is not clear from the given specifications. Further, training on Erection, Commissioning, Operation and Maintenance for STG & its auxiliaries and Boiler & its auxiliaries are already covered under E-Learning package (SECTION VI, PART-C, GENERAL TECHNICAL REQUIREMENTS, Cl. no. 8.03.05). Thus we strongly feel that separate AR/VR based training model should be removed from Current Tender specification. However, Bidder can add the requirement of training on AHP & CHP in E-learning package. Kindly confirm.	a) Specification requirement is clear. The hardware will comprise of VR goggles, compatible VR workstation, necessary sensors, joysticks and all other associated hardwares. The software will comprise of individual VR modules of all models indicated in the specification with necessary license. b) The quantity of all hardware, software and licenses are five number (5 nos) each. c) All major equipment shall be considered in the model. However the exact count of the same shall be finalized during detailed engineering. d) Bidder understanding is correct. e) Bidders understanding is not correct. Please refer reply (b) for quantity of hardware, software and license. f) Bidder understanding is not correct. Bidder to comply specification requirement.
905	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure C to IIC Contract quantity	24 of 24	N	24/7 safety control room shall be functional from initial stage of the project construction. Temporary safety control room for the same is to be made functional within three (3) months of LOA. Permanent safety control room shall be made functional within six (6) month from LOA	a) Bidder wish to clarify that no major site activities will be started within 3 months of LOA. Hence, Bidder request Owner to remove the requirement of temporary Safety control room. b) Bidder request Owner to inform the minimum dimensions required for Permanent Safety Control room.	a) Bidder proposal is not acceptable. Bidder to comply specification requirement. b)Refer clause no 5.33.00, Sub section D-1-5, Part B of technical specification.
906	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIC CONTROL & INSTRUMENTATION SYSTEM	17 of 18	21.00.00 (1b)	Digital Helmet: Realwear based Digital Helmet	Bidder wish to highlight that "Real ware Digital helmet" is a Real ware company's product. Bidder request Owner to inform the alternate makes of Digital Helmet in addition to Real ware.	Any equivalent ruggedized handsfree devices with robust design and having functionality similar to that specified shall also be acceptable.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
907	Section-VI/Part-A	IID - Civil works	11 of 13	2.02.00	However, construction water may be provided by Owner at one point near existing Stage-II reservoir on chargeable basis.	Owner to kindly indicate the construction water charges.	Construction water shall be charged as per prevailing rates as on the withdrawal of the same.
908	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.01.00	Schedule of front Handover of stores area:	Owner to kindly note that schedule of front handover of stores area will delay the below mentioned activities which could have been otherwise started by EPC Contractor after the NOA: a) Civil works of main plant foundation in vicinity area b) Soil investigation c) Construction of Priority Road Therefore Owner is requested to handover the stores area (Sr. No. 1 to 7) on the date of NOA in order to meet project timelines.	Construction schedule has been given considering front handover of stores area as per clause no 5.01.00 Sub section III Part-A of technical specification. Bidder to plan the construction activities considering the same.
909	Section-VI/Part-B TENDER DRAWINGS	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT TENDER DRAWINGS	104 OF 120	5.23.17.01	For all coal Conveyors, each down comer shall lead the water / coal slurry to RCC pit (of 2 Cu.M capacity) to allow settling of coal. The water from the pit shall overflow into contractor's R.C.C drain, which will lead the discharge finally into coal slurry settling pond. Refer below mentioned tender drawing. General Layout Plan - 4540-999-POC-F-001 Layout of Drains - 4540-001-POC-A-005 Layout of Roads - 4540-001-POC-A-004	It is not feasible to discharge/route the coal water coming from Conveyors (Conveyor 4A/B & Conveyor 5A/B) & TP'S (TP-2,TP-3 & TP's in main plant area) to settling pond because of layout constrains (like crossing existing track hopper and road side drain at many locations). In view of this, bidder proposes that coal water coming through each down comer shall lead the water / coal slurry to RCC pit (of 2 Cu.M capacity) to allow settling of coal. The water from the pit shall overflow into R.C.C drain, which will lead the discharge finally into trunk drain routed alongside the nearby road. Please confirm.	Bidder to lead the coal water coming from Conveyors and TPs to Coal Slurry Settling pond.
910	Section-VI/Part-B TENDER DRAWINGS	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT TENDER DRAWINGS	104 OF 120	5.23.17.01	Drainage of the complete coal stock pile, area around stacker reclaimer rails etc. shall be discharged into the owner's coal slurry settling pond. Refer below mentioned tender drawing. General Layout Plan - 4540-999-POC-F-001 Layout of Drains - 4540-001-POC-A-005 Layout of Roads - 4540-001-POC-A-004	It is not feasible to discharge/route the coal water coming from stock pile area (falling south side of Conv.9 as per General Layout Plan drawing 4540-999-POC-F-001) because of layout constrains (like crossing road and road side drain in these areas). In view of this, bidder proposes that coal water coming from this Stock pile area around stacker reclaimer rails etc. shall be discharged into a proposed sedimentation tank placed just next to the stock pile area. Please confirm.	Bidder to lead the coal water coming from Coal Stock pile area to Coal Slurry Settling pond.
911	TENDER DRAWINGS, Part E				General Layout of MUW System Drag No. 4540-001-POC-A-009 Space for laydown and preassembly Land belongs to Kukudula school	As per the GLP, the space for laydown and preassembly (10 Acre) is overlapping with "Land which belongs to Kukudula school". Bidder understands that the aforesaid space (10 Acre) near proposed Reservoir will be made available to EPC Contractor on or before the date of NOA. Please confirm.	laydown area of 10 acres is exclusive of Kukudala School land.
912	Section-VI/Part-A			ANNEXURE-P :	Details of facilities to be dismantled	Bidder would like to clarify that apart from the list of facilities identified in tender specification for dismantling, there may be few additional existing facilities which may be required for dismantling in order to accommodate Stage III facilities as per specification. Items originated out of such additional dismantling work shall be Bidder's property. Please confirm.	Confirmed

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
913	Section-VI/Part-B	SUB SECTION A-15 CW SYSTEM	20 OF 31	2.05.00	Service water distribution shall be used for effective cleaning /washing of each area and shall also fill the service water (PVC tank of 100 liter capacity) tank provided on roof top of each building to supply water to toilets	We understands that service water tanks only required for toilets. Owner to please confirm.	Bidder understanding is not correct. Service water distribution system shall be provided in line with the specification requirement. However, bidder to refer amendment No- A-WS-05
914	Section-VI/Part-B	1) SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN 2) SUB SECTION A-15 CW SYSTEM	1) 1 OF 31 2) 20 OF 31	1) 9.03.01 2) 2.05.00	1) Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc. Service water tank shall be of RCC construction. 2) service water (PVC tank of 100 liter capacity) tank provided on roof top of each building to supply water to toilets	In first clause service water tank capacity is mentioned with 8 hours requirements and tank MOC is mentioned as "Polyethylene" and "RCC" where as in second clause tank capacity is mentioned as 100 liter and MOC as PVC. Owner to please clarify the tank capacity and MOC requirements.	Bidder to refer Amendment no : A-WS-05
915	Section-VI/Part-B	SUB SECTION A-15 CW SYSTEM	21 OF 31	2.09.00	The plant potable water network shall supply potable water required for all the facilities/ buildings/ areas included in Contractor's scope except make up water pump house & ash water recirculation pump house and shall fill the potable water tanks provided on roof top of each building to supply drinking water (PVC tank of capacity as specified in Civil Works sub section) to drinking water point /water coolers inside the building	Tank for potable water shall be provided on building where toilets are envisaged. Owner to please confirm.	Bidder understanding is not correct. Plant potable water network shall be provided inline with requiremnts of technical specifications. Bidder to comply.
916	SECTION – VI/ PART-B/	SUB-SECTION-D-1-5 CIVIL WORKS	66 OF 120	5.18.01.02	Circulating Water Pump House (CWPH), Raw Water Pump House (RWPH) and Make-up water Pump House (MUWPH) :- Hand-rail with 32 NB (medium) pipes shall be provided around the operating floor on the forebay side in the stoplog and trash rack area.	a) Bidder understand that handrail member sections are mentioned for MUW pump house. Bidder understand that outdoor handrails (if required) for MUW Pipeline steel bridges to be same as MUWPH b) Also Kindly confirm the height of handrail and number of layers to be provided.	Refer clause no 9.02.01 of section VI, Part -B

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
917	SECTION – VI, PART-B	SUB-SECTION B-17	1.01.07	2 of 60	The GIS building shall have adequate provision (at least 4.0m) for maintenance bay shall be provided one side of GIS building considering the future provision for GIS extension.	Bidder understand that future provision at one end of GIS to be provided, however space for future bay other than indicated in note-4 of SLD (Dwg. No. 4540-001-POE-J-001, Rev.A) is not required. Owner may please confirm.	Bidder under standing is correct for future provision of space at one end of GIS. However bidder understanding is not correct for space for future bay other than indicated in Note-4. Space for Future bay provision at one end shall be considered after Line #3 -tie-Line#4 bay.
918	SECTION – VI, PART-B	SUB-SECTION B-17	2.03.08	8 of 60	The removal of individual enclosure part or entire breaker bays shall be possible without disturbing the enclosures of neighboring bays.	Bidder understand that removal of breaker component is required and not entire breaker module along with control cabinet. Owner may please confirm.	Bidder under stand is not correct . In GIS , it is not possible to remove the breker componennt with out remove the entire breaker module along with control cabinet.
919	SECTION – VI, PART-E	Dwg. No. 4540-001-POE-J-001, Rev.A	400kV GIS SLD	1	Bay arrangement shown for 400kV GIS SLD.	Bidder understand that bay arrangement shown in Tender SLD is indicative only. Same can be modified/swap based on the layout requirement or OEM requirement. Owner may please confirm.	Bidder's understanding is not correct.
920	SECTION – VI, PART-B	SUB-SECTION B-17	1.01.07	2 of 60	Maintenance room (as a part of GIS building) shall be constructed for carrying out repair works / small part assembly, storage of material, test equipment and tools and tackles to be stored separately from GIS hall in this room.	Owner may please specify the required dimension of Maintenance room	The minimum dimension of Maintenance room shall be considered 5mt X4mt.
921	SECTION – VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	3.06.00	8 of 15	MOTOR FEEDERS BELOW 90KW SHALL BE CONTACTOR CONTROLLED. THE MOTOR FEEDERS FOR 90KW & ABOVE SHALL BE AIR CIRCUIT BREAKER CONTROLLED.	Bidder proposes that Motors below 110kW shall be contactor controlled and the Motor feeders for 110kW & above shall be air circuit breaker controlled. Owner may please accept.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.
922	SECTION – VI, PART-B	SUB-SECTION-D-1-5	5.18.05	85 of 120	Regarding requirement of corridor for power supply line laying in areas of canal crossing, road crossing etc. following shall be applicable: a. Wherever culverts is being used for crossing of existing roads highways etc. necessary space provision for laying of 2 nos. 200mm dia HDPE/hume pipe shall be considered along both sides of pipe line for laying of cables.	Bidder understands that space provision for laying of 2 nos. of 200mm dia HDPE/hume pipe inside culverts shall be provided by Owner. However scope of supply and laying of 2 nos. of 200mm dia HDPE/hume pipe inside culvert shall be by bidder. Owner may please confirm.	Bidder's understanding is in correct. The space provision, supply and laying is in the scope of bidder.
923	SECTION – VI, PART-B	SUB-SECTION B-04: TRANSFORMERS AND ASSOCIATED MAINTENANCE, MONITORING & TESTING	1.05.1	7 of 33	Permissible maximum losses for 420 kV, 265 MVA Generator Transformer, shall be as per Annexure-A of CEA standard specification and technical parameters for Transformers and Reactors (66kV and above voltage class).	Generator Transformer losses depends on transformer design and varies from supplier to supplier. Bidder understand that, Bidder is allowed to choose losses from offers quoted by various manufacturers. Being EPC project, selection of supplier and equipment shall be done by Bidder. Hence, Bidder understands that the losses specified in CEA standard specification is indicative and not binding. Owner may please confirm.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
924	SECTION – VI, PART-B	SUB-SECTION B-04: TRANSFORMERS AND ASSOCIATED MAINTENANCE, MONITORING & TESTING	1.05.2	8 of 33	Permissible maximum losses for for 420 kV, 125 MVAR Shunt Reactor shall be as per Annexure-A of CEA standard specification and technical parameters for Transformers and Reactors (66kV and above voltage class).	Reactor losses depends on reactor design and varies from supplier to supplier. Bidder understand that, Bidder is allowed to choose losses from offers quoted by various manufacturers. Being EPC project, selection of supplier and equipment shall be done by Bidder. Hence, Bidder understands that the losses specified in CEA standard specification is indicative and not binding. Owner may please confirm.	Bidder's proposal is not acceptable. Bidder to comply with tech specification requirements.
925	SECTION – VI, PART-E, TENDER DRAWINGS	-	Drg.no. 4540-001-POE-J-001 Rev.A	-		Bidder would like to clarify that the additional earth switch is not required for electromagnetic VTs, since primary of VT is itself earthed. These additional earth switch is required basically for AIS type CVTs where there is an obligation to earth the additional capacitive charges after disconnecting VT from main circuit. Hence, bidder will consider VT with DS (Disconnecting switch) for bus bar metering. Owner may please confirm.	Bidder clarification not acceptable. Bidder to comply the specification requirement.
926	SECTION – VI, PART-B	SUB-SECTION B-17 SWITCHYARD	5.0.04	26 of 60	CORE DETAILS OF 400kV VT(GIS) Output Burden – Minimum 75 VA	Bidder would like to clarify that the burden of secondary cores of voltage transformer 75VA mentioned is abnormally high. Normal burdens are in the range of 25-50VA which is more than adequate for sub-station protection system requirements. Also as per latest CEA guidelines rated burden for voltage transformer shall not exceed 50VA. Also, as per best engineering practice & proven design, bidder propose to consider 50VA burden for each windings of voltage transformer. Owner may please confirm.	Referred CEA guidelines is in draft. However bidder clarification is noted. Please refer Amendment No B-16

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
927	SECTION – VI, PART-B	Sub Section -B-17	2.03.21	10 of 60	Adequate number of gas leak detectors shall be installed at various locations at the base of the GIS structure to detect presence of gas which may be harmful for human. The detector shall send alarm signal locally as well as at remote stations.	Bidder propose to provide Gas Density monitor in each of the gas compartment. In case of Gas leak, Gas Density monitor shall raise the alarm at defined pressures. Hence, gas leak detector is not required. Owner may please confirm.	Bidder understanding of gas leak detectors & Gas Density Monitor is not correct. Gas density monitor is to detect gas leakage for each of the gas compartment. Gas leak detectors are to be provided in the GIS hall. Bidder to comply the specification requirement.
928	SECTION – VI, PART-B	Sub Section -B-17 Sub Section -B-17	2.21.00 11.01.00	13 of 60 37 of 60	Commissioning Tests On completion of the erection and installation, following commissioning tests shall be performed as per IEC 62271-203, CIGRE working Group 23.03, 1975-Electra No.42, 7-29: Contractor shall perform any additional test based on specialties of the items as per the field QP/ instructions of the equipment supplier or Employer without any extra cost to the Employer.	Bidder would like to clarify that the Site routine test shall be performed as per IEC and OEM standards practice.	Bidder to conduct the site routine test as per IEC and OEM standards practice & also comply the clause 2.21.00 , 11.01.00.
929	SECTION – VI, PART-B	Sub Section -B-17	4.03.00 (b)	20 of 60	The contact shielding shall also be designed to prevent restrikes and high local stresses caused by the transient recovery voltages when these currents are interrupted.	We would like to inform that, Offered disconnectors fully comply IEC 62271-102. As the GIS disconnectors are off-load type switch, the referred clause is not applicable. Owner may please confirm.	The Bidder understanding is not correct. The clause is applicable when the disconnector is in live condition. Bidder to comply the specification requirement.
930	SECTION – VI, PART-B	Sub Section -B-17	11.05.00 (f) 11.06.00 (e)	38 of 60	Capacitance and tan delta measurement at minimum 10kV.	As per OEM recommendation, the subject tests is not applicable for GIS.	These tests are site routine & commissioning test. Bidder to perform the tests as per the list.
931	SECTION – VI, PART-B	Sub Section -B-17	11.07.00 (e)	38 of 60	SURGE ARRESTER a) Grading leakage current. b) Resistance of ground connection. c) Resistive current drawn at rated voltage after energisation.	As per OEM recommendation, the subject tests shall not be performed at site.	These tests are site routine & commissioning test. Bidder to perform the tests as per list.

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
932	Section VI/ Part-A	Sub section- IB	1 of 15	3.02.00	Water requirement for the project will be met from upstream of the Samal barrage discharge on the River Brahmani and shall be pumped to the raw water reservoir located about 28 kms from intake well	Intake well is not applicable for this project.	Bidder to note that it is intake system. Bidder to comply the specification requirement.
933	Section VI/ Part-A	Sub section- A-01	27 of 28	5.00.00	Note: If one unit is stopped, the methanol plant need not to be stopped	Bidder request owner to elaborate requirement. Further any item needs to be take care by bidder shall also be elaborated.	The requirement indicate the necessary interconnection & isolation provisions with other unit. Bidder to accordingly consider items as also specified. Further the sourcing of input requirements like steam etc. shall be taken from the common facilities so as to ensure un-interrupted supply.
934	Section VI/ Part-A	Sub section- A-01	27 of 28	5.00.00	Table : Facility for 200 TPH CO2 Capture Plant at Talchar 2*660 MW 9. Duct tap off location : From Common duct after FGD	Bidder understand that tapping shall be consider for Absorber outlet duct for each unit. There will be one terminal point for each unit. Please confirm bidder understanding.	Bidder to note that tapping shall be from the common duct after FGD system before the chimney inlet.
935	Section VI/ Part-A	Sub section- A-01	28 of 28	5.00.00	1. The height covered for sheeting will be from boiler roof to Penthouse and 15 m below from penthouse. 2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof with access through staircase / lift	Bidder understands that No Forced ventilation system is envisaged for boiler enclosure covered portion. Please confirm Bidder's understanding.	Bidder to ensure the specified requirements of ventilation and light. Specific details shall be discussed during detail engineering as per the specific design offered.
936	Section VI/ Part-A	Sub section- IIA-16	13 of 18	1.03.01	Provisions shall be there for locating another Pump in the Pump House, for future use	Bidder understands that provision shall include only space provision for pumps for future use. No other provision is envisaged. Please confirm Bidder's understanding.	Bidders' understanding is correct.

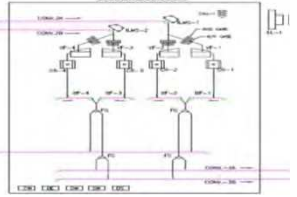
Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
937	Section VI/ Part-A	Sub section- IIA-16	15 of 18	1.04.10	Four (04) numbers (3 working + 1 stand by) refrigerant type air dryer for the above compressors along with accessories as specified and as required.	Requirement of dryer for AHP Compressors, shall be based on OEM Technology requirement. Kindly confirm acceptance.	Bidder to comply the specification requirements
938	Section VI/ Part-A	Sub section- IIA-21	1 of 1		1. Determination of optimal grid connected roof-top Solar PV power plants capacity on different buildings of this package 2. Determination of optimal grid connected solar PV systems for south facing walls (BIPV facade) of different buildings of this package	1. NTPC is requested to provide list of buildings where roof top solar PV power plant is envisaged. Further, Please clarify requirement of roof top solar for AWRS pump house and electrical room, Make Up water pump house & electrical room, buildings in	Refer Amendment No F-1 & F-2
939	Section VI/ Part-B	Sub section- A-25	2 of 26	1.7	Providing a suitable Solar PV module cleaning & water washing system. Bidder shall also provide for water connection from the nearest service water line with necessary pumping arrangement and provide adequate number of water taps with isolating valves depending on the roof/sheds area	Bidder request Owner to elaborate on requirement of cleaning arrangement, access and maintenance requirement for following. 1. south side wall of buildings 2. coal shed 3. Roof top of shed which are not accessible	Refer Amendment No F-1 for deletion of south side wall of building, Further for cleaning arrangement, access & maintenance requirement, please refer Clause no 11 of sub section A-25
940	Section VI/ Part-B	Sub section- A-25	2 of 26	1.7	Providing a suitable Solar PV module cleaning & water washing system. Bidder shall also provide for water connection from the nearest service water line with necessary pumping arrangement and provide adequate number of water taps with isolating valves depending on the roof/sheds area	Bidder proposed to provide waterless cleaning system for solar PV as an alternative. Owner is requested to please confirm.	Bidder to comply the specification requirements
941	Section VI/ Part-B	Sub section- A-25	1 of 26		In all buildings/sheds where solar PV system is installed permanent Staircase access has to be provide with Mild Steel Stairs with minimum width of 1.0m & finished with primer & weather resistant enamel paint	At all Building / shed where Owner has envisaged solar PV, it may not be possible to provide staircase. For access, cage ladder shall also be acceptable. Owner to please accept.	Bidder to comply the specification requirements
942	Section VI/ Part-B	Sub section-D-1-5	94	5.21.00	Steel shed with roof covering with provision for a structural steel monorail shall be provided for foam system including associated civil works for foam bladder tank foundations, grade slab, pipe pedestals etc.	Bidder understand steel shed shall be provided for foam bladder tanks however there will be no foam pumps so monorail shall not be envisaged for foam system. NTPC to confirm	Bidder's understanding is correct.

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
943	Section VI/ Part-A	Sub section- IID	2 of 13		In case where superstructure dismantling is in Owner's scope, dismantling of all underground facilities including paving /flooring and projection of structures above ground level etc., if any, is in the scope of bidder	Bidder understands that UG facility will be dismantled only in case it is interfering with new proposed facility.	Bidder's understanding is correct. However, bidder to refer Clause 1.00.00 of Part-A, Section-VI, Sub Section - IID
944	Section VI/ Part-A	Sub section- IID	2 of 13	1.00.00	Dismantling planning shall be as detailed below: iii. Rail track from Plant entry gate upto Track Hopper	Bidder understand that Track hopper dismantling is not in scope of work. Further, Track hopper shed (above ground) shall be dismantled by Owner.	Track hopper dismatling is not in EPC scope. Dismantling of Track hopper shed is in EPC Scope. Bidder to refer Amendment no....
945	Section VI/ Part-A	Sub section- IID	2 of 13	1.00.00	Viii, Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- I Raw water reservoir	1. Owner is requested to please provide tentative routine of MuW pipe line from plant boundary to stage-I reservoir 2. If UG piping is not interfere with new proposed facility Dismantling of Stage-I MuW pipe is not envisaged.	1.The overground portion of the pipeline is shown in Tender drawing 4540-999-POC-A-015 - Titled "EXISTING FACILITIES, BUILDING WITHIN STAGE-III PLANT AREA". However, the underground portion of pipeline has to be located by the bidder using pipe locator before start of work. 2.Bidder to refer CI 1.00.00 of Sec-VI, Part-A Sub Section IID
946	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	ETP Facility at SI No. 4(a)-xvi shall not be dismantled. Same is to be utilized for Stage-III.	Due to space constraint for stock pile and coal storage shed as well as operation of stacker-reclaimer. Bidder request Owner to dismantle the existing ETP facility to ensure front availability from start of the project.	Bidder to refer Amendment no. D1-4
947	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	Existing Stage-II reservoir area will be handed over to the Project area (Stage- III EPC contractor) after completion & handing-over of new Stage-III reservoir and providing connection from new reservoir to the existing Stage-II PT Plant by the bidder.	1. Bidder has not envisaged raw water piping from Stage-III raw water pump house to Stage-II PT plant. Owner to please confirm it the same is in scope of work. 2. Bidder request owner to please provide flow diagram for Raw water system for stage-III. 3. If piping between Stage-III pump house to Stage-II PT plant in Bidder scope, then, Owner is requested to please clarify scope of demolition / modification work in pipe line corridor etc.	1. Confirmed 2. The flow diagram is to be prepared by the bidder based on technical specification. 3.Bidder to refer Clause 1.00.00 of Part-A, Section-VI, Sub Section -IID

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
948	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	Existing Stage-II PT Plant area can be handed over to the project area (Stage- III EPC contractor) only after completion & handing-over of new Stage-III PT Plant.		No query
949	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	Existing Stage-II reservoir area will be handed over to the Project area (Stage- III EPC contractor) after completion & handing-over of new Stage-III reservoir and providing connection from new reservoir to the existing Stage-II PT Plant by the bidder.	Owner is requested to please provide flow and pressure to be considered for Potable water supply to existing potable water system	To be dealt during detailed engineering
950	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	Existing Stage-II reservoir area will be handed over to the Project area (Stage- III EPC contractor) after completion & handing-over of new Stage-III reservoir and providing connection from new reservoir to the existing Stage-II PT Plant by the bidder.	Owner is requested to please provide flow and pressure to be considered for supply of water from stage-III to stage II PT plant.	To be dealt during detailed engineering
951	Section VI/ Part-A	Sub section- IID	3 of 13	1.00.00	Packaged type Sewerage treatment plant (3 nos. as indicated in tender drawing General Layout Plan) and sewage pumping station including sewage pump, sump & house and connection up to sewage treatment plants (either of owner or bidder); connection of sewage lines of all buildings under Bidder's scope to the nearest sewerage system.	STP for Stage-III plant are is in scope of bidder. Bidder do not envisage any connection with Owner's STP. Owner to please confirm.	Connection of sewage line of misc. building like permanent store, workshop, FQA lab, Admin building, construction office, main gate complex, fire station, Canteen, safety park etc. up to owner's STP located southside of misc building in GLP.
952	Section VI/ Part-A	Sub section- IID	7 of 13	1.00.00	Civil, Structural works for pipe /cable /duct supporting structures, trestles and foundations, Condensate Storage Tank and CST pump house , trenches, duct banks, pedestals, thrust blocks, trenches, Hume pipes & culverts, duct	Bidder has envisaged pumps in Condensate storage tank area shall be kept open. No Pump house is envisaged by Bidder. Owner to please confirm.	Confirmed

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
953	Section VI/ Part-A	Sub section- IID	7 of 13	1.00.00 4540-001-POC-A-012	Intake structure in the river, RCC channel including desilting arrangement, forebay, sump, Stop-logs and Trash Racks, pump house for makeup water pumps including river bank protection. Note - 7 COFFER DAM/DYKE SHALL BE CONSTRUCTED BY BIDDER FOR EXECUTION OF PUMP HOUSE ,FORE BAY,CHANNEL AND RETAINING WALLS ON THE THREE SIDES OF THE FACILITY AREA.	River bank Protection shall be provided in the area wherever required as per Bidder's layout.	Bank protection shall be provided in the form of stones in crates over a suitable synthetic filter along the right bank from 100m upstream to 50m downstream of the proposed intake.A 150mm thick sand layer should be providedover the filter to prevent the mechanical rupture of the fabric by stone crates.The toe of right bank/end of approach channel should be protected by providing apron.
954	Section VI/ Part-A	Sub section- IID	8 of 13	1.00.00	Facilities for rainwater harvesting in Plant area and other buildings in Bidder's scope	Owner has considered rain water harvesting in plant area. Please elaborate on Other buildings.	Facilities for rainwater harvesting in Plant area and other buildings of plant in Bidder's scope
955	Section VI/ Part-A	Sub section- IID	8 of 13	1.00.00	Civil, structural, architectural works for SOLAR PV plant on 'A-Row' elevation for main power house and roof top of building/facilities in the bidder's scope	Owner is requested to please elaborate on cleaning requirement of Solar PV plant on A row of Power house.	It is clarified that there is no solar PV plant on A Row of power house. Bidder to refer Amendment no. D1-32
956	Section VI/ Part-A	Sub section- IID	8 of 13	1.00.00	Primary health center with rest room	Please provide details of Primary health center (size, dimension etc.) along with rest room to be considered in bidder scope.	To be provided as per local bylaws.
957	Section VI/ Part-A	Sub section- IID	9 of 13	1.00.00	Raiway Siding	Owner Is requested to please provide details of utility (i.e. Service water , potable water, power etc) to be provided in railway siding area from plant.	Service water, Potable water, power etc is to be provided in all buildings included in the Railway Siding works.

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
958	Section-VI/Part-B	SUB-SECTION-G-03	2 of 15	1.01.03	B) Control room for placing panels as well as HMI shall be provided for following areas: External CHP CR at Mine end	No scope of External CHP Control room at mine end is envisaged in scope of work.	External CHP Control room at mine end is not envisaged.
959	Section-VI/Part-B	SUB-SECTION-G-03	3 of 15	1.01.03	However, for FGD building, cable vault shall be provided below switchgear & control room.	Bidder understands that this clause is applicable for Main ESP and/or FGD control building. Please confirm bidder understanding.	Bidder understanding is correct.
960	Section-VI/Part-B	SUB-SECTION-G-03	9 of 15	1.01.03	The headroom for F.O. trestle in outlying area shall be 2.0m except at road crossing where the headroom shall be 8.0m and for rail crossing the headroom shall be provided as per clause no. 1.01.02(c) of this chapter.	Bidder understand that headroom of 2 M for outlying area shall be applicable for all trestle in plant area except main plant area trestle. Please confirm bidder understanding.	Bidder understanding is correct . This is true for all trestles in outlying area unless otherwise specified elsewhere in specifications.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
961	SECTION – VI, PART-E	4540-001-POM-A-040				Bidder requests Owner to allow option for reversible belt feeder below crusher in additional to unidirectional belt feeder. Kindly confirm the acceptance.	Reversible belt feeder below Crusher shall not be allowed. Bidder to comply stipulation of Technical Specification.
962	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION A - 14 WATER TREATMENT PLANT	PAGE 30 OF 36	19.01.00	Corrosion Protection for gates: Acid/Alkali proof chlorinated paint & rubber lined.	Bidder understands that corrosion protection for gates should be Acid/alkali proof lining instead of chlorinated paint & Rubber lining. Please confirm Bidder's understanding.	Bidder's understading is not correct. Bidder to provide Rubber lined for surface in contact with acid or alkali . For non contact area, Acid/Alkali proof chlorinated paint shall be provided.
963	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION A - 14 WATER TREATMENT PLANT	PAGE 31 OF 36	21.00.00	UF permeate transfer pumps: Type of pumps: Horizontal Centrifugal (With VFD)	Owner to note that VFD for UF transfer pump is not necessary required, hence, Bidder requests Owner to delete the VFD requirement for UF transfer Pump. Please confirm acceptance.	Bidder's proposal is not acceptable. VFD for UF transfer pump to be provided meeting technical specification requirements.
964	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION A - 11 CONDENSATE POLISHING UNIT	PAGE 3 OF 16	4.04.00	Cation resins shall be supplied in hydrogen form and Anion resins shall be supplied in hydroxide form. Cation Resin of gel type may also be offered meeting the criteria as mentioned below in d) (iv).	As mentioned in referred clause, cation resin of gel type can be used but no details mentioned under criteria mentioned in clause d) (iv). In absence of clarity, Bidder understands that gel type cation resin can be offered. Please confirm Bidder's understanding.	Bidder's understanding is correct. Cation Resin of gel type may also be offered meeting the criteria as mentioned in clause no- 4.04.00 c) (iv) as stipulated in clause no- 4.04.00 a) of SUB-SECTION A - 11, Part-B.
965	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION A - 11 CONDENSATE POLISHING UNIT	PAGE 5 OF 16	4.06.00	External Regeneration Facility (Regeneration Plant): 1) Resin Separation & Cation Regeneration Vessel (2 sets). 2) Anion Resin Regeneration Vessel (2 sets). 3) Mixed Resin storage vessel (2 sets). 4) Resin injection hopper, complete with a water ejector system for resin makeup. Resin injection hopper shall be sized to handle upto 150 litre of as received new resins.	Owner to note 2 sets of each vessel as per referred clause are not required for 2x660 MW, hence, Bidder proposes one (1) set of each vessel for Resin separation & cation regeneration vessel, Anion resin regeneration vessel and Mixed resin storage vessel which is sufficient for 2x660 MW as followed in past projects. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
966	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB-SECTION A - 11 CONDENSATE POLISHING UNIT	PAGE 9 OF 16	5.06.00, b)	Pre Filter (Cartridge Filter): Type: Back washable	Bidder proposes non back washable pre filter instead of back washable. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.

967	SECTION-VI / PART-A SECTION – VI, PART-E SECTION – VI, PART-E	SUB-SECTION-I INTENT OF SPECIFICATION 4540-001-POM-A-037- Plant Water Scheme 4540-136-POM-A-001- Liquid Effluent Treatment System	3 of 8	1.02.00	Water Treatment Plant Including, - DM plant and CW chemical treatment. - Pre treatment and liquid effluent treatment plant - Chlorine di-oxide plant - Condensate polishing unit including regeneration facility - <u>Reverse osmosis plant for waste water</u> - Laboratory equipment	Discrepancy observed between referred drawings and tender specification for ETP. In absence of clarity, Bidder understands that all liquid effluents shall be collected and treated with Flash mixer/tube settler and lamella clarifier in line with tender drawing of Liquid Effluent Treatment System and no any Reverse osmosis (RO) treatment is envisaged for waste water system. Please confirm Bidder's understanding and kindly amend the specification.	Bidder's understanding is not correct. Bidder to design the complete Plant as ZLD compliant meeting the technical specification requirement as a minimum. Bidder shall further consider and provide any other system as required for waste water system for meeting ZLD compliance.
968	SECTION-VI / PART-B SECTION – VI, PART-E SECTION – VI, PART-E	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A- 2 EQUIPMENT SIZING CRITERIA 4540-001-POM-A-037- Plant Water Scheme 4540-136-POM-A-001- Plant Water Scheme	59 of 101	3.05.00	h) Service Water System Clarified water from the clarified water tank shall be used as service water. Service water pumps shall take suction from this tank and supply water to the service water pipe network. Capacity of service water pumps shall be as follows: Capacity of each Pump – as per system requirement (minimum 200 Cu.m/hr).	Discrepancy observed between tender specification and drawings regarding source of the service water. As per referred P&ID and Layout of liquid effluent treatment system and Plant Water Scheme, treated service water and CW blowdown water also used as service water, however, as per clause 3.05.00, only clarified water from the clarified water tank is mentioned. Requests Owner to clarify that treated service water and CW blowdown from CMB shall be used as service water or not.	Bidder understanding is not correct. Clarified water from the clarified water tank shall be used as one of the source of service water. Further, bidder to provide provision of re-use of treated service water and CW blowdown from CMB as shown in 4540-001-POM-A-037 and 4540-136-POM-A-001 in service water system.
969	SECTION-VI / PART-B	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A- 2 EQUIPMENT SIZING CRITERIA	58 of 101	3.05.00	d) AC & Ventilation System Makeup Pumps Capacity of each Pump – To meet complete makeup requirement of AC & Ventilation systems (all AC Plants and Air-washer units) of the complete station (minimum 100 m3/hr). e) FGD Gypsum wash System Makeup Pumps Capacity of each Pump – To meet complete makeup requirement of FGD Gypsum wash requirement.	Bidder proposes to consider common pumps for the AC & Ventilation System Makeup and FGD Gypsum wash System Makeup. Also, the minimum capacity of the pump can be decided based on the actual requirement of AC & Ventilation System Makeup and FGD Gypsum wash System Makeup. Accordingly, minimum 100 m3/hr need not to be followed. Please confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
970	SECTION-VI / PART-B SECTION – VI, PART-E SECTION – VI, PART-E	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A- 2 EQUIPMENT SIZING CRITERIA 4540-001-POM-A-037- Plant Water Scheme 4540-136-POM-A-001-- Liquid Effluent Treatment System	59 of 101	3.05.00	h) Service Water System Clarified water from the clarified water tank shall be used as service water. Service water pumps shall take suction from this tank and supply water to the service water pipe network. Capacity of service water pumps shall be as follows: Capacity of each Pump – as per system requirement (minimum 200 Cu.m/hr).	Discrepancy observed between tender specification and drawings regarding source of the service water. As per referred P&ID and Layout of liquid effluent treatment system and Plant Water Scheme, treated service water and CW blowdown water also used as service water, however, as per clause 3.05.00, only clarified water from the clarified water tank is mentioned. Requests Owner to clarify that treated service water and CW blowdown from CMB shall be used as service water or not.	Bidder understanding is not correct. Clarified water from the clarified water tank shall be used as one of the source of service water. Further, bidder to provide provision of re-use of treated service water and CW blowdown from CMB as shown in 4540-001-POM-A-037 and 4540-136-POM-A-001 in service water system.
971	SECTION-VI / PART-B	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A- 2 EQUIPMENT SIZING CRITERIA	58 of 101	3.04.00	All water systems including CW chemical treatment system shall be designed considering the total make-up water availability of 6000 m3/hr without AWRS and 3900 m3/hr with AWRS.	Bidder understands that CW chemical dosing and complete water system shall be designed based on the capacity decided as per the tender datasheet and actual requirement, total make-up water availability is indicated for the reference only, please confirm.	Bidder to note that CW chemical dosing system shall be designed for the worst condition requirement which shall be decided during detailed engineering considering minimum of 5 COC and meeting specification requirement.
972	SECTION-VI / PART-B	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A- 2 EQUIPMENT SIZING CRITERIA	59 of 101	3.05.00	Capacity of each Pump – as per system requirement (minimum 200 Cu.m/hr). i) Potable Water System Potable water system shall meet the drinking water required for all the plant facilities/ buildings included in Contractor's scope and supply water to Employer's colony up to the specified terminal point. Number and Capacity of pumps shall be as follows: Capacity of potable water requirement will be 80 m3/hr for colony and 20 m3/hr (minimum) for plant	Bidder noted the Capacity of potable water requirement for colony and for plant, However, Owner is requested to provide the actual consumption of the potable water in the colony as well as plant to decide average potable water consumption for water balance.	Bidder to calculate average potable water requirement in colony and plant for water balance based on latest statutory norms of manpower water consumption requirement and good engineering practice. However capacity of pumps shall be in line with specification requirement.

973	SECTION-VI / PART-B	SUB-SECTION-A-14 BID DOC.NO. CS-4540-001A-2 WATER TREATMENT PLANT	20 of 36	11.01.00	9) Chemical preparation tanks with necessary agitation requirement shall be provided as required. After neutralization, the neutralized wastewater shall be pumped to N-pit.	Bidder understands that chemical waste of ClO2 plant shall be transferred to the N-pit and in N-pit neutralization process will be carried out.	Bidder's understanding is not correct. After neutralization of chemical waste of ClO2, it shall be pumped to N-pit.
974	SECTION-VI / PART-B	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A-2 EQUIPMENT SIZING CRITERIA	64 of 101	3.06.00	Bidder shall consider DM water consumption during boiler hydro test, cold startup of the both units in design calculation while sizing the DM plant and DM water storage tanks.	Bidder proposes to consider DM water consumption during boiler hydro test, cold startup of the one unit and not for both units running simultaneous, other unit will be considered as running in stable load, for design calculation of sizing the DM plant and DM water storage tanks.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
		SUB-SECTION-A-14 BID DOC.NO. CS-4540-001A-2 WATER TREATMENT PLANT	31 of 36	20.00.00	DM water storage tanks	Owner is requested to please confirm acceptance.	
975	SECTION-VI / PART-B	SUB-SECTION-A-01 BID DOC.NO. CS-4540-001A-2 EQUIPMENT SIZING CRITERIA	60 of 101	3.06.00	Chemical House: A common two (2) storey Chemical house of RCC construction shall be provided to install various Chemical dosing equipment, pumps, tanks, piping etc. of PT-CW & Potable, PT-DM, PT-RO plant (As applicable)	Bidders understands that common chemical house can be provided for all plant chemical including the CW chemical dosing. Please confirm Bidder's understanding.	Bidders understanding is not correct. Separate chemical house for PT- DM and CW chemical treatment shall be provided by the bidder meeting the technical specification requirements.
976	Section-VI/Part-B Section-VI/Part-E	SUB-SECTION-D-1-5 4540-001-POC-A-007	23 of 120	5.04.02	Raw water reservoir shall have gross usable capacity as indicated in the tender drawing THE RAW WATER RESERVOIR SHALL HAVE A GROSS USEABLE CAPACITY OF 127500 CUBIC M EXCLUDING DEAD STORAGE.	Bidder understands that gross usable capacity of raw water reservoir shall be 127500 M3 excluding dead storage and free board. Please confirm bidder understanding.	Bidder understanding is correct.
977	General				FGD Waste water	Bidder understands that FGD waste water shall be discharge to Ash slurry sump. From ash slurry sump, it will dispose to Mind void by ash slurry disposal pumps. Please confirm bidder understanding.	Bidder understanding is correct.
978	Section VI/ Part-B/ Sub section-A-01	Section VI/ Part-B/ Sub section-A-01	69	3.12.02 (iv)	All the landings of boiler staircases, turbine building, crusher house, transfer points/junction house of internal & external CHP, bunker floors, service building, administrative building, etc. and other multi-storied structures of the entire plant shall be provided with hydrant landing valves. The PLC based panel at fire water pump house and Remote IO panel at Booster pump house shall indicate the status of each pump, system pressure, operation of hydrant and/ or spray system, failure of starting of pumps, healthiness & failure of batteries/ chargers, main supply, low level of fuel oil of diesel engines, tripping of pumps, low level / very low level of water in the water supply system, status of batteries & chargers of panels and diesel engines etc. Alarms from these panels shall also be available to operator at fire alarm addressable panels, central monitoring station and DDCMIS. Control & operation of fire water pumps and borewell pumps of external CHP (at plant end & mine end) shall be possible from OWS at respective DDCMIS of external CHP control system.	External CHP area is located remotely from main plant and it is not part of this specific project. Bidder understands that no fire protection and detection system is envisaged for external CHP area in this tender. Please confirm Bidder's understanding.	Bidder's understanding is correct. Refer amendment in this regard. Amendment No : A-PU-1 Amendment No : A-PU-2 Amendment No : A-PU-3 Amendment No : A-PU-4
	Section VI/ Part-B/ Sub section-A-01	Section VI/ Part-B/ Sub section-A-01	72	3.12.05 (i)			
979	Section VI/ Part-A	Sub section-A-12	6	4.00.00	d) MVW Spray system 1) Various cable galleries (in Main Plant area, in ESP control Building, in FGD Buildings, Switchyard, AHP control Building, CHP control Building, Water Treatment Control Building, etc.).	Bidder understands that MVW spray system shall be provided for protection of cable galleries/vault wherever cable galleries/vault are considered for electrical and control buildings as per electrical design requirements. Please confirm Bidder's understanding.	Bidder's understanding is correct.

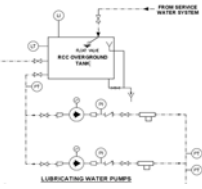
980	Section VII/ Part-A	Sub section-IIA-12	6	4.00.00	d) MVWS spray system 7) All cable trestles of main plant area (from transformer yard to chimney)	1. Bidder understands that fire protection system shall be considered for the Cable trestles only where multiple cable tray arranged in vertical section like its generally arranged in various cable vault of electrical buildings and not in the section where other type of arrangement applicable as practically its vary difficult to arrange fire protection system for each cable tray on Trestles. 2. Fire detection with LHS cable shall also be provided only on alternate tray. Please confirm Bidder's understanding.	1. Bidder's understanding is not correct. MVW spray system shall be provided for all cable trestles of main plant area (from transformer yard to chimney). 2. For LHS cable detection system, Bidder to refer clause 5.05.00, Sub-Section-A-18 (Fire Detection & Protection System), Part-B of Technical Specification.
981	TECHNICAL SPECIFICATION SECTION – VI, PART-A	SUB-SECTION-IIA-15 COAL HANDLING PLANT	4, 5 of 7	1.20.00	Adequate number of ventilation equipment for ventilating the underground portion of Track Hopper, underground tunnel of Conveyors, underground portion of Transfer Points, Coal Stackyard shed complete with all mechanical, electrical, civil and structural works and associated foundations.	Bidder understands that Coal Stackyard shed shall be provided with Natural Ventilation and hence, Mechanical ventilation is not envisaged. Please confirm Bidder's understanding.	Bidder's understanding is correct.
982	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	77 of 101	3.13.01	7. In Air conditioning system the return air shall be through ducts and use of plenum space for return air shall be avoided. Further, FGD control room and ESP Control Room, service building, etc. where various floors are air-conditioned and no intermediate or intervening floor are left non-air-conditioned, the space above false ceiling shall be used as return air plenum.	Bidder understands that Administrative building also to be provided with only supply air duct and the space above false ceiling shall be used as return air plenum in line with service building. Please confirm Bidder's understanding.	Bidder's understanding is correct.
983	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	78 of 101	3.13.01	Air Conditioning system for Service Building, Canteen Building, Administrative Building, etc. shall be designed in- line with ECBC code to make it "Green Building".	Bidder understands that Service Building, Canteen Building and Administrative Building only shall be designed in- line with ECBC code to make it "Green Building". No other building is considered for Green Building design, Please confirm Bidder's understanding.	Bidder's understanding is correct.
984	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	80, 81 of 101	3.13.02	(v) GIS building Centralized mechanical ventilation system comprising of centrifugal fans, pre & fine filters, ducting, grilles/diffusers, back draft dampers, acoustic insulation (if required), etc.	Bidder proposes to consider wall mounted supply air Axial fan filter unit for mechanical ventilation of GIS buildings inline with past project. Please note that ducting may obstruct and interfere with Crane movement inside GIS hall. Please confirm acceptance.	In view of huge requirement of ventilation air, centralized mechanical ventilation system has been envisaged. Bidder to comply with specification requirements.
985	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	112 of 120	5.24.00	CHP Workshop cum Office Building: This shall be RCC framed structure having two storeys in office area and single storey (double height) in workshop area. Total floor area of the building shall be 900 Sq.m (700 Sq.m. Office area and 200 Sq.m. Workshop).	Bidder understands that Air conditioning and Ventilation system for CHP Workshop cum Office Building is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incase, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification

986	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	112 of 120	5.25.00	O&M WORKSHOP BUILDING: The office complex shall be 6.50mX110m in plan area. The office complex shall be made 2 storied for adequate space for operating personnel, MCC room, stores, Laboratories, Toilets, Conference room & Tool room. The floor to floor/ roof clear height shall be 4.50m.	Bidder understands that Air conditioning and Ventilation system for office complex is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incuse, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification
987	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	114 of 120	5.31.00	FQA BUILDING: Total area shall be decided based on the requirements based in QA chapter, however, minimum area shall not be less than 800 Sqm	Bidder understands that Air conditioning and Ventilation system for FQA BUILDING is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incuse, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification
988	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	113 of 120	5.27.00	FIRE STATION BUILDING: It shall be of RCC Frame structure& Brick masonry. The building shall be provided with area 600 sq. m required to accommodate Fire tenders and fire personnel including Dy./Asst. Commandant's (Fire) office.	Bidder understands that Air conditioning and Ventilation system for FIRE STATION BUILDING is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incuse, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification
989	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	113 of 120	5.28.00	DOZER SHED: The building shall provide for Dozer shed space, Workshop space, Office Rooms, Stores, Toilet & Pantry as per functional requirement. Minimum size of the dozer shed shall be 500 Sq.m.	Bidder understands that Air conditioning and Ventilation system for Dozer shed space, Workshop space, Office Rooms, Stores, Toilet & Pantry is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incuse, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification

990	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	119 of 120	5.33.00	Safety Control Room	Bidder understands that Air conditioning and Ventilation system for Safety Control Room is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incase, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification
991	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	119 of 120	5.34.00	BIO TOILET	Bidder understands that Ventilation system for BIO TOILET is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incase, HVAC system is to be provided by Bidder than Owner is requested to provide the details of the same.	Bidder's understanding is not correct. A/C System for control room/RIO room/office areas/etc. of all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. Ventilation System for all area/buildings (which are in the scope of the Bidder) is in the scope of the Bidder. For sizing & type of A/C and Ventilation System, Bidder to refer clause 3.13.00, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification
992	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	119 of 120	5.35.00	WORKER'S ACCOMODATION BUILDINGS	Bidder understands that Ventilation system for WORKER'S ACCOMODATION BUILDINGS is not envisaged as per tender specification. Hence, HVAC for the same has not considered by the Bidder. Please confirm Bidder understanding. Incase, HVAC system is to be provided by Bidder than Owner is requested to provide the details for the same.	Only provision for centralised Aircoolers is envisaged as shown in tender drawings.
993	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	79 of 101	3.13.01	DESIGN PHILOSOPHY - Air conditioning system 20. During normal operation period, all the working equipment shall run on A.C. power supply. However, in case of complete black-out condition, DG sets being provided are required to cater the load of some of the air-conditioning equipment so that Main Plant Control Rooms and CER remain air-conditioned. The equipment to run on DG set are: * 2 nos. AHUs for CR & CER	Bidder understands that only one AHU shall be operating in emergency condition for CR and CER. Please confirm Bidder's understanding.	Bidder's understanding is not correct. Two (2) Nos. AHUs for CR & CER shall be operating in emergency condition as specified at referred clause.
994	SECTION- VI, PART – B	SUB SECTION- G-03 LAYOUT PHILOSOPHY	1 of 15	1.01.02 (c)	Face of the buildings and facilities shall be located in such a way so as to have an offset of minimum 15 m with respect to center line of double lane road and 12 meter with respect to center line of single lane road...	Considering limited space availability for accommodating all the facilities of plant meeting the functional requirements, it is requested that the requirement of 15m/12m shall be relaxed to 12m/9m on case to case basis.	Bidder to comply specification requirement .
995	TECHNICAL SPECIFICATION SECTION – VI, PART-E	4540-999-POC-F-001	-	General Layout Plan	Space for CO2 capture (60 x 50)	It is understood that the location indicated in GLP for CO2 capture is indicative and the same can be adjusted by Bidder based on their layout. The same shall be permitted to be relocated just outside the Power Block area. It is also understood that space allocation (60 x 50) is tentative and can be adjusted slightly in Shape and Size. Please confirm.	The bidder has flexibility to the extent that the width of the area of carbon capture may be reduced to minimum 40 m from existing 50 m shown in tender drawing while maintaining the total area of 3000 m2 . Also , minor shifting of the area may be done to the extent that the distance from chimney may not increase by more than 20 m from the existing distance shown in GLP

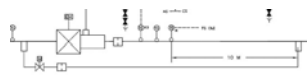
996	Section -VI, Part-B	Sub-section-G-03	1 of 15	1.01.02, b)	The area for construction/erection facilities like lay-down, pre-assembly, offices and stores is to be managed by the Bidder within the overall area available within the plant boundary as shown in General Layout Plan. In case bidder requires additional area, he shall make his own arrangement at....	Bidder understands that vacant land of the plant as indicated in GLP for laydown and pre assembly area, future green belt...etc can be utilized for Stage-III facilities, if required. Please confirm acceptance.	Only space for pre assembly and batching plant area as marked in GLP can be utilized.
997	Section -VI, Part-B	Sub-section-G-03	4 of 15	1.01.02, c)	Face of the buildings and facilities shall be located in such a way so as to have an offset of minimum 15 m with respect to center line of double lane road and 12 meter with respect to center line of single lane road....	Offset distance for building from center line of road to face of the building may compromise in some cases due to space constraint in the plant. Kindly accept it.	Bidder shall comply with specification requirement.
998	Section -VI, Part-B SECTION – VI, PART-E	Sub-section-G-03 SECTION – VI, PART-E	4 of 15	1.01.02, c) 4540-999- POM-F-001, Rev. 0	In case of rail track minimum 3 m horizontal clearance between face of adjacent structure to center line of rail and 8.5m vertical clearance between bottom of structure to top of rail shall be maintained. GLP	As per GLP, pipe rack is indicated on rail track for Fly ash handling system. Bidder understands that there will be sufficient space available on rail track to locate the pipe trestle structure/ foundation. Please confirm Bidder's understanding.	Detail engineering has to be done by the bidder in compliance with technical specifications and railway statutory requirement .
999	Section -VI, Part-B	Sub-section-G-03	10 of 15	1.03.00, 39 (VII)	In the tier of trestle, wherever fly ash handling pipes are routed, grating platform all along the length and for full width of the gallery and trestle of that tier shall be provided.	Bidder understands that required grating will be provided only below the containing fly ash conveying pipes. No grating is envisaged on the tier where all water and air pipes will be installed. Please confirm bidder understanding.	Bidder understanding is correct.
1000	Section -VI, Part-B	Sub-section-G-03	5 of 15	1.02.00 (g)	Bidder as a safety requirement shall provide Fire wall on A-row of TG building in front of power transformers as per the statutory and safety requirements.	Bidder understands that Fire wall on A-row of TG building is not envisaged if the distance of power transformer from A row is maintained inline with statutory requirements. Please confirm.	Bidder to comply technical specification and shall provide fire Wall at A row as per the statutory and safety requirement
1001	Section -VI, Part-B	Sub-section-G-03	1.04.00	14 of 15	5. The Bidder shall also make arrangement for storing following mandatory spares (whichever is applicable as per scope of the package) inside TG hall with access from EOT crane: a. Complete assembly of HPT module or its alternative, as applicable b. Complete assembly of IPT module or its alternative, as applicable c. LP Turbine bladed rotor assembly d. HP/IP/LP casing e. Drive Turbine bladed rotor for TDBFP f. Generator Stator/ Generator Rotor g. Boiler Feed Pump motor	Item (f): Generator stator is not applicable. Please confirm.	It is clarified thar Generator stator is not applicable.
1002	Section - VI, Part-E	Section - VI, Part-E	-	4540-999- POC-F-001, Rev. 0	Note 7 : For Boundary wall, this drg may be referred.....and security of the plant.	a) Owner to note that new boundary wall is overlapping with existing boundary in southwest and east direction. Therefore, the existing boundary wall in those location needs to be completely dismantled in order to construct new boundary wall. Bidder understands that the dismantling of existing boundary wall will not be allowed by CISF officials considering the safety of the plant and the said boundary is also in good condition. Therefore, the part of existing boundary wall which is completely overlapping with new boundary wall is not required to be dismantled. Please confirm. b) In case the aforesaid proposal is not acceptable, and Owner wants Bidder to dismantle the aforesaid wall then the construction sequence may please be advised.	a) New boundary wall is to be constructed as shown in the GLP. b) Dismantling and new construction in overlapping area to be taken up in consultation with site during execution of work.

1003	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	27 OF 28	6.00.00	Provision for ready plant for methanol firing The methanol as produced above (refer cl. 5.00.00) shall be utilized, as a co-firing fuel/support fuel, for future firing in the boilers under the package scope. The provisioning of methanol as a future fuel shall be for 30% BMCR load. The same shall be done by providing/identifying required space including necessary provisioning for pipe routings, cables etc. and for this purpose loads to be factored-in for the trestle design, cable design. The required space for this purpose has been shown in GLP. The space for the pumps, tanks etc. shall be kept for the above in fuel oil pump house and boiler area also. Also refer space provisioning requirements referred elsewhere in the specifications.	Bidder understands as under regarding methanol firing provision: 1. Bidder understand that storage of methanol shall be provided inside methanol production area by Owner. 2. Further, Methanol pressurising pumps shall also be kept in Methanol production area near methanol storage. 3. Bidder will provide space for methanol supply piping to Boiler on pipe cum cable trestle. 4. No space shall be provided for methanol pressurising pumps in Fuel oil pump house area. 5. Space provision shall be provided at boiler ground level for methanol drain tank. Owner to confirm Bidder's understanding.	Bidder to note the following- 1 & 2. Bidder's understanding is not correct. Necessary space shall be kept in boiler and FOPH (Fuel oil pressurizing pump house) area. 3. Necessary space and loading provisions shall be kept in the provided carrying arrangement (cable/trestle etc.) towards supply pipe from FOPH to boiler as per above. 4. Bidder's understanding is not correct. Space shall be provided in line with the specifications requirements. 5. Space provisions shall be kept for tanks as specified.
1004	SECTION-VI, PART-A	SUB SECTION-A-22 SEPARATION OF PLANT DRAINS FROM STORM WATER DRAINS	3 OF 3	1.11.00	Fuel oil handling Area The wash water from the FOPH area containing traces of oil shall be pumped to oil water separator RCC pit in the fuel oil unloading area. The decanted water shall be reused/recycled for the washing of fuel oil handling areas. Parallely, decanted water shall be collected in FOH area RCC pit/ sump(s) and pumped to Employer's waste service water sump (WSWS) located in LET plant.	Wash water from FOPH area shall be transferred to WSWS which is in bidder scope. Please confirm.	Bidder's understanding is not correct. Bidder to provide the complete system for wash water from the FOPH area containing traces of oil shall be pumped to oil water separator RCC pit in the fuel oil unloading area. The decanted water shall be reused/recycled for the washing of fuel oil handling areas. Parallely, decanted water shall be collected in FOH area RCC pit/ sump(s) and pumped to Employer's waste service water sump (WSWS) located in LET plant as specified in specification.
1005		SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	3 OF 4	1.05.00	Raw water system to supply water to Water Pre-Treatment (PT) Plant and Ash water makeup including 3 x 50% Raw water PT pumps and 3x 50% Raw water Ash pumps. Both the systems Raw water (PT) and Raw water (Ash) should be designed with separate Forced water lubrication	Bidder proposes common lubrication system for raw water pumps for PT and ash. Please confirm.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
1006	SECTION – VI, PART-A SECTION – VI, PART-A SECTION-VI, PART-B	1) SUB SECTION IIA-11 CW SYSTEM 2) SUB SECTION IIA-11 CW SYSTEM 3) SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1) 3 OF 4 2) 1 of 4 3) 69 OF 101	1.05.00 1.01.01 (7) 3.11.00	1) One number EOT crane (10 tons minimum capacity) shall be for equipment handling and 2 tons minimum capacity electric hoist for handling stoplog gates & trash racks in Raw water pump house. 2) One (1) number 60 Tons (minimum) capacity EOT crane for CW pump house for handling of pumps, drives, discharge Valves, rubber expansion joint etc. during erection, operation and maintenance & one (1) number 5 Tons (minimum) capacity auxiliary monorail electric hoist for handling trash rack & stop log gate. 3) Cranes & Hoists should be sized to handle heaviest component to be handled with 25% margin (with minimum capacity if specifically indicated elsewhere for any system/ equipment) and should comply to IS: 3177/IS: 3938 (as applicable).	Bidder understands that crane capacity shall be fixed based the design criteria specified in Part – B, Mechanical, Section – VI, Sub section-A-01 Equipment sizing criteria ,Pg. No 69 OF 101 (PDF Pg.No 1508 of 2672) at Clause No.3.11.00 . Owner to confirm.	Bidder to note that capacity requirements specified for EOT cranes of CW/RW & MUW PH are Minimum capacity to be provided. However, higher design capacity required in line with Clause No 3.11.00, Point a), Sub-Section A-01, Part-B is in bidder's scope.
1007	SECTION-VI, PART-A	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	57 OF 101	3.03.00 1(b)	a. For TG ECW system- Design flow required for all TG coolers b. For SG ECW system- Design flow required for all SG auxiliaries + other Station Auxiliaries (Air compressors, Mill reject, Ash Handling compressors, FGD & SCR system, any other system envisaged by the bidder)	Alternatively, For Station Auxiliaries separate Primary Cooling water (ECW) and Second cooling water system (ACW) along with Separate cooling tower for station auxiliaries is also acceptable. In such case, SG ECW system shall carry Equipment cooling water requirement for Boiler& auxiliaries only. Owner is requested to please accept.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
1008	SECTION-VI, PART-A	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	58 OF 101	3.03.00 sr no (5)	Overhead ECW (DM water) tank (separate for TG ECW system and SG ECW system): 1 X 10 cum (min.) (at 60% of the tank height)	We propose to consider 10 m3 as minimum tank volume and other margins like freeboard, dead volume etc. (as applicable) shall be decided by OEM as per their standard practice during detail engineering. Owner to please accept the same.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.

1009	Section VI Part-B	1) SUB SECTION A-15 CW SYSTEM 2) SUB-SECTION-IID CIVIL WORKS 3) SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA 4) SUB SECTION A-15 CW SYSTEM	1 of 31 6 OF 13 55 OF 101 27 OF 31	1) 1.01.00 2) 1.00.00 sr no 13 3) 3.01.00 sr.no (h) 4) 9.00.00 (7)	1) CW pumps shall be located in CW pump house with shed. 2) CW pump house with steel superstructure and metal sheeting at roof including pump foundations, maintenance area, forebay and Transition zone. 3) Location of Pumps: Indoor 4) Pumps and drives to be designed for : Outdoor duty & Continuous Operation	We understands that CW pump house shed is open from side and steel roof at top. Owner to please confirm.	Confirmed
1010	Section VI Part-B	SUB SECTION A-15 CW SYSTEM	31 OF 31	1.00.0	Control philosophy for CW System, MuW, ECW and Auxiliary Water Pumps etc The Pumps shall be controlled from the Control Room	We understands that MUW pump shall be controlled through control room located near MUW pump house. Owner to please confirm.	Bidder understanding is correct. MUW pump shall be controlled from control room located near MUW pump house. Also refer clause no 2.04.05 of IIC, part A for remote operation of Make up water system.
1011	Section VI Part-B	1) SUB SECTION A-15 CW SYSTEM 2) SUB-SECTION A - 14 WATER TREATMENT PLANT 3) Technical Data sheet of Pumps	1)21 OF 31 2) 25 OF 36 3) 24 OF 31	1) 2.07.00 (c) 2) (C) 1 3) 5.00.00	1) A DM water makeup pump house shall be provided near the main DM Water Storage tanks of Water Treatment Plant. All the pumps and associated pumps, drives, Valves etc. shall be located indoor in this pump house. 2) Service of duty -----Continuous, outdoor ----- 3) Pumps and drives to be designed for: Outdoor duty & Continuous Operation.	Bidder understands that DM water, Service water, Clarified make up, filter water pump, Treated water, Potable water pumps are located outside in open pump house . Owner to please confirm bidder understanding.	Bidder understanding is not correct. Bidder to refer SUB SECTION A-14 WATER TREATMENT PLANT CLAUSE 1.01.00 (3).
1012	Section VI Part-B	XXXX-001-POM-A-038A SCHEME DIAGRAM OF RAW WATER SYSTEM	44 of 73			In flow diagram service water tapping is provided at lubrication tank inlet. We understand that provided tapping is only required for initial filling of tank for normal operation tapping from RWP (PT) header and RWP (Ash) header shall be considered. Owner to please confirm.	Bidder's understanding is correct
1013	Section VI Part-B	SUB SECTION A-15 CW SYSTEM	20 OF 31	2.01.0	From the water reservoir in the Plant, raw water shall be drawn to the Raw Water pump house sumps through an intake channel and forebay OR through Intake Pipes	As per past project experience (i.e 2X660 MW Khargone TPP, 2X660 MW Buxar TPP) we propose Raw water sump shall be directly connect to reservoir via intake channel without forbay or intake pipe. Owner to please accept.	Bidder's proposal is not acceptable. Bidder to comply the technical specification requirement.
1014	Section -VI, Part-B	A-08	10 of 19	1.08.0, Notes : (4)	Gland packing for gate and globe valves shall be alloy steel/SS wire reinforced graphite with stem corrosion inhibitor.	Gland packing will be selected suitably based on the operating conditions of fluid and it's service. Based on services, Teflon single/double and Garlock packing may also be used as an alternative of Graphite packing. Owner is requested to confirm.	Bidder's suggestions based on proven design may be considered during detailed engineering.
1015	Section -VI, Part-B	A-08	12 of 19	1.13.00, 3)	All gate and globe valves shall have bonnet-back seating arrangement or similar arrangement as per manufacturer's standard proven practice.	Back seating is not required for the valves under controlling / regulating services as the packing of these valves can't be replaced during operation. However, for other application, spec requirement will be followed. Owner is requested to confirm Bidder's understanding.	Bidder's suggestions based on proven design may be considered during detailed engineering.
1016	Section -VI, Part-B	A-08	12 of 19	1.13.00, 7)	All gate, and globe valves of size 50 mm and below in vacuum service shall have extra deep gland packing without requiring water gland sealing. All gate and globe valves of size 65 mm Nb and above in vacuum services shall have adequately deep gland packing and shall be equipped with lantern rings to admit pressurized water for gland sealing.	Bidder proposes to use Garlock packing as an alternative for valves operating in vacuum conditions. Owner is requested to confirm Bidder's proposal.	Bidder's suggestions based on proven design may be considered during detailed engineering.
1017	Section -VI, Part-B	A-09	04 of 19	2.03.05	Material of construction for pipes carrying various fluids shall be as follows:	Material requirement for some low pressure piping system (plant drains, service water) is not specified in tender spec. Bidder understands that material selection for low pressure piping shall be as per relevant codes and standards..	Material has been specified for various types of water based on Quality. Bidder to note that based on type of Water & quality, material shall be selected.
1018	Section -VI, Part-B	A-09	03 of 19	2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 NB and above as required for periodic observations and inspection purposes.	Inspection holes shall be provided at suitable locations for pipes 1200NB and above as required for periodic observations and inspection purposes as per standard practice. Please confirm.	Bidder's Proposal not acceptable. Bidder to comply the specification requirements.

1019	Section -VI, Part-B	A-09	10 of 19	2.12.02	Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gunmetal for sizes 50 Nb and below. For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.	Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , etc. 50 Nb and below shall be forged steel body ASTM A 105 For compressed air and potable water applications, stainless steel forged valves shall be provided for sizes 50 NB and below.	Bidder may please refer Clause No. 2.13.01 (d), Sub-section: A-09, Part-B of Technical specification, which mentions "Forged carbon steel & Forged stainless steel valves are also acceptable in place of Gun metal valves."
1020	SECTION – VI, PART-B	SUB SECTION –VI CHAPTER-08 WATER SYSTEM	PAGE 3 OF 27	1.00.00 SL.No 7	Complete assembly of rubber expansion joints (including bolts & nuts)	Bidder understand that spares shall be provided for each type of rubber expansion joint as below. i) Control rod ii) Stretcher Plate iii) Rubber bellow iv) Fasteners Complete assembly is not required. Owner requested to confirm.	Bidder understanding is not correct. One (1) set of complete assembly of rubber expansion joint (including bolts & nuts) of each type /size / rating to be provided as per specification.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1021	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	SEC A-01	PAGE 50 OF 101	CI 2.06.01 Boiler feed pump	The conditions corresponding to (i) (5) shall be met by MDBFP at 47.5Hz.	Bidder understands that MDBFP shall be capable to develop head corresponding to 100%TMCR at 47.5 Hz frequency. Please confirm Bidder understanding.	Bidder understanding is not correct.It shall be as per BMCR/VVO as per the conditions mentioned for head & Flow.Please refer clause 2.06.01 (i) 5 (a) & (b) for more clarity.Bidder to comply specification requirement.
1022	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	SUB SECTION-A-01	PAGE 54 OF 101	CI 2.09.00	Low Load Feed Control valve (0 to 30% BMCR capacity range) in Feed regulating station (FRS) for feed water flow control , downstream of BFPs, shall be sized with maintaining a differential pressure (DP) of 5kg/cm2(abs) during unit startup upto 30% BMCR Load.	Feedwater flow control below 30% BMCR shall be done using the FRS and the control philosophy shall be as per OEM standard practice. Please confirm Bidder understanding.	This is as per NTPC operating experience and specified differential pressure shall be also used for sizing of control valve.Bidder to comply specification requirement.
1023	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	SUB SECTION-A-01	PAGE 48 OF 101	2.03.06	Provide sentinel relief valve on tube side. Relief valve on shell side sized to pass flow from two ruptured tubes (four open ends) or 10% of water flow corresponding to VVO condition with 3% make up and 77 mmHg (abs) condenser pressure at 10% accumulation whichever is higher and set to open at heater shell design pressure.	As per HEI requirement, Shell side relief valve shall be sized for 10% of the feed water flow or Flow based on the clean rupture of one heater tube resulting in two (2) open ends discharging , whichever is greater, at 10% accumulation. Please confirm acceptance.	This is based on NTPC operating experience and for ensuring safety of the system.This is over and above HEI requirement specified.
1024	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	SUB SECTION-A-07	PAGE 4 OF 25	CI 1.16.00	Seat tightness of the HP and LP bypass valves shall be equivalent to block valve tightness conforming to MSS SP61.	Bidder clarify that leakage class MSS-SP-61 is applicable only for On-Off valves. The same is not envisaged for Control Valves. Please confirm acceptance.	HP and LP Bypass valve operates in control mode only during start-up and transient phases. In normal operation these will work in off mode so this requirement of tightness shall be MSS-SP61 to avoid any leakage. Bidder to comply specification requirement.
1025	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	SUB SECTION-A-07	PAGE 5 OF 25	CI 01.16.00	HP-LP Bypass should have the provision of removable valve seat arrangement for ease of maintenance	HP-LP bypass valve seat arrangement shall be as per standard proven practice of supplier. Please confirm acceptance.	In past for sub-critical units valves with removable type seat have been offered and supplied. Further, welded or removable seat is not related to provenness. Bidder to further refer amendment. (Amendment No : A-TG-10)

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1026	TECH SPEC-PART 6	Flow diagram HP & LP bypass system	Drg. No. 4540-999-POM-A-005	-		The required pressure drop shall take place in HP bypass valve itself. Hence, the orifice at downstream of the HP bypass valve shall not be required. Please confirm acceptance.	This shall be discussed during detail engineering.
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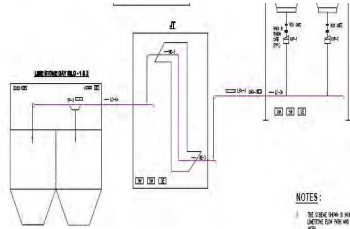
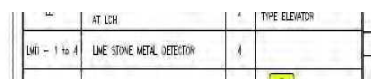
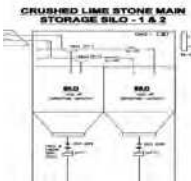
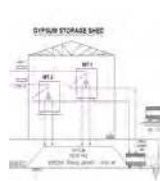
Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1027	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.20	34 of 101	ESP SIZING CRITERIA (A) Electrostatic Precipitator Design Data Design Point 2. Type of Coal - Worst coal (max. ash coal from range)	Bidder understands that Type of Coal - Worst Coal (max. ash coal from range) indicated in referred clause of ESP sizing criteria are to be considered from "Range of 95% coal supplies" mentioned under DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2 . Please confirm Bidder's understanding.	Bidder to note that the type of coal should be considered from the entire range of coal.
	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2	8 of 15	Range of 95% coal supplies - Design, Worst, Best coal Range of 5% coal supplies (Range of Adequacy coal) - Worst, Best		
1028	SECTION-VI, PART-B	SUB-SECTION-E-2 ELECTROSTATIC PRECIPITATOR	1.01.01	1 of 1	2) Work tests for collecting electrodes and rigid discharges electrode include the Following: (d) Cupping test for deep drawn sheets as per IS 513.	Bidder request owner to kindly remove the Cupping Test requirement for collecting electrodes and rigid discharge electrodes based on latest version of IS 513:2016..	As per latest IS:2016 this test is there as per mutual agreement. Bidder is requested to follow the specification requirement.
1029	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.21.01	37 of 101	FGD SYSTEM SIZING CRITERIA Design Point 2. Type of Coal - Design/Best/Worst Coal whichever give maximum sizing determining values.	Bidder understands that Type of Coal - Design/Best/Worst Coal indicated in referred clause of FGD system sizing criteria to be considered from "Range of 95% coal supplies" mentioned under DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2 . Please confirm Bidder's understanding.	Bidder to note that the type of coal should be considered from the entire range of coal.
	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2	8 of 15	Range of 95% coal supplies - Design, Worst, Best coal Range of 5% coal supplies (Range of Adequacy coal) - Worst, Best		
1030	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.21.01	37 of 101	FGD SYSTEM SIZING CRITERIA Design Point 2. Type of Coal - Design/Best/Worst Coal whichever give maximum sizing determining values. 4. Gas flow (M3/sec) :To be worked out by Bidder when firing the specified worst coal at VWO load, considering 20% excess air at economizer outlet, 15% Air heater in leakage & 2% duct and 1% ESP leakage as a minimum. 6. Inlet SO2 concentration (mg/Nm3)- To be worked out by the Bidder (based on the above conditions).	Bidder understands that FGD should be designed based on flue gas flow rate when firing the specified Design/Best/Worst Coal as per SN (2) above at VWO load whichever gives maximum SO2 load in kg/hr . Hence, the corresponding Flue gas flow (m3/sec) will be selected based on maximum SO2 load in kg/hr, when firing specified Design/Best/Worst coal at VWO load, considering 20% excess air at economizer outlet, 15% Air heater in leakage & 2% duct and 1% ESP leakage as a minimum. Please confirm Bidder's understanding.	Bidder's understanding is correct.
1031	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.21.02	38 of 101	FGD SYSTEM SIZING CRITERIA The Flue Gas Desulphurisation (FGD) System shall also be designed to achieve SO2 emission of less than 100 mg/Nm3 (6% O2 dry) for the range of loads at different operating conditions and for range of coals as specified in this Sub-Section below.	Bidder understands that the range of coal as specified in referred clause are to be considered from "Range of 95% coal supplies" mentioned under DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2 . FGD system design for Range of 5% coal supplies (Range of Adequacy coal) - Worst, Best is not required. Please confirm Bidder's understanding.	Bidder to note that the type of coal should be considered from the entire range of coal.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1032	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.21.02 1.05.21.03	38 of 101	FGD SYSTEM SIZING CRITERIA 1.05.21.02 - The Flue Gas Desulphurisation (FGD) System shall also be designed to achieve SO ₂ emission of less than 100 mg/Nm ³ (6% O ₂ dry) for the range of loads at different operating conditions and for range of coals as specified in this Sub-Section below. 1.05.21.03 - The Flue Gas Desulphurisation System shall also be capable to limit SO ₂ to less than 100 mg/Nm ³ (6% O ₂ dry) on sustained basis when Steam Generator is fired with upto 30% imported coal (by weight) blended with Indian coal as specified.	Bidder understands that Clause no. 1.05.21.03 mentioned under SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA to be referred for the "the range of coals as specified in this Sub-Section below". Please confirm Bidder's understanding.	Bidder's query is not clear. However, bidder to note that the type of coal should be considered from the entire range of coal.
1033	SECTION – VI, PART-A	SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	5.03.00	4 of 7	This system shall be comprising of 2x100% gypsum dewatering system with each stream sized to dewater 110% of the maximum gypsum produced by all the two units operating simultaneously at 100% BMCR, with any coal from the specified range of coals (whichever gives the maximum gypsum flow).	As per clause 1.05.21.01, FGD sizing criteria, of SECTION-VI, PART-B, SUB SECTION-A-01, Equipment sizing criteria, FGD DESIGN POINT is VWO . NTPC is requested to modify the clause as "This system shall be comprising of 2x100% gypsum dewatering system with each stream sized to dewater 110% of the maximum gypsum produced by all the two units operating simultaneously at FGD DESIGN POINT, with any coal from the specified range of coals (whichever gives the maximum gypsum flow)". The same is already modified in recent NTPC tenders.	Refer amendmen A-SG-19 in this regard.
1034	SECTION – VI, PART-A, SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	5.05.01	5 of 7	The under flow from the secondary hydro-cyclone shall be taken to the filtrate water tank. The over flow from the secondary hydro-cyclone shall be taken to ZLD System.	Please note that overflow from the secondary hydrocyclone is taken to waste water tank and the same is pH corrected by lime neutralisation. The Ph Corrected water shall be sent to the ash slurry system. ZLD system need not to be designed for FGD system.	Agreed
1035	SCHEME OF FGD ABSORBER SYSTEM	-	4540-001-POM-A-022			Please note that as per scheme of FGD absorber system, there is emergency spray shown in bypass duct after bypass damper. Please clarify the purpose of this emergency spray in bypass duct after bypass damper.	Pl. refer 'errata' in this regard.
1036	SCHEME OF FGD MILLING SYSTEM	-	4540-001-POM-A-023			As per tender, clause no. 3.01.04, 2x100% limestone slurry pumps shall be provided for each absorber connected to each of the limestone slurry tank (total 4 nos. of pumps for 2x660 MW). As per tender flow scheme also, 2x100% limestone slurry pumps is mentioned but shown are three (3) limestone slurry pumps for each limestone slurry storage tank. Bidder understands that 2x100% limestone slurry pumps for each absorber (total 4 nos. of pumps for 2x660 MW) to be provided. Please confirm.	Bidder's understanding is correct.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1037	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B, SUB-SECTION-A-05 (FGD)	SUB-SECTION-A-05 (FGD)	3.01.00	4 of 28	The entire flue gas system, flue gas ducts inlet to absorber and bypass duct etc. shall be designed to meet the following conditions: 2. Design Inlet Gas Temperature (deg.C) 150 or as per Design Point conditions, whichever is higher	Discrepancy is found in the inlet gas temperature between the mentioned clauses. As per clause 1.05.21.01, FGD system sizing criteria, inlet temperature mentioned is 145 degree Celsius or as predicted by the bidder under conditions stipulated above, whichever is higher. However, in clause 3.01.00, it is mentioned as 150 or as per Design Point conditions, whichever is higher.	Please refer amendment A-SG-37 in this regard.
1038	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.21.01	37 OF 101	FGD SYSTEM SIZING CRITERIA The FGD system and all the associated auxiliaries shall be designed to comply with the requirements stipulated under 'Guarantee Point' and 'Design Point' conditions indicated below: <u>Design Point</u> Gas temperature at FGD inlet (deg. C) 145 degree Celsius or as predicted by the bidder under conditions stipulated above, whichever is higher	NTPC is requested to kindly clarify.	
1039	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	3.03.01 3.03.02	5 of 28	Gates at outlet to Absorber shall also be provided with 2x100 electrical heaters. Quick opening Bi-plane motorized/pneumatic damper along with 2x100% seal air fans & 2x100% electrical heaters shall also be provided in the by-pass duct.	Please note that as per specification the blade and other components in the gas path, of the bypass damper and gate at Absorber outlet shall be made of Carbon steel with C276 cladding of sheet of minimum thickness 1.6 mm or better material. The seals shall be made of Alloy C- 276 or better material. Please note that MOC of bypass damper and gate at absorber outlet is corrosion resistant. Hence, 2x100% heaters is not required. Please confirm the acceptance.	Bidder to comply with the specifications requirement.
1040	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	5.05.00	09 of 28	An emergency cooling system for automatic spray of quenching water for a sufficient time (minimum 15 min) at the inlet to the absorber, in case the gas temperature exceeds the design temperature due to failure of upstream equipment's shall be provided to protect the FGD and all other sensitive downstream equipment against high flue gas temperatures.	Discrepancy is found in the short term excursion temperature time. Bidder understands short term excursion temperature time to be considered is minimum 15 minutes. This is also as per all ongoing NTPC projects. Please confirm.	Bidder to note that the specified time is for quenching water time. Bidder to comply with the specifications requirements.
1041	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	3.01.00	04 of 28	Short temp excursion temperature of inlet gas (for approx. thirty(30) minutes at a time) (deg. C)		Bidder to note that the specified time is the flue gas temperature excursion time. Bidder to comply with the specifications requirements.
1042	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	5.06.06	10 of 28	The ME system shall be equipped with washing and drain provisions, where drains are directed into the absorber. Washing provisions shall include external and internal piping systems with replaceable nozzles, water pressure booster pumps complete with all piping, valves, instrumentation and controls. The mist eliminator wash piping shall be constructed of Chlorobutyl/Bromobutyl rubber lined carbon steel or glass fiber reinforced plastics. The mist eliminator spray headers shall be made of FRP or rubber lined Carbon Steel, corrosions and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry).	As per latest NTPC tender specification of Lot-6, the clause is modified as "The ME system shall be equipped with washing and drain provisions, where drains are directed into the absorber. Washing provisions shall include external and internal piping systems with replaceable nozzles, water pressure booster pumps (if required) complete with all piping, valves, instrumentation and controls. The mist eliminator wash piping/header shall be constructed of Chlorobutyl/ Bromobutyl rubber lined carbon steel or glass fiber reinforced plastics. Polypropylene or PVC is also acceptable for mist eliminator wash headers provided Contractor or its Collaborator has proven experience for the same. " Kindly accept the same.	PI refer amendment A-SG-38 in this regard.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1043	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	6.07.03	15 of 28	The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the limestone at part load operation. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 10mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends.	Please note that as per latest NTPC specification of Lot-6 the clause is already modified as "The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the limestone at part load operation. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends." Bidder requests NTPC to accept the same.	PI refer amendment A-SG-20 in this regard.
1044	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	7.04.09	17 of 28	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor. The elevation of discharge point of vacuum belt filter shall be atleast 10.0 m above GL.	Please note that the elevation of discharge point of VBF will depend on general arrangement of gypsum dewatering system equipment. Also, as per latest NTPC specification, the clause "The elevation of discharge point of vacuum belt filter shall be atleast 10.0 m above GL." is already removed. Bidder requests NTPC to remove minimum requirement of 10.0 m above GL for discharge point.	PI refer amendment A-SG-21 in this regard.
1045	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	5.06.17	11 of 28	The spray headers (if provided) and air supply headers shall be made of FRP or Carbon Steel with Chlorobutyl/Bromobutyl rubber lining (minimum 10 mm natural rubber lining), corrosion and erosion resistant in the inner and outer side (Silicon Carbide coating on metal/FRP surface exposed to slurry). Optionally ceramic coating is also acceptable provided bidder has proven experience for the same. The slurry spraying system shall be made of material resistant to erosion and corrosion. During the lifetime of the plant, only the nozzles shall be replaced. The distribution system of the slurry shall be hydraulically optimized. The spray nozzles shall be of silicon carbide or ceramic or equivalent having a minimum guaranteed life of 20,000 hrs. The design of the spray nozzles shall be such that rapid wear, encrustation and plugging are avoided. Nozzle pipes and slurry spray nozzles shall be with bolted flanged connections. Nozzle pipes shall be installed easily to be removed partially through absorber modules.	Please note that for JBR technology, this clause is not applicable and in recent NTPC tenders, the following clause is already added in addition to mentioned clause. " In case of JBR technology, following shall apply: 1. Slurry spray headers shall be made of Nickel based alloy in gas cooling section. 2. Air supply header inside JBR shall be made of FRP. 3. Slurry spray nozzles in gas cooling section shall be made of SiC. Other slurry spray nozzles are made of SiC or High Alumina or equivalent having a minimum guaranteed life of 20,000 hrs. All wash and water nozzles and pipes shall be made of FRP. SiC coating shall be provided inside FRP slurry pipes." Bidder requests NTPC to include the same.	PI refer amendment A-SG-39 in this regard.
1046	SECTION-VI, PART-B / SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA		1.05.13.03	18 of 101	Margin over 100% BMCR pressure requirement : 44%	Please note that for booster fan sizing, Bidder shall consider following as per all ongoing NTPC projects. Bidder shall consider the margin over pressure requirement as 44% over the calculated head value excluding the static head. Margin on Static head shall be taken as 10%. For bubbling type Absorber, Bidder shall consider choking/blockage of 10% sparger tubes while calculating the head requirements of fan. Please confirm acceptance.	PI refer amendment A-SG-40 in this regard.
1047	TECHNICAL SPECIFICATION SECTION - VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	Annexure – IV-5	11 of 15	*Guaranteed parameters (guarantee on limestone consumption, auxiliary power consumption & gypsum purity) shall be based on available (reactive) CaCO3 content of 89%.	Discrepancy is found in the CaCO3 content for guarantee case. As per annexure IV-5, limestone analysis, CaCO3 content of 89% to be considered whereas as per clause 1.03.03 of functional guarantee CaO content of 51% to be considered which corresponds to around 91% CaCO3. Please clarify.	This is not discrepancy. Please. refer note indicated in annexure IV-5 of SS-IB, section-A also for more clarity.
1048	TECHNICAL SPECIFICATIONS SECTION - VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.03.03	30 of 73	(vi) Gypsum Purity The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for the range of specified coal(s) and based on CaO content of 51% in limestone		

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1049	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	3.01.00	4 of 28	6. Recirculation Slurry pH: Not less than 5.5 under all operating conditions	Please note that this clause is applicable only for conventional spray type absorber. In case of JBR technology, Slurry pH will be maintained between 4 and 6. The same is as per all ongoing NTPC projects.	PI refer amendment A-SG-22 in this regard.
1050	SECTION – VI, PART-A	SUB-SECTION-IIA-04 FLUE GAS DESULPHURISATION SYSTEM	5.03.00	4 of 7	One (1) number passenger cum goods elevator of minimum capacity of 1000kgs for each Absorber (to be provided in case height of absorber is higher than 20m) and One (1) number passenger cum goods elevator of minimum capacity of 1000kgs in Limestone Grinding System Building shall be provided for easy access & movement of man/materials.	Discrepancy is found in the requirement of elevator between the mentioned clauses. As per ongoing projects, One (1) number passenger cum goods elevator of minimum capacity of 1000kgs for each Absorber (to be provided in case height of absorber is higher than 20m)	PI refer amendment A-SG-41 in this regard.
1051	SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	15.01.00	26 of 28	ELEVATORS One (1) no. Passenger cum goods elevator per Absorber (higher than 15 m). Mill building and dewatering building	One (1) number passenger cum goods elevator of minimum capacity of 1000kgs in Limestone Grinding System Building shall be provided for easy access & movement of man/materials. No Elevator is provided in Gypsum dewatering building. Please check & confirm the acceptance.	
1052	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05 (FGD)	PAGE 10 OF 28	5.06.06	The mist eliminator wash piping shall be constructed of Chlorolobutyl/Bromobutyl rubber lined carbon steel or glass fiber reinforced plastics.....	Carbon steel pipe shall be selected for outside pipe up to the nozzles at Mist Eliminator casing. Inside the mist eliminator casing piping header shall be of FRP/CSRL/PP/PVC as per tender specification. This is in line with ongoing NTPC FGD projects. Please confirm	PI refer amendment A-SG-38 in this regard.
1053	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05 (FGD)	PAGE 7 OF 28	5.01.00 (iv)	The slurry recirculation pumps shall have motor /pneumatic driven knife gate valve at pump suction and motor/pneumatic operated Butterfly Valves at discharge side as per the standard practice of bidder.	The Slurry recirculation pumps are not applicable to our offered system. The Gas Cooling pumps provided in our system shall have motor driven butterfly valve in both suction and discharge line which is more durable and compact than gate valve. This is in line with ongoing NTPC FGD projects. Please confirm	Bidder to comply with the specifications requirement.
1054	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05	PAGE 14 OF 28	6.05.04	All parts of the mill including mill body, trunnion, hydro-cyclones, integral pipes, mill circuit pumps and other parts in contract with limestone slurry shall be provided with replaceable rubber wear liners.	For limestone slurry preparation system - Mill auxiliaries, integral piping & connecting piping, we will be following as per clause no.12.02.00 FRP pipes (with SiC erosion resistant layer for slurry exposed surface) instead of carbon steel rubber lined pipes as per clause no. 6.05.04, 6.05.09 & 6.07.03. The same is being followed in the ongoing NTPC projects.	Bidder to comply with the specifications requirement.
1055	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05 (FGD)	PAGE 14 OF 28	6.05.09	The mill auxiliaries like separator tanks, mill circuit pump, hydro-cyclones and all connecting pipes handling limestone slurry shall have replaceable rubber linings.	Bidder request NTPC to check and confirm.	
1056	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05 (FGD)	PAGE 15 OF 28	6.07.03	The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 10 mm thickness . Additional thickness of 2 mm rubber lining shall be provided at bends.		
1057	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB SECTION –A-05	PAGE 23 OF 28	12.02.00	The Contractor can provide slurry pipes size up to 400 NB made up of FRP material as per ASTM 2310 and testing as per ASTM B2583(silicon carbide coating on slurry exposed surface)if it has previous experience of providing the same		

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1058	Section-VI/Part-A	SUB SECTION-IIA-14	Clause no. 1.01.01	586 of 2672	Truck Tipplers each of minimum 40T capacity (Gross weight 60 T minimum) to discharge Limestone on to Box Feeders/Surface Feeders/Truck Unloading Hopper	Bidder understand truck tipler capacity require to consider max. 40 ton (gross wt. 60 ton). Bidder understand maximum 14 wheeler truck with wheel base max 9 meter & rear over hang of the truck max 2 meters require to tipples by truck tipler or else specify the model and make of the truck to be considered. Bidder request to owner to confirm.	Bidder to follow Truck Tipplers in line with Latest Lot FGD projects
1059	Part-6 Section-VI/Part-B Subsection -A-20	-	Drg. No. 4540-001-POM-A-039 (SH-01) Clause no. 3.01.0.(b)	45 of 73 1897 of 2672	Crushed limestone feed the same onto double stream conveying system up to the limestone day silos. 	As per flow diagram (Drg. no. 4540-001-POM-A-039 (SH-01 Rev.A), there is one conveyor stream shown from main storage silo to Limestone day silo-1& 2, where as in clause no. 3.1.0(b) it is mentioned, Crushed limestone feed the same onto double stream conveying system up to the limestone day silos. Bidder request owner to check and clarify what is to be followed.	Bidder to refer revised Limestone flow diagram and refer Amendment of respective clause. Amendment No : A-MH-1
1060	Part-6	-	Drg. No. 4540-001-POM-A-039 (SH-01)	45 of 73		Bidder understand 3 nos. Metal Detector to be considered in the equipment list, in case single stream of conveyor(from Crushed silo to JT) In case of double stream of conveyor, the requirement of Metal detectors shall be 4 no. Bidder request NTPC to clarify nos. of metal detectors and location of the same with flow diagram. Bidder request owner to confirm.	Bidder to refer revised flow diagram. Amendment No : A-MH-1
1061	Section-VI/Part-A	SUB SECTION-IIA-14	Drg. No. 4540-001-POM-A-039 (SH-01 & 02) & Clause no. 1.01.09	45 of 73 & 46 of 73 587 of 2672 589 of 2672	  Limestone Storage Silos to store limestone equivalent to consumption of minimum 7 days at Design point (Generation of all units to be considered). The maximum capacity of each limestone storage silo shall not exceed 2000 MT The storage shed shall be sufficient to store gypsum equivalent to gypsum generation of minimum 7 days at Design point (Generation of all units to be considered).exceed 2000 MT	Crushed Limestone Main Storage silo-1 &2- a) As per flow diagram (4540-001-POM-A-039 (SH-01 Rev.A) total limestone storage capacity in silo is (1950X2=)3900 MT b) in clause no. 1.01.09 - it is mentioned 7 days storage required and shall not exceed 2000 MT Bidder request owner to clarify, what is to be followed. Gypsum storage capacity:- a) it is mentioned as 6000MT in flow diagram (4540-001-POM-A-039 SH-02 Rev.A). b) in clause no. 2.02.00 - it is mentioned 7 days storage required. Bidder request owner to clarify, what is to be followed.	Bidder to provide 2 Nos. Silos with minimum storage capacity of 1950 MT each. However, if total 7 days storage requirement exceeds 2x1950 MT, then bidder need to provide additional capacity. In that case, bidder has to provide additional silos (if required), as capacity of single silo should not be exceed 2000 MT.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1062	Section-VI/Part-B	Subsection -A-20	Clause no. 3.1.0.(b)	1897 of 2672	From the limestone storage shed/Silo paddle feeders will extract/ reclaim crushed limestone and feed the same onto double stream conveying system up to the limestone day silos.	As per flow diagram bidder understand that, from bulk storage silo material will feed to day silo through rod gate, rack & pinion gate, vibrating feeder & single down stream conveyor. Bidder request to owner to confirm.	Bidder to refer Amendment of respective clause. Amendment No : A-MH-14
1063	Section-VI/Part-B	Subsection -A-20	Clause no. 3.2.0	1897 of 2672	Each stream shall have a set of Rod gates and Rack & Pinion Gates before Vibrating screen Feeders to permit maintenance of equipment.	As per flow diagram bidder understand that there is no Rod gates and Rack & Pinion Gates before vibrating screen feeder. Bidder request to owner to confirm.	Bidder to refer revised Limestone Flow diagram. Amendment No : A-MH-1
1064	Section-VI/Part-B	Subsection -A-20	Clause no. 3.2.0	1898 of 2672	Crush limestone to (-) 20 mm size or to suit limestone pulverizer and system.	Bidder understand that crushed limestone 90% size (-)20 mm & 100% (-)25 mm to suit limestone pulverizer & system. Bidder request to owner to confirm.	Bidder to follow stipulation of Technical Specification.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1065	Section-VI/Part-B	Subsection -A-20	Clause no. 4.1.3	1900 of 2672	The cleaning efficiency should be measured in periodic intervals with suitable instrument.	As per OEM, there is no specific instrument which can be fitted external scrapper for measuring cleaning efficiency. It shall be done manually by collecting material at load / no load condition. Hence same is not considered. Bidder request Owner to check the requirement.	Cleaning efficiency should be measured with suitable arrangement. Bidder to comply.
1066	Section-VI/Part-B	Subsection -A-20	Clause no. 4.4.3	1904 of 2672	'Skirt Material' shall be of low friction, high tear resistance & abrasion resistant polyester based polyurethane/Rubber with Durometer Shore A Hardness of '65 (+/-) 5 and min thickness should be 15 mm. Chamfering to be done at one edge of the skirt. Skirt Plate of each side shall be in single piece.	Bidder understands that said clause is related to Skirt sealing rubber. Skirt top cover & side plate shall be as per SECTION-VI, PART B, SUB-SECTION-A-20, Clause No. 2.2.3 Bidder request Owner to confirm our understanding.	Confirmed. Bidder to refer amendment of respective clause. Amendment No : A-MH-8
1067	Additional Query	-				Please furnish limestone flow analysis report for silo design. Else Owner is requested to provide following material characteristics & source of limestone for flow analysis: 1) Cohesive strength 2) Wall Friction 3) Compressibility 4) Permeability 5) Segregation Tendency	Bidder to envisage inputs in line with latest executed Lot FGD projects
1068	Additional Query	-				Owner to furnish make & model no. of trucks, loader shovel used for Limestone & gypsum loading system	Bidder to follow details in line with latest executed Lot FGD projects.
1069	Additional Query	-				Bidder has not considered to provide snub pulley in small conveyors as frequent compression and expansion of cover grade in the zone of snub pulley will be detrimental to the life of belt and not recommended. Bidder requests owner to confirm.	Bidder to follow stipulation of Technical Specification.
1070	Additional Query	-				Bidder requests owner to furnish repose angle for limestone & gypsum for designing of limestone & gypsum handling system	Bidder to envisage repose angle in line with latest executed Lot FGD projects
1071	Additional Query	-				As Specification is silent regarding height of Gypsum stockpile, Bidder would recommend maximum 10 meter stockpile height with three side retaining wall and one side truck bay for loading of gypsum through trucks as per the earlier executed projects of NTPC.	Confirmed.
1072	Part-4	-	4540-999-POC-F-001 General Plot Plan	PDF page 10 of 37		Bidder understand that ramp & parking area both shown in layout are not feasible as made. This area shown shall be utilised for ramp coming towards the truck tippler. There should be separate space for parking. Bidder request owner to specify separate parking area to be considered, nos. of trucks to be parked and type of parking is open without any shed.	Separate open type parking area (paved) in the vicinity of Truck Tippler for parking of eight numbers of Truck may be considered.
1073	Part-4	-	4540-999-POC-F-001 General Plot Plan	PDF 10 of 35	Note 4: The layout shown is suggestive & same may be further developed by the bidder at detail engineering stage	Bidder understand that there is a flexibility with bidder to optimize Layout compliance with functional & operational requirement.	Layout may be optimized during detail engineering complying the functional & operation requirement in line with the technical specification.
1074	SECTION-VI, PART-B	SUB SECTION-A-20	4.1.2	5 of 101	The calculated life time of the Idler bearings shall be minimum 80,000 operating hours.	As per Previous project experience with NTPC & other customer, idler bearing life is 40000 hours. Bidder request Owner to relook onto the same & confirm.	Bidder to follow stipulation of Technical Specification.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1075	SECTION-VI, PART-B	SUB SECTION-A-20	4.1.4	5 of 101	Suitable guards marked up scale attached to the frame to monitor belt stretch and access/maintenance platforms with handrails all around etc. shall be provided	Bidder would request to clarify the requirement which is not clear to us.	Technical Specifications is clear in this regard. Marked up scales are to be provided to monitor belt elongation in the take-up tower. Access and maintenance platform with handrails are also to be provided to access these scales and for maintenance of take-up pulley & counterweight etc.
1076	SECTION-VI, PART-B	SUB SECTION-A-20	4.1.5	6 of 101	The design lifetime of the bearing shall not be less than 80,000 operating hours.	As per Previous project experience with NTPC & other customer, Pulley bearing life is 60000 hours. Bidder request Owner to relook onto the same & confirm.	Bidder to follow stipulation of Technical Specification.
1077	SECTION-VI, PART-B	SUB SECTION-A-20	4.4.1	8 of 101	Coal Chutes shall be fabricated from wear resistant steel plates, Hardox 400, 400 HBN or higher quality. However, Limestone/Gypsum chute may be fabricated from Tiscral or equivalent. The material selection shall assist the free flow of coal. The thickness of the chutes shall be 20 mm for the three sides where material slides/impacts the chute and 10 mm for the chute wall that is not subject to abrasion. Chutes shall be provided with 12 mm thick abrasion resistant wear plates at impact points and bolted with countersunk screws. Material : (a) Chute work (b) Sliding zones & adjacent sides : - 20 mm thk. Hardox 400, 400 HBN or higher quality for Coal - 20 mm thk. Tiscral or equivalent for Limestone/Gypsum (c) No striking/ Non sliding zones : 10 mm thk MS	Bidder understand material impact zone 20 mm thick chute plate of Hardox (for Coal) & Tiscral / equivalent (for limestone & gypsum) shall be provided. However, specification asked for again 12 mm thick abrasion resistant wear plates at impact points separately. Bidder understand 12 mm thick plate separately is not required. As two clauses are contradictory regarding chute plate material at non striking zone , bidder is following as per Clause No. 2.1.2 (10 mm thick MS) Please confirm our understanding.	Bidder to refer Amendment of respective clause. Amendment No : A-MH-6
1078	SECTION-VI, PART-B	SUB SECTION-A-20	2.1.0	57 of 101	Crusher Drive arrangement :Electric motor, scoop type hydraulic coupling, gearbox.	Bidder proposed V belt drive for crusher as followed for all NTPC FGD projects. Bidder request Owner to accept the same.	V belt drive for Limestone Crusher may be accepted in line with NTPC FGD Projects.
1079	TECHNICAL SPECIFICATION, SECTION-VI,PART-B	SUB SECTION-A-20	2.01.02 f)	80 OF 101	Dust Suppression System (Plain water type) (2) Location of spray External transfer Points/Gypsum storage area	For Gypsum Handling area after discharge of Vacuum Belt filter material will be wet type. There is no possibility of dust generation. Please allow to delete DS system at receiving end of Gypsum conveyor GA-1A/1B and discharge end at Gypsum	Bidder to follow stipulation of Technical specification and provide Dust Supression over Gypsum Storage area.
1080	VI/PART-B	SUB-SECTION-A-01	1.05.22.01	38 of 41	The Bidder shall furnish unit rates for addition and deletion in height of the chimney with respect to the height mentioned above in relevant schedule of BPS.	To furnish the unit rates bidder shall consider chimney height as minimum 150m and maximum 275m. Please confirm.	In the base proposal, height of chimney shall be considered 275 M. However, take out price to be indicated in case chimney height reduces 150 m for single flue and 220 M for dual flue case from base proposal i.e. 275 M.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1081	VI/PART-B	SUB-SECTION-A-01	1.05.22.01	39 of 41	Alternatively, Contractor can also provide chimney of 8 mm thick (minimum) mild steel with Borosilicate Glass Block Lining of minimum 38 mm thickness, which should have been in successful operation for similar application in at least two (2) units, located at different locations, for a period not less than two (2) years as on the date of Techno-Commercial bid opening. In such a case, Contractor/Lining supplier shall provide a ten (10) year full replacement guarantee and fulltime onsite QA supervision, during erection & commissioning, by the supplier of the lining system.	To make all bidders at par, bidder requests owner to specify the exact thickness of borosilicate glass block lining as this stack shall be used for both bypass and FGD in operation cases, therefore there will be very limited vendors with required Proneness (Similar operation).	Bidder to note that the requirement of minimum thickness is already specified. Accordingly bidder to frame the proposal.
1082	VI/PART-B	SUB-SECTION-D-1-5	5.03.03	20 of 120	The wind shield shall be designed for vertical loading, cross wind loading, seismic loading, circumferential wind loading, thermal gradients etc. The load calculation and load combinations shall be as detailed in IS 4998. The wind shield shall be analysed for cases with and without flue liner loads.	Bidder understands that latest edition of IS 4998 i.e. IS 4998 : 2015 shall be used for shell design. Please confirm.	Bidder understanding is correct. The load calculation and load combinations shall be as per latest edition of IS 4998
1083	VI/PART-B	SUB-SECTION-D-1-7	7.02.02 (h)	3 of 12	For NGL of the proposed area GLP along with enclosed topographical survey drawing and borelog data may be referred.	The drawing 4540-999-POC-F-002 does not have any topography data for FGD facilities including limestone and gypsum handling area. Kindly share the topographical survey for the FGD facility area.	Available data is already shared. Topographical survey is included in Scope of work. Bidder can carry out Topographical Survey.
1084	VI/PART-B	SUB-SECTION-D-1-7	7.03.00	4 of 12	Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer	Bidder requests to consider Single stage flushing by airlift technique.	Bidder to comply provisions of Technical Specification
1085	VI/PART-B	SUB-SECTION-D-1-7	7.10.00 (a)- 11	11 of 12		19) Other Structure / Facility : Minimum One (01) borehole under each area / facility	Bidder to comply provisions of Technical Specification
1086	VI/PART-B	SUB-SECTION-D-1-7	7.10.00 (b)- 2	11 of 12		Bidder understands that as the Booster fan in FGD is to be placed on Vibration Isolation System (VIS), dynamic load on foundation is not envisaged. Hence, the cyclic plate load test under booster fan in FGD is not required. Thus no Cyclic Plate Load test is required in FGD area.	Bidder to refer Cl. 5.06.03 of Part-B, Section-VI, Subsection-D-1-5. VIS is not envisaged for Booster Fan foundations.
1087	VI/PART-B	SUB-SECTION-D-1-7	7.10.00 (b)- 6	12 of 12		Bidder understands that as the Booster fan in FGD is to be placed on Vibration Isolation System (VIS), dynamic load on foundation is not envisaged. Hence, only one number of Cross Hole shall be done in FGD area including other facilities of FGD area.	Bidder to refer Cl. 5.06.03 of Part-B, Section-VI, Subsection-D-1-5. VIS is not envisaged for Booster Fan foundations.
1088	VI/PART-A	SUB-SECTION-IIA-04	9.01.00	6 of 7	One (1) number passenger cum goods elevator of minimum capacity of 1000kgs for each Absorber (to be provided in case height of absorber is higher than 20m)	This is in contradiction with clause 15.01.00 of Section IV, Part B, Sub-section-IIA-05 page 26 of 28 "One (1) no. Passenger cum goods elevator per Absorber (higher than 15 m), Mill building and dewatering building". Kindly confirm the value of height of Absorber for elevator consideration	Refer amendment A-SG-41 in this regard.
1089	SECTION-VI, PART-B, Book 2 of 5-Electrical	SUBSECTION B-08	2.11.00(HT and LT power cables & control cables)	Page 3 of 6	For LT cables, Same cable sizes to be used for same type & rating of motor i.e. if there are three pumps for one application, all three pumps motor should be provided with same cables sizes	Bidder confirms to provide same cable sizes for same type & rating of motor in same equipment of a system within Single Unit. However, in case equipment's of Two different Units of a System are located away from each other due to layout requirements, Bidder proposes to provide different cable sizes for the same as the difference between calculated cable sizes of Two Units may be different. Please check & confirm.	Bidder proposal is not acceptable. Bidder to comply with technical specification
1090	SECTION-VI, PART-B, Book 2 of 5-Electrical	SUBSECTION- B-10	2.01.04 (CABLING EARTHING AND LIGHTNING PROTECTION)	Page 3 of 29	No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.	Noted. Further, sub zero level cable vault/trenches may be provided below control building/switchgear rooms in Non-main plants such as CHP, FGD. Kindly confirm.	Confirmed

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1091	SECTION-VI, PART-B, Book 2 of 5-Electrical	SUBSECTION-B-06	7.0.00 (LT SWITCHGEARS & LT BUSDUCTS)	Page 14 of 50	Intelligent Motor Controller (IMC)	Bidder proposes to provide Standard Motor/Heater Feeders (Non-IMC) in the FGD Areas. The same is being accepted and followed in NTPC - Buxar FGD projects. Please confirm.	Bidder to provide IMC in FGD area.
1092	SECTION-VI, PART B ANNEXURE	SUB-SECTION-A-21	3.00.00 (32)	8 of 12	CHP 220V DC system shall be separate and independent from other DC systems of plant.	Being small requirement at Bunker MCC Building, DC loads for Bunker MCC Building, shall be fed from Main plan DC system, in line with standard practice. Separate Dedicated DCDB at Bunker MCC Building will be provided. Incomers of this DCDB shall be taken from Main plant DCDB of Unit/station.	Bidder proposal is not acceptable. Bidder to comply with technical specification
1093	SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	8.03.04 (iv)	16 of 114	Further, two Licenses of the used <u>3D Modelling Software</u> (One for Engineering View and One for Site View) shall be provided along with <u>compatible Hardware</u> for possible review and study of the Model Files being submitted by the Bidder Time to time.	a) Supply of 3D modelling software (two licenses) is not included in PART-A of Tender specification. Bidder request Owner to clarify if same shall be included in Bidder's scope. b) Bidder understand that requirement of the software is for viewing purpose only. Please confirm c) If 3D modelling software is to be included in Bidder's scope, then Bidder request Owner to clearly specify the requirement of "Compatible hardware" indicated in the referred clause and also provide specification of the hardware (if any hardware is required).	a) The Supply of 3D modelling software is included in bidder scope . b) Bidder understanding is not correct . The requirement of software is not only for viewing but also editing . Further, as per specification bidder has to also furnish model of this project in line specification requirement, so that the same can be viewed and edited for any future use of owner. c) 3D modelling software is included in Bidder scope and bidder to provide "compatible hardware " required for operating the software to view and edit 3D models smoothly in line with specification requirement .By "compatible hardware " it is meant that the hardware meets the "minimum recommended requirement" as per the software OEM .

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1094	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	PAGE 12 & 13 OF 23	U)	SIDE ARM CHARGER Carriage Wheels (a) Bearings (b) Oil Seals . . ix) Servo motor	Bidder understands that Side Arm charger is not envisaged in this Project. Hence, the spares mentioned in the referred clause for the same are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Confirmed. Refer Amendment No-A-MH-19
1095	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	PAGE 13 & 14 OF 23	W)	Wagon Tippler and Accessories Carriage Wheels (a) Internals complete including input and output shafts and gears etc. (b) Oil Seals . . ix) Coupling bolts of drive shaft (fitted/machined bolts) one complete set	Bidder understands that Wagon Tippler is not envisaged in this Project. Hence, the spares mentioned in the referred clause for the same are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Confirmed. Refer Amendment No-A-MH-19
1096	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	PAGE 15 OF 23	X)	APRON FEEDERS 1 Head Pulley complete with shaft 2 Tail pulley complete with shaft . . 16 Coupling bolts of drive shaft (fitted/machined bolts) one complete set	Bidder understands that Apron Feeder is not envisaged in this Project. Hence, the spares mentioned in the referred clause for the same are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Confirmed. Refer Amendment No: A-MH-19
1097	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	PAGE 21 OF 23	O)	PLC (STACKER / RECLAIMER & WAGON TIPPLER)	Bidder understands that Wagon Tippler is not envisaged in this Project. Hence, the spares mentioned in the referred clause for the same are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Confirmed. Refer Amendment No:- A-MH-32
1098	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER-04 COAL HANDLING PLANT	PAGE 15 OF 23	Z.A	Truck Tippler	Bidder understands that Truck Tippler is not envisaged in this Project for coal handling plant. Hence, the spares mentioned in the referred clause for the same are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Truck Tippler shall be applicable for Limestone Handling plant
1099	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER - 03 ASH HANDLING PLANT	PAGE 4 OF 13 PAGE 6 OF 13	4.02.00 4.05.00	FLY ASH PNEUMATIC CONVEYING SYSTEM Airlock/Blow Tank System: For first stage Pressure Conveying (if applicable) For second stage conveying SCREW COMPRESSOR [Transport Air compressors (TAC) & conveying Air Compressor (CAC)] (Quantities as specified shall be applicable for TAC & CAC separately)	Bidder understands that for single stage pressure conveying, mandatory spares for second stage (airlock, TAC..etc) are not applicable. Please confirm Bidder's understanding. Also, Owner is requested to provide the list of mandatory spares for single stage pressure conveying.	Confirmed. Mandatory Spares for second stage conveying shall not be applicable,if bidder provide single stage Pressure Conveying system. Separate list of mandatory spares for single stage conveying shall not be provided.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1100	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER - 03 ASH HANDLING PLANT	PAGE 7 OF 13 PAGE 12 OF 13	4.06.00 11.02.04	Air Drying Plant for IA System Pre filter element (ceramic candle) . . Valve actuators Air Blower for drying plant	Bidder understands that if dedicated instrument air compressors are not envisaged for AHP system then spares for air dryer of IA system shall not be applicable. Please confirm Bidder's understanding and amend the referred clause accordingly.	Confirmed. Refer Amendment No-A-MH-20
1101	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER - 03 ASH HANDLING PLANT	PAGE 12 OF 13	11.02.03	Motors IAC compressor	Bidder understands that if dedicated instrument air compressors are not envisaged for AHP system then spares for IAC Compressor shall not be applicable. Please confirm Bidder's understanding and amend the referred clause accordingly.	Confirmed. Refer Amendment No-A-MH-20
1101	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER - 03 ASH HANDLING PLANT	PAGE 12 OF 13	10.03.00	ASH POND FUGITIVE DUST SUPPRESSION SYSTEM	Bidder understands that Ash pond is not envisaged in this Project. Hence, ASH POND FUGITIVE DUST SUPPRESSION SYSTEM mentioned in spares list is also note applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Confirmed. Refer Amendment No-A-MH-18
1102	TECHNICAL SPECIFICATION SECTION-VI, PART-A	SUB-SECTION-VI CHAPTER - 03 ASH HANDLING PLANT	PAGE 9 OF 13	6.00.00	FLY ASH STORAGE SILO (quantities as specified shall be applicable for fly ash Storage silo and HCSD silo separately)	Bidder understands that HCSD Silo is not envisaged in this Project. Hence, Spares for HCSD silo are also not applicable. Please confirm Bidder's understanding and delete the requirement from mandatory spares list.	Refer Amendment No: A-MH-21
1103	General	SUB-SECTION-VI Mandatory Spares			-	Owner to note that items/equipment/system which are not envisaged in this tender but the mandatory spares of the same if mentioned in the spares list given in the specification. Bidder understands that spares for such items shall not be applicable. Please confirm Bidder's understanding.	Bidder's query is generic and doesnot give the specific items. Bidder to comply the specification requirement

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1104	Section VII/ Part B	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.01 (a)	1 of 13	Drum / Separator/ Storage Tank Each plate shall be subjected to a 100% normal ultrasonic at the mill to meet the minimum requirements of EN 10160:1999 / equivalent ASTM standards. Elevated temperature tensile tests shall also be carried out on plate material for each heat.	Bidder would like to clarify that as per standard practice, we generally use forged material as per pressure part schedule and design instead of plate material for water separator. Hence, this test is not applicable for bidder's design.	These test is critical & shall be carried out as per Tech Spec/applicable standard.
1105	Section VII/ Part B	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.01 (b)	1 of 13	Drum / Separator/ Storage Tank (b) After cutting to size and removal of cut outs, the plates shall be subjected to magnetic particle test along the edges of the plate and on areas adjacent to the cut outs.	Bidder will carry out cut outs by machining-boring only. Bidder proposes to check visual inspection only.	Wherever gas cutting is involved, MPI is necessitated.
1106	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.01 (j)	1 of 13	After stress relieving (SR) all welds, internal and external shall be examined by MPI methods depending on size and accessibility and all butt welds shall be subjected to 100% radiography	Bidder would like to consider ultrasonic testing/radiography/ PAUT+TOFD method for volumetric examination in line with clause no.1.01.01 (h).	Surface & Subsurface defects may not be detected by any volumetric examination.MPI to be coninued. Volumetric examination PAUT+TOFD is acceptable inplace of RT
1107	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.02 (C)	2 of 13	Headers (c)All full penetration nozzle and attachment welds shall be subjected to UT prior to Stress Relieving	We would like to clarify that maximum area shall be covered. Some location full coverage not possible due to nearby Stubs, Hole, opening or nozzle.	UT of All full penetration nozzle and attachment welds shall subject to feasible/accessible area
1108	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.03 (c)	2 of 13	All tubes/panels/coils shall be checked for clearance by steel ball test and for cleanliness by sponge passage.	We would like to clarify that Sponge & ball pass will only be carried out for flat Panel & coils as per bidder's standard practice. For steel Ball & Sponge test of Panels, there are constraint due to Y-pieces, Riffle tubes, 3-Dimensional Opening (3D) etc in WW panels.	Exceptions where there are difficulties can be identified and agreed during QP or execution stage. Hence there is no need for the proposed change.
1109	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.03 (d), ii	2 of 13	(ii) FIELD WELDS: a) Finished butt welds shall be subjected to RT or UT. Wherever the code/standard/process specifies random sampling, the same shall be minimum 20%. b) Finished butt welds not covered under random sampling for RT/UT, referred above at point(a) shall be subjected to RT or UT or PAUT.	Please clarify the quantum of RT or UT or PAUT in field butt weld joints	RT is min 20% and rest either RT,UT or PAUT.
1110	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.04 (g)	4 of 13	All load bearing attachment welds shall be subjected to MPI after SR	NTPC is requested to note that Bidder proposes to carry out PT for inaccessible areas where MPI cannot be done.	PT can be used as an alternative to MT for inaccessible areas.Hence there is no need for the change of request.
1111	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.01.04	3 of 13 & 4 of 13	Wherever MPI is mentioned	NTPC is requested to note that Bidder proposes for MPI on grade 91, 92 and MPI/PT for other grades.	PT can be used as an alternative to MT for inaccessible area.
1112	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.3 (d)	8 of 13	Full range performance test shall be carried out on one fan of each type and size as per BS 848, Part-1.	NTPC is requested to note that BS 848, Part 1 is now withdrawn and replaced by BSEN ISO 5801. Bidder proposes to perform testing as per BSEN ISO 5801 or equivalent.	This portion is also covered in Section-VI/Part B ,Sub-section- A-05.Engg to comment.
1113	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (a)	Pg 8 of 13	Raw material for shaft, coupling, gears and pinions, top and bottom races and other rotating components shall be subjected to UT. MPI/LPI shall be carried out to check surface soundness.	NTPC is requested to note that forged shafts used in Roller Journal Assembly / Tensioning Parts Assembly shall be subjected to UT & MPI, as applicable, during stages of production. However, Shaft, Coupling, Gears & Pinions, Top & Bottom races and other rotating components are the part of bought-outs viz., Gear Box with Lubrication units, Hydraulic Tilting Device, Roller Loading Device etc. These are compliant to supplier internal quality norms & no reports for UT/MPI/LPI will be produced.	This is not an issue.This type of things are generally sorted out during finalisation of QP.
1114	Section VII/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (b)	Pg 8 of 13	Wear-resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out. For ceramic material check for various properties including hardness, density, wear rate and composition shall be carried out.	As per bidder's standard practice, wear resistant parts viz. Roller Liners (Roller Journal Assembly) & Table Liners are composites comprising of SG Iron & Hi chrome material. For such composite material, UT/RT/MPI is technically not feasible. However, LPI shall be conducted to ensure surface integrity. (LPI acceptance norms will be as specified by the supplier specification & approved by bidder).	Surface checking shall not replace volumetric requirements. The same shall continue. However, technical feasibility for various types/materials of wear resistant parts shall be discussed during detailed engineering based on type/materials proposed by the bidder.

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1115	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (c)	9 of 13	Butt welds in the tube/separator/body casing of the mill shall be tested by UT/RT and MPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced.	NTPC is requested to note that these Butt weld shall be subjected to UT after PWHT, as applicable. MPI for fillet welds is not possible considering positional difficulty. Bidder proposes to perform LPI in place of MPI.	LPI in place of MPI at inaccessible areas-acceptable.
1116	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (d)	9 of 13	All gear boxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.	NTPC is requested to note that trial run duration shall be as per manufacturer specification (approved by Bidder). Oil leakage shall be checked during no load trial run test at bidder's works/shop.	Specifications are asking for certain basic requirements. The details can be worked out based on the execution plan of the particular supplier. These things can not be tied up at this stage
1117	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (e)	9 of 13	Trial assembly (stacking) of at least one mill complete with all major components needs to be carried out at shop.	NTPC is requested to note that at shop, only one mill will be trial assembled with 01 no. Grinding Table, 01 no. Roller Journal Assembly, 01 no. Lower Housing Assembly and 01 no. Middle Housing Assembly.	Scope of Trial Assembly are a part of QP finalisation exercise. There is no need to address the same in address the same in specifications.
1118	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.04 (f)	9 of 13	Fabricated pipe welds should be examined by MPI.	NTPC is requested to note that in case of Pulveriser mill, pipe welds are applicable only for Lower housing (seal air arrangement). This is a low pressure piping. Hence, bidder will perform LPI in place of MPI for these pipings.	MPI is a preferred NDT check, over LPI. However in accessible area LPI is acceptable.
1119	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.06 (c)	9 of 13	All pumps including spare cartridges shall be subjected to performance test at the manufacturer's works under as near site conditions as possible and strip down examination after the test.	NTPC is requested to note that Bidder will consider strip test only in case there is an abnormal sound during performance test of pump.	Strip down test in case there is an abnormal sound during performance test of pump including spare cartridge.
1120	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.11 , c, (ii)	11 of 13	For plates of 25mm < thickness < 32mm - 10% RT/UT and 100% MPI	NTPC is requested to note that Bidder proposes to perform either MPI or PT in lieu of MPI.	PT can be used as an alternative to MT for inaccessible areas. Hence there is no need for the requested change.
1121	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.11 , c, (iv)	11 of 13	All fillet welds of built up plate girders shall be inspected 100% by MPI	NTPC is requested to note that Bidder proposes to perform either MPI or PT in lieu of MPI.	PT can be used as an alternative to MT for inaccessible areas. Hence there is no need for the requested change.
1122	Section VI/ Part B/SUB-SECTION-E-1 Steam Generator and Auxiliaries	SUB-SECTION-E-1 Steam Generator and Auxiliaries	1.02.15 (a)	12 of 13	Hydraulic pressure test shall be carried out on each pipe and expansion bellow	NTPC is requested to note that bidder will perform air leak test in place of hydrotest for metallic expansion joint/below for piping. It is not possible to perform hydraulic pressure test for metallic expansion joint.	The specified one is chosen based on stringency, same will continue. However for MEJ air leak test is acceptable.
1123	Section VI/ Part B	SUB-SECTION-E-5 L P Piping Package	Note 3	01 of 02	Followings are the testing requirements for fabrication of pipes at site ~~RT / UT by (TOFD/PAUT) Technique~~ Wherever MPI is mentioned	LMB proposes to include manual UT in addition to RT / UT by (TOFD/PAUT) Technique as an option for NDT	PAUT & TOFD is latest technique of NDT , bidder to meet the specification requirements.
1124	Section VI/ Part B	SUB-SECTION-E-6 Power Cycle Piping	-	-		NTPC is requested to note that bidder will carry out MPI on grade 91, 92 and MPI/PT on other grades pipes. NTPC is requested to note that bidder will carry out MPI to the extent possible. However, for inaccessible areas where MPI is not possible to perform, bidder will perform PT in place of MPI.	PT can be used as an alternative to MT for inaccessible area.
1125	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.06	PAGE 8 OF 14	Balancing of Coal/Primary air flow: Contractor shall balance the primary air as well as coal flows in the pulverised fuel pipes such that the minimum PF and PA flow imbalance in the PF pipes from each coal pulveriser does not exceed 5% of average flows. The above balancing shall be checked by the Contractor by carrying out both clean air test and dirty air test (using dirty pitot tubes).	Bidder would like to conduct clean air flow test. Kindly confirm acceptance.	Bidder to comply the specifications requirements.
1126	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.08	PAGE 9 OF 14	Steam Temperature Imbalance The Contractor shall demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 deg C under all loads including transients.	Kindly note that Temperature imbalance shall be demonstrated at steady load and not during transient condition. Kindly confirm acceptance.	Bidder to comply the specifications requirements.
1127	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.10	PAGE 9 OF 14	Capabilities of all drives After completion of installation of drives, contractor shall demonstrate the capability of all drives as specified elsewhere in Section VI Part B of Technical Specifications	Kindly note that demonstration of capabilities of individual drive is not possible at site. Shop test report will be provided. Kindly confirm acceptance.	Bidder to comply the specifications requirements.

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1128	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.11	PAGE 9 OF 14	Margin on Fans After completion of installation of fan drives, Fans, inlet and outlet ducting, measuring equipments etc. contractor shall demonstrate the margin on seal air fans, primary fans, Forced draft fans and induced draft fans as specified elsewhere in Section VI Part B of Technical Specifications.	Demonstration of Margins on Fans and other drives are not possible at site. Shop test report will be provided.	Bidder to comply the specifications requirements.
1129	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.13 a)	PAGE 10 OF 14	Performance characteristic of fans (PA/FD/ID fan capacity, head developed, etc.)	Bidder would like to provide shop test report of similar capacity, head fans. Kindly accept the same.	Bidder to comply the specifications requirements.
1130	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOC NO.: CS-4540-001A-2	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.15.03 (b)	12 of 28	Oil supply line for input shaft bearing should be taken from side/top of the common line, having a collection chamber at the bottom side to trap debris if any.	Bidder would like to follow OEM practice of Gear box supplier for collection chamber. Kindly confirm acceptance.	The detailed aspects shall be reviewed based on the selected mill specific design/scheem. Bidder to comply the specifications requirements.
1131	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC.NO. CS-4540-001A-2	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	1.05.08.03	13 of 101	The YGP index for the specified coal is indicated in Project Information, Sub-section- I-B, Part-A, Section-VI of Technical specification when measured as per BS Standard BS-1016 Part-111. The Bidder shall furnish a curve along with his offer indicating the variation in guaranteed wear life with variation in YGP index of coal fired. Separate curves for different wear elements of mill shall be furnished e.g. for grinding rolls, grinding rings, clearly indicating its relationship with YGP index of coal. The curve shall be subject to Employer's approval.	Kindly note that separate curve for wear element i.e only for Roller & Table liner indicating its relationship with YGP index of coal shall be provided. Kindly confirm acceptance.	Bidder to comply the specifications requirements.

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1132	SECTION – VI, PART-B	SUB SECTION-A-02 - SG AND AUXILIARIES	10.02.01 b)	19 of 65	Bunker Shut Off Gates shall be motor operated & RC Feeder outlet gates shall be pneumatic operated	We have observed discrepancy in the highlighted two clauses of tender specification. We understand that bidder may provide motor operated gate at RC feeder outlet as per bidder's standard design. Kindly confirm acceptance.	Bidder to refer the amendment A-SG-10 for clarity in this regard.
	SECTION – VI, PART-A	SUB SECTION-II A-01--SG AND AUXILIARIES	2.15.01	11 of 28	Coal chute between outlet of feeder and inlet of mill along with motor/ pneumatic operated shut off gate at RC feeder outlet		
1133	SECTION-VI, PART-B	SUB SECTION- G-04 - STANDARD PG TEST PROCEDURE.	3	PAGE 218 OF 224	NOISE LEVEL MEASUREMENT For eventual noise, from the discharge line, accessories and /or ancillary equipment which are not included, a correction factor of Maximum 4 dB (A) shall be allowed for background & ambient noise.	We would like NTPC to kindly accept following requirements: A) In case of screw compressor: For eventual noise, from the discharge line, accessories and/or ancillary equipment which are not included, a correction factor of (+) 8 dBA maximum shall be allowed for background & ambient noise. B) In case of centrifugal compressor: For eventual noise, from the discharge line, accessories and/or ancillary equipment which are not included, a correction factor of (+) 12 dBA maximum shall be allowed for background & ambient noise. Kindly confirm acceptance.	A correction factor of (+) 8 dBA is already specified in the technical specification. Bidder to refer clause 3.14.00, Page-83-84 of 101, Sub-Section-A-01 (Equipment Sizing Criteria), Part-B of Technical Specification. Bidder to comply with requirements of technical specification. Further, Bidder to refer amendment in Sub-Section-G-04 (Part-B) in this regard. Amendment No : A-PU-5
1134	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	3.02.00	PAGE 1 OF 7	SCREW AIR COMPRESSORS - DESIGN AND CONSTRUCTION	NTPC is requested to note that MOC of compressor component varies based on the sub-vendor standard design. Hence, we request NTPC to accept the MOC as per OEM standard design.	Any superior material & type (as per proven and relevant standard) of various components of screw compressor is also acceptable. Bidder to refer clause 3.02.06, Page-2 of 7, Sub-Section-A-16 (Compressed Air System), Part-B of Technical Specification.
1135	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	3.02.05	PAGE 2 OF 7	Bearings shall be high precision antifriction type IS- 25 Grade 84). The axial thrust load shall be minimized by dividing the axial load of compression on the main and auxiliary bearings through suitable balancing arrangement.	NTPC is requested to note that MOC of compressor component varies based on the sub-vendor standard design. Hence, we request NTPC to accept the MOC as per OEM standard design.	Any superior material & type (as per proven and relevant standard) of various components of screw compressor is also acceptable. Bidder to refer clause 3.02.06, Page-2 of 7, Sub-Section-A-16 (Compressed Air System), Part-B of Technical Specification.
1136	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	3.03.00	PAGE 2 OF 7	Gear Box Gears shall have a rating of AGMA-12 or equivalent.	NTPC is requested to note that Gear Box shall be as per OEM standard design. We request NTPC to kindly confirm the acceptance.	Any superior material & type (as per proven and relevant standard) of various components of screw compressor is also acceptable. Bidder to refer clause 3.02.06, Page-2 of 7, Sub-Section-A-16 (Compressed Air System), Part-B of Technical Specification.
1137	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	4.02.00	PAGE 2 OF 7	CENTRIFUGAL AIR COMPRESSORS- DESIGN AND CONSTRUCTION	NTPC is requested to note that MOC of compressor component varies based on the sub-vendor standard design. Hence, we request NTPC to accept the MOC as per OEM standard design.	Any superior material & type (as per proven and relevant standard) of various components of centrifugal compressor is also acceptable. Bidder to refer clause 4.02.05, Page-3 of 7, Sub-Section-A-16 (Compressed Air System), Part-B of Technical Specification.
1138	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.03.00	PAGE 3 OF 7	Coolers shall be provided with removable tube bundle design in accordance with design code TEMA Class C and shall be constructed with removable shell cover.	Bidder noted Shell and tube type Oil cooler arrangement. However, we would request NTPC to accept alternative arrangement of Plate type Oil Cooler with SS plate. In such case, Coolers shall be designed as per OEM standard. NTPC is requested to confirm acceptance.	Plate type oil coolers as per OEM standard & proven design are also acceptable.
1139	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.05.00	PAGE 3 OF 7	The coolers shall be designed for maximum heat load and atleast 10 percent design margin shall be provided in the number of tubes.	NTPC is requested to note that the margin on the tubes shall be as per OEM design requirement. NTPC is requested to confirm acceptance.	Bidder to comply the requirements of clause 5.05.00, Page-3 of 7, Sub-Section-A-16 (Compressed Air system) of Part-B of Technical Specification.
1140	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.06.00	PAGE 3 OF 7	Adequately sized safety valves shall be provided for both intercoolers and after coolers.	NTPC is requested to note that Centrifugal compressor OEM shall not provide the safety valves/relief valves for Intercoolers, Aftercoolers, oil coolers because the blow off valve is designed for the safety of the compressor & coolers. NTPC is requested to confirm acceptance.	Safety provisions as per manufacturer's standard & proven design are also acceptable.
1141	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.07.00	PAGE 3 OF 7	Moisture separator units shall be equipped with a level gauge glass with isolating cock.	NTPC is requested to note that it is not possible to provide level gauge glass with isolation cock due to space constrain. The same shall be provided as per OEM standard design. NTPC is requested to confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply with requirements of technical specification.

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1142	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.08.00	PAGE 3 OF 7	The drain trap shall be timer based.	NTPC is requested to note that automatic drain trap will be of level based type for Intercoolers & Aftercoolers of Compressor & Air Dryer as per OEM standard design. NTPC is requested to confirm acceptance.	Based on feedback from several NTPC stations, timer based drain trap has been envisaged. Bidder to comply with specification requirements.
1143	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	5.09.00	PAGE 3 OF 7	INTERCOOLER, AFTERCOOLER & OIL COOLERS (FOR SCREW/CENTRIFUGAL) Cooler shells, channels and covers shall be of carbon steel (SA 285 Gr C / SA 516 Gr 70). Tube sheet shall be of Brass or SS and the tubes shall be of Admiralty brass or Aluminium brass or Copper or SS 304.	NTPC is requested to note that MOC and all components within compressor skid shall be as per OEM standard practice. NTPC is requested to confirm acceptance.	Bidder to comply the requirements of technical specification. However, as per manufacturer's standard & proven design, any superior material to the material specified in technical specification shall also be acceptable.
1144	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	8.07.00	PAGE 5 OF 7	Each ADP shall be provided with two (2) numbers of 100 percent capacity pre-filters and two (2) numbers of 100 percent capacity after-filters at the upstream & downstream of towers.	NTPC is requested to note that Pre-filters & After Filters are not applicable for the Single drum HOC type dryer. Hence, the same will not be provided by Bidder in case single drum HOC type dryer provided. NTPC is requested to confirm acceptance.	Bidder's understanding is correct. Bidder to refer clause 8.20.00, Page-5 of 7, Sub-Section-A-16 (Compressed Air System), Part-B of Technical Specification.
1145	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	8.07.00	PAGE 5 OF 7	The filtering media shall be of ceramic candle type elements designed to withstand atleast 50% of static pressure as differential pressure.	NTPC is requested to note that MOC and all components within Air dryer skid shall be as per OEM standards. NTPC is requested to confirm acceptance.	Bidder to comply the requirements of technical specification. However, as per manufacturer's standard & proven design, any superior material to the material specified in technical specification shall also be acceptable.
1146	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	8.09.00	PAGE 5 OF 7	Each electric motor driven blower (2x100% capacity for each ADP) shall be provided with individual dry type filters at inlet.	NTPC is requested to note that electric motor driven blower (2x100% capacity for each ADP) is not applicable or HOC type dryer. Hence, the same will not be supplied by Bidder in case HOC type dryer provided. NTPC is requested to confirm acceptance.	Bidder's understanding is correct.
1147	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	8.14.00	PAGE 5 OF 7	Desiccant shall be activated alumina only and adsorption capacity and density of the same shall not be more than 8% and 900 kg/m3 respectively	NTPC is requested to note that dessicant activated alumina is not applicable for the offered Single Rotary Drum Type Dryer. OEM will offer Silica Gel as the Desiccant. NTPC is requested to confirm acceptance.	Based on past feedback, only activated alumina as desiccant has been envisaged. Bidder to comply the requirements of technical specification
1148	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	8.15.00	PAGE 5 OF 7	In case of Heat of compression type, adsorbers shall be sized so that even when the compressor is operating at part load, complete regeneration shall be achieved within the cycle time	NTPC is requested to note that Oil free screw compressors operates either at no load or full load. Hence, Part load operation of screw compressor is not applicable. NTPC is requested to confirm acceptance.	Bidder's understanding is correct.
1149	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	9.00.00	PAGE 5 OF 7	INTERCONNECTING PIPING, FITTING AND VALVES	NTPC is requested to note that piping MOC within Compressor & dryer Skid shall be as per OEM standard design. Piping outside skid shall be as specification requirement. NTPC is requested to confirm acceptance.	Bidder to comply with requirements of technical specification. However, as per manufacturer's standard & proven design, any superior material to the material specified in technical specification shall also be acceptable.
1150	SECTION-VI, PART-B	SUB SECTION-A-16 - COMPRESSED AIR SYSTEM	12.00.00	PAGE 7 OF 7	PAINTING	NTPC is requested to note that painting for Compressor, Dryer & Receiver shall be as per OEM standard practise. NTPC is requested to confirm acceptance.	Bidder's proposal is acceptable.
1151	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES	2.20.02	19 of 28	Platforms below APH outlet duct interconnections with common flue gas duct header and below expansion joints at the inlet of ESP. Platforms below expansion joints at the outlet of ESP.	NTPC is requested to note that tender specification requirement is not clear. Bidder will provide platforms for approach of dampers, access doors & Instrument tapings at ESP inlet and outlet ducting inline with executed NTPC project reference. NTPC is requested to confirm acceptance.	- The requirement of platforms at various locations have been clearly spelt out in the specified clause along with details in corresponding part-B chapter (SS-A-02). - Bidder to comply the specifications requirements.
1152	SECTION-VI, PART-A	SUB SECTION-IIA-02A SELECTIVE CATALYTIC REDUCTION SYSTEM	Annexure-SG-04	3 of 3	Scope of work for SCR/Hybrid ready plant shall include but not limited to the following: a) Duct up to Economiser Bypass Gate including Economiser Bypass Gate b) Duct up to SCR Inlet Gate including SCR Inlet Gate c) SCR Outlet Gate along with the duct from SCR Outlet Gate to APH inlet. g) Ash Handling System for SCR hoppers	a), b) & c) Bidder proposes to provide blanking plates nearest to the tapping point of Economiser bypass duct, SCR inlet duct, SCR outlet duct connections without gates / dampers to avoid ash accumulation on the ducting inline with executed NTPC project reference. Bidder proposes "g) Ash Handling System for SCR hoppers (if required)." NTPC is requested to confirm acceptance.	Bidder to refer the "amendment" in this regard along with the sketch (provided for clarity purpose). (Amendment No: A-SG-06)
1153	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	4.01.01	85 of 101	a) Bottom Ash, Economizer, Eco outlet duct hopper (if applicable), APH, Duct hopper, SCR Hopper ash Handling System, system shall be kept ready for SCR hopper Ash Handling system.	a) Bottom Ash, Economizer, Eco outlet duct hopper (if applicable), APH, Duct hopper, SCR Hopper ash Handling System (if applicable), system shall be kept ready for SCR hopper Ash Handling system (if applicable). NTPC is requested to confirm acceptance.	Bidder to follow stipulations of Technical specification w.r.t SCR Hopper ash handling system.

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1154	SUB-SECTION-IIA-13 FO UNLOADING SYSTEM	SUB-SECTION-IIA-13 FO UNLOADING SYSTEM	2.01.03	2 of 2	(c) One (1) no. hand operated monorail Hoist of 2 tonnes capacity along with monorail in the fuel oil unloading pump shed.	As indicated in referred clauses, Bidder proposes to consider combined house for fuel oil unloading and pressurizing pumps with One (1) no. hand operated Hoist of 2 tonnes capacity along with monorail. NTPC is requested to confirm acceptance.	Confirmed.
	SECTION-VI, PART-B	SUB SECTION A-19 FO UNLOADING SYSTEM	10.02.00	9 of 9	the layout of building namely Pump House shall consider the following parameters. (f) For handling of equipments in the pump house One (1) no. hand operated monorail Hoist of minimum 2 tonnes capacity alongwith monorail in the fuel oil unloading pump house shall be provided.		
	SECTION-VI, PART-A	SUB-SECTION-IIID CIVIL WORKS	1.00.00	6 of 13	12. Civil, structural, architectural works for fuel oil unloading & storage system namely fuel oil unloading cum pressurizing pump house with switchgear room, MCC cum control room and Fuel oil unloading system civil works including Fuel Oil tanker unloading platform, foundation and dyke wall and all associated works for LDO storage tank.		
1155	SECTION-VI, PART-A	SUB-SECTION-IIA-17 MILL REJECT HANDLING SYSTEM	1.01.01	1 of 1	(c) Mechanical feeder including Vibrating Feeder (if applicable) for mill rejects below each pyrite hopper for feeding at consistent rate to the mill reject conveyor. (d) Metallic Belt conveyor/Chain Flight Conveyor along with drives, accessories, supports etc for conveying the mill rejects from the mills for each row of mills in each unit. The conveyor shall be fully enclosed.	As mentioned in Technical specification Section -VI / Part-A / SUB-SECTION-IIA-17 MILL REJECT HANDLING SYSTEM, clause 1.01.01, Bidder proposes to consider the requirement of Vibrating feeder if applicable as per the MRHS layout. NTPC is requested to confirm acceptance.	Noted. Applicability of the Vibrating feeders, shall be finalised during detail engineering based on the type of system & MRS Layout.
	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	4.03.03	97 of 101	In case of mechanical conveying system, a vibrating feeder and metallic belt/chain flight conveyor carry mill reject from hopper to subsequent metallic /chain flight conveyor for further conveying to Bucket elevator for final storage at Silo.		
1156	SECTION-VI, PART-B	SUB-SECTION-A-22 MILL REJECT HANDLING SYSTEM	2.00.00	1 of 3	The discharged rejects from coal mill shall be collected in a dedicated pyrite hopper. Each pyrite hopper shall be provided with cylinder operated knife gate valves at inlet and outlet. Material from pyrite hoppers shall be removed by Mechanical conveyor and fed to main conveyor for further conveying. The main conveyor shall feed to a bucket elevator which in turn will feed to main storage silo.	NTPC is requested to note that the discharged rejects from coal mill shall be collected in a dedicated pyrite hopper. Each pyrite hopper shall be provided with cylinder operated knife gate valves at inlet and outlet. Material from pyrite hoppers shall be removed by Mechanical conveyor (if applicable) and fed to main conveyor for further conveying. The main conveyor shall feed to a bucket elevator which in turn will feed to main storage silo. NTPC is requested to confirm acceptance.	Bidder to comply stipulation of Technical specification

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1157	SECTION-VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	10.05.22	24 of 65	(a) Mill reject system shall automatically discharge the tramp iron and other non grindable material through an outlet connection at a suitable height (to be approved by Employer) to a dense phase pneumatic conveying system .	No specifications are provided regarding Pneumatic Mill reject system in Mill reject handling clause of SECTION-VI, PART-B / SUB-SECTION-A-22 MILL REJECT HANDLING SYSTEM and SECTION-VI, PART-A, SUB-SECTION-IIA-17 MILL REJECT HANDLING SYSTEM. Where as Dense phase pneumatic handling system indicated in 10.00.00 COAL PREPARATION AND FIRING SYSTEM clause. NTPC is requested to clarify the applicability of pneumatic mill reject handling system and provide necessary Technical specification requirements for the same if applicable.	Dense phase Pneumatic Mill reject system is not envisaged, bidder to provide Mechanical conveying system only. Further please refer amendment A-SG-33 against the clause 10.05.22 , A-02, part-B.
	SECTION-VI, PART-B	SUB-SECTION-A-22 MILL REJECT HANDLING SYSTEM	1.00.00	1 of 3	Mechanical conveying system shall be employed for handling of the mill rejects . Each mill reject discharge hopper shall be fitted with Feeder which shall discharge the mill rejects through Mechanical Conveyors to a storage Silo. The transmitting vessel shall operate on level probe mode with timer back-up.		
	SECTION-VI, PART-A	SUB-SECTION-IIA-17 MILL REJECT HANDLING SYSTEM	1.00.00	1 of 1	To handle the Mill Rejects on a continuous basis, the Bidder shall provide a Mill Reject Handling System. The Mill Reject Handling System shall comprise Mechanical Conveying system. The Rejects shall be stored in storage silo. From the storage silo, the Mill Rejects shall be disposed off in trucks.		
1158	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.15.03 (d)	13 of 28	(d) The coal mill shall be suitable for installation on RCC block type foundations and also at a suitable height in order that complete mill reject system as (described at sub section II A -17 of Part A) should be above the finished floor level of mill area or zero meter whichever is higher. Adequate maintenance space all around the mill zero meter have to be provided. However, the non drive end part of bucket elevator may be allowed to placed at minus meter with adequate maintenance space.	As mentioned in SECTION-VI, PART-A, SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP, clause 2.15.03 (d), Bidder will consider the Bucket elevator inside pit arrangement which is below the ground / finished floor level. NTPC is requested to confirm acceptance.	Non-drive end part of Bucket Elevator (for handling of Mill reject) may be kept below ground, but Sump pumps arrangement along with associated system shall be provided to discharge accumulated water from the Pit... Based on site feedback the clause 1.03.00 (58) had been kept in layout .Bidder to follow clause 1.03.00 of G-03 .
	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	13 of 15	58. All facilities of mill reject handling system specified elsewhere in the specification such as pump, tank, conveyor, piping etc shall be above ground level in boiler area.		
1159	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	06 of 15	Clear passage between two ESP 10m wide (Minimum)	NTPC is requested to note that considering restricted power block width and additional provisions given in the contract like CO2 capturing plant etc.. Bidder proposes min. 6m passage way in between two ESP. NTPC is requested to confirm acceptance.	Bidder to comply specification requirement as reduction in width may lead to erection and O&M considerations
1160	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	05 of 15	2. Distance between TG hall (C-row) column and first row of boiler columns - 12 M (Clear passage width will be minimum 10 m)	NTPC is requested to clarify that Bidder may consider Bunker emptying chute arrangement at the front side of boiler outside the D Grid up to ground level in case Front mill arrangement is selected. Kindly confirm acceptance. We would also like to be clarify that 10 m clear passage way and 7 m minimum head room may not be maintained at particular locations. NTPC is requested to confirm acceptance.	Bidder to comply specification requirements .
	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	07 of 15	18. Clear head room in Passage bay between TG hall and first row of boiler column i.e. CD bay - 7m (Except in control tower area, where the minimum head room shall be 5.0m)		
1161	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	06 of 15	14. Clear head room for material movement at ground level in Boiler Envelop - 5.0m (Minimum) (Unless specified Otherwise)	NTPC is requested to note that clear passage way with 5 m headroom has been considered for the areas identified for vehicle movement inside the boiler envelope for equipment maintenance. Remaining areas will be considered with piping, ducting and other boiler facilities based on system requirement. NTPC is requested to confirm acceptance.	Bidder understanding is correct . However , specification requirement shall be complied .
1162	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	09 of 15	37. Mill handling arrangement complete with crane and handling facilities along with removal space shall be provided. For side mill arrangement, one bay shall be provided as maintenance space on each side. For front mill and rear mill arrangement, one maintenance bay shall be provided on both side of mill bunker building. The mill maintenance bay shall be of minimum 7.0 m width.	NTPC is requested to note that considering the restricted power block area available in the GLP, Bidder proposes to maintain the mill maintenance space of 5.0 m width on both sides of Mill bay which is sufficient for handling of mill components. NTPC is requested to confirm acceptance.	Bidder to comply specification requirement .
1163	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.03.00	13 of 15	56. De-NOx System shall be located in boiler area. Bidder to bring out the details regarding De-NOx system and its location basis clearly in bidding documents.	NTPC is requested to note that the space indicated for ammonia storage is not sufficient. As per CCOE guide lines (30 m clear space to be maintained from ammonia storage tank edge to fencing), min. 75mx90m space is required considering ammonia tank size of similar capacity project. Considering SCR ready design, employer shall check the space provision in plant area based on the above minimum requirement.	Bidder to refer the revised GLP. at amendment D1-34.
	PART – E (TENDER DRAWINGS) SECTION - VI	General Layout plan	4540-999-POC-F-001/Rev.0	10 of 35	Ammonia storage		

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1164	SECTION-VI, PART-B	SUB-SECTION – G-03 LAYOUT PHILOSOPHY	1.08.00	14 of 15	Bottom flange level of Air-Preheaters (Both Primary and Secondary) hoppers and additional hoppers (if any) shall be fixed based on dry ash evacuation system as offered by the bidder taking care of clear height requirement between Boiler & ESP and considering unobstructed route for Fly Ash conveying pipes avoiding vertical bends.	Bidder understands that mentioned requirement is for dry ash handling system for RAPH hopper. In case of coarse ash slurry system, Bidder will consider the hopper elevation based on the OEM recommendation of ash handling system vendor.	Bidder understanding is correct. However, in case of coarse ash slurry system also layout requirements to be fulfilled for accessibility and ease of O&M.
1165	SECTION-VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	10.05.30	25 of 65	The mill and its motor, gear box foundation bolts shall have adequate maintenance space and accessibility for tightening both from top and bottom side of foundation bolts. Alternatively, additional minimum four (04) numbers of extra foundation bolt shall be provided at extreme corners of base plate which can be used in case of failure of existing foundation bolts	As per Bidder's design, entire foundation bolts will be embedded inside the RCC with anchor frame arrangement. Further, foundation bolt sleeves will be filled with grouting and nuts at bottom side of the bolts will be tack welded. Hence, tightening of bolts from bottom side is not required. Bidder has followed the same design in all previous executed projects. Hence, additional bolts are not required. NTPC is requested to confirm acceptance.	The detailed aspects shall be discussed during detail engineering based on the specific type of sub-system/mill specific design.
1166	SECTION-VI, PART-B	SUB SECTION-A-16 COMPRESSED AIR SYSTEM	1.03.00	1 of 7	Unit Air receivers for instrument air system provided to cater the requirements of Instrument air requirement of respective SG (Steam generator) & auxiliaries and TG (Turbine Generator and its auxiliaries). The Unit Air receivers shall be located in TG building area.	As per mentioned PID, IA requirement for ash handling also taken from plant compressor header. Also no separate tapping is shown for TG area. NTPC is requested to please clarify.	IA requirement for ash handling system shall also be met by main plant instrument air compressors. Accordingly, dedicated air receivers have been shown for ash handling system in referred P&ID after taking tapping from main IA header. Further, there are already separate tapings shown in the referred P&ID from main IA header for TG area.
	SECTION-VI, PART-B	SUB SECTION-A-16 COMPRESSED AIR SYSTEM	1.04.00	1 of 7	Further, a dedicated air receiver shall be provided near Demineralising Plant to meet the instrument air requirement of Water Treatment plant. Dedicated air receivers shall be provided to meet the instrument air requirement of ash handling System.		
	TECH_SPECS_PART6	TECH_SPECS_PART6	4540-001-POM-A-047-Rev A	50 of 73	SCHEMATIC DRAWING OF COMPRESSED AIR SYSTEM		

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1167	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.24.03	21 of 28	Complete lifting tools and tackles. Contractor shall provide motorized hoists and trolleys for all items requiring maintenance and weighing 500 kg or more. All auxiliary structures, monorails, runway beams for all lifting tackles, hoists etc., are included in Contractor's scope of supply. Access ladders with suitable platform shall also be provided for approach to all motorized hoists/trolleys mounted on their runway beams for the maintenance of hoists/trolleys. Items weighing more than 50 kg and required to be replaced for maintenance shall be provided with manual hoists/trolleys with runway beams/supporting structure etc.	Bidder proposes to consider the type of hoists based on the hoist capacity as per the details mentioned in clause 2.00.00 of SECTION-VI, PART-B, SUB-SECTION-A-24, SERVICE ELEVATORS CRANE, HOIST & MONORAIL. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements as at Cl. 2.24.03, SS-IIA-01 for the scope of Steam Generator & Auxiliaries.
	SECTION-VI, PART-B	SUB-SECTION-A-24 SERVICE ELEVATORS CRANE, HOIST & MONORAIL	2.05.00	6 of 6	Suitable EOT Crane/HOT Crane/Monorail beams with hoists/Chain Pulley Blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendor for the various areas/equipment. Some of the areas/equipment not covered by TG hall EOT cranes are indicated below. For balance areas/equipment, not listed hereinafter, the requirements of Specification shall be followed. For the hoists with more than 2.0 ton lifting capacity or more than 10.0 M lift, motor operated hoist block for both long travel and lift shall be provided. Other hoist blocks shall be of hand operated type for both travel and lift. However, all monorails coming out of the building shall be provided with electric hoist block, irrespective of load and lift.		
1168	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.30.00	24 of 28	Specific features catering to boiler reliability In order to ensure the trouble-free operation and maintenance of the Steam Generator & associated systems, following specific features, as a minimum, shall be provided. Any related provisioning w.r.t. monitoring and control of the healthiness of these sub-systems (especially S.N.- 5 to 8) shall be ensured by hooking the feedback to the control system. 1. Each area maintenance feasibility to be ensured in Steam Generator design including coil tube replacement and APH basket removal. 2.	As per Tender Specification requirement, SCR ready design system has to be considered. Hence, considering future SCR installation and in order to provide aero dynamic layout of SCR connecting ducts like Eco-Bypass ducting, Vertical SCR inlet ducting, economiser coil tube replacement is not envisaged as per bidder experience in recent NTPC projects. NTPC is requested to confirm acceptance.	Bidder to comply with the specifications requirements.
1169	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.30.00	24 of 28	7. Boiler to be provided with vacuum cleaning system network to ensure proper hygiene. In this context portable system to capture the ash around the boiler peripheral surface shall be provided alongwith net worked transmission of captured ash to a common location. Following specific elevations of Boiler requiring installation of vacuum cleaning arrangement in Boiler Front, Rear, LHS and RHS are also to be covered other than required areas: 1) Penthouse Floor 2) Gooseneck area floor covering both first pass and backpass. 3) Boiler Scaffolding door floor covering both first pass and backpass 4) Top wall blower tier floor covering both first pass and backpass 5) Top burner top floor covering both first pass and backpass 6) Burner bottom floor covering both first pass and backpass 7) S Panel (approx.8.5 to 9M)	Bidder will consider open grating for Boiler platforms at various elevations except oil prone areas in which chequered plates have been considered as per Tender specification. Hence, possibility of ash accumulation on the platforms around boiler peripheral is very less. Bidder presumes that vacuum cleaning system for ash removal on platforms is not required. NTPC is requested to confirm acceptance.	Bidder to comply with the installation of vacuum cleaning arrangements as per the specifications requirement.
1170	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	7.00.00	28 of 28	1. Boiler enclosure shall be covered with colour coated metal sheeting. The metal sheet shall display a visually appealing painting (which will be informed later) on outside. The height covered for sheeting will be from boiler roof to Penthouse and 15 m below from penthouse. During Overhauling or repair, the covering should not restrict material movement from Top and Sides of the boiler. Accordingly, removable type sheet shall be provided for such location. Necessary approach and lugs shall be provided for this purpose. 2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have flat roof with access through staircase / lift.	1) We would like to clarify that Boiler enclosure shall be covered with colour coated metal sheeting. The metal sheet shall display a visually appealing painting (which will be informed later) on outside. The height covered for sheeting will be from boiler roof to Penthouse and 15 m below from penthouse top." NTPC is requested to confirm acceptance. 2. Provision for ventilators / glazed windows shall be made as per functional requirements. The boiler enclosure shall have sloped roof with access through staircase / lift. Bidder proposes Sloped roof for ease of rain water draining purpose.	Refer amendment A-SG-11 in this regard.

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1171	SECTION-VI, PART-A	SUB SECTION A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	7.00.00	Pg 27 of 28	Architectural Features for Steam Generator Enclosure: The boiler enclosure shall have flat roof with access through staircase / lift.	Architectural Features for Steam Generator Enclosure: NTPC may note that, required slope for rain water drain cannot be avoided. Hence as per bidder understanding, The boiler enclosure shall have flat roof with necessary slope for rain water drain. Please confirm the bidder understanding.	Confirmed.
1172	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.18.00 / (8)	PAGE 17 OF 28	One (1) drain oil tank of 6m ³ capacity with one oil transfer pump with motor, duplex filter at suction and other accessories for each Steam Generator to transfer drain oil from steam generator area to LDO storage tank(s). Control of the same shall be implemented in SG C&I system.	As different tender clauses and tender P&IDs differs on Drain oil tank capacity, no of drain pumps, Drain pump capacity and type of pump (Vertical / horizontal pumps) , and filters, Bidder proposes the following : a) Pump house is common for both unloading and pressurising pumps . b) One no. of common drain oil tank(Rectangular type) at FOUPH having effective capacity of 10Cu.m of dimension 2.5m-wide x 2m-depth x 2 m height . and 2 no's 10 m ³ /hr (1 working + 1 stand by) pumps of Vertical single screw type. c) One no 6 Cu.m capacity drain tank each for SG at boiler area with 1 no each / SG with one no Horizontal single screw pump with suction filters . pump capacity will be 4Cu.m/hr . NTPC is requested to confirm acceptance.	a) Pump house may be common for unloading and pressurising pumps b) Common Drain oil tank with effective capacity of 10Cu.m of dimension 2.5m-wide x 2m-depth x 2 m height . and 2 no's 10 m ³ /hr (1 working + 1 stand by) pumps for common Pump House may be accepted."
	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.18.00 / (9)	PAGE 18 OF 28	One (1) drain oil tank common for two (02) steam generator units in pressurizing pump house area having 10m ³ capacity and one oil transfer pump with motor, duplex filter at suction and other accessories to transfer drain oil from pump house to LDO storage tanks. Control of the same shall be implemented in FOPH control system.		
	SECTION-VI, PART-A	SUB-SECTION-IA-13 FO Unloading system	2.01.01 / (c)	PAGE 1 OF 2	One (1) number drain oil tank of capacity six (6) cu.m complete with accessories and instrumentation.		
	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	11.04.01	PAGE 33 OF 65	Drain oil tank(s) design/construction shall comply with following requirements:- (iii) Tank capacity :- 6m ³ (each) (min. effective volume)in SG area and 10m ³ (min. effective volume) in FO pressurizing pump house area		
	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	11.04.01	PAGE 33 OF 65	Drain oil tank(s) design/construction shall comply with following requirements:- (iv) Dimensions 3M x 2M x 1M, 2.5MX2MX2M		
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	1.02.00	PAGE 1 OF 9	One drain oil tank shall be furnished to collect the oil drained from various pipes and from the equipments in the unloading pump house. The tank shall conform to IS: 800. The tank shall have accessories as indicated in tender drawing and shall have minimum liquid holding capacity of 6 m ³ . The technical details and design specification for tank shall be as per Table -M1 appended to this Section.		
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	4.01.01	PAGE 4 OF 9	(B) DRAIN OIL TANK:- Nominal capacity of tank - 6 m ³ Size - 3 m x 1.5 m x 1.5 m (Minimum Dimensions to be adhered to)		
	SECTION - VI PART – E (TENDER DRAWINS)	P&I Diagram for LDO System	DRG.NO. 4540-001-POM-A-032	-	DRAIN OIL TANK:- CAP. 6 m ³ 1.5 m x 1.5 m x 3 m		
	SECTION-VI, PART-A	SUB-SECTION-IA-13 FO Unloading system	2.01.02	PAGE 2 OF 2	b) Two (2) nos. LDO drain pumps-set each of capacity 10 cu.m/hr. complete with all the accessories of drive and mounting as specified.		
	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	11.03.04	PAGE 30 OF 65	Drain Oil Pumps :- (v) No. of pumps - 3 (vi) Capacity of each pump - 4M ³ /hr		
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	8.00.00	PAGE 7 OF 9	Drain Oil Pumps :- 6. No. of pumps - 2 7. Rated capacity in design viscosity range-10 m ³ /hr		
	SECTION - VI PART – E (TENDER DRAWINS)	Fuel Oil Scheme	DRG.NO. 4540-001-POM-A-017	-	1 Nos of Horizontal Drain Oil Pump shown for Pressurizing Pump House Area		
	SECTION - VI PART – E (TENDER DRAWINS)	P&I Diagram for LDO System	DRG.NO. 4540-001-POM-A-032	-	DRAIN OIL PUMP VERTICAL, SINGLE SCREW 2 Nos (1 W + 1 S) CAP. 10 m ³ /HR.		
1173	SECTION-VI, PART-A	SUB-SECTION-IA-13 FO Unloading system	1.06.00	PAGE 1 OF 2	A LDO unloading header with five (05) Numbers hose connections for connecting neoprene rubber flexible hoses (05 nos.) to Road tankers shall be provided. One spare connection has been kept in the unloading header.	NTPC is requested to confirm whether existing Unloading header to be used or the same to be considered in bidder scope. NTPC is requested to confirm acceptance.	Bidder to comply specification requirement w.r.t scope of unloading header.Existing header shall not be used.
1174	SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.08.00 A)	PAGE 12 OF 38	1. Coal compartment assembly - 2 sets** 5. Coal nozzle castings - 1 set** 6. Adjustable coal nozzle tips - 1 set**	S.No. 1 - Coal Compartment assembly contains Coal Nozzle castings & Adjustable coal nozzle tips & the same is being repeated in S.No. 5 & 6. Bidder proposes to remove S.no. 5 & 6 to avoid repetition.	Such detailed aspects shall be discussed during detail engineering based on the specific type of sub-system/ burner specific design offered in line with the specifications.

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1175	SECTION-VI, PART-B	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	4.05.03	PAGE 101 OF 101	Unloading LDO from minimum five (05) nos. road tankers shall be kept. The Oil from tankers shall be unloaded to unloading header by gravity which shall then be pumped to LDO storage tanks through existing unloading pumps.	NTPC is requested to confirm whether existing pump to be used or new pumps to be supplied for Unloading LDO.	Existing pumps shall not be used.
	SECTION - VI PART – E (TENDER DRAWINGS)	P&I Diagram for LDO System	DRG.NO. 4540-001-POM-A-032	-	LDO UNLOADING PUMPS CAP. 50 m ³ /hr. 2 NOS. (1 W + 1 S)		
1176	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	5.01.04	PAGE 4 OF 9	For sizes 400 NB and below the pipe material shall be conforming to API 5L Gr.B ERW	NTPC is requested to confirm whether the pipe material - SA 106 Gr B/C is acceptable.	Bidder to comply specification requirement w.r.t. pipe material.
1177	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	6.04.02	PAGE 5 OF 9	Gate valves for sizes up to and including 40 NB shall be of class 800, forged carbon steel valves with solid wedge, OS & Y rising stem, bolted bonnet with deep stuffing box and lantern ring. Trim shall be of 13% chrome steel. Body material shall conform to ASTM A 105 and ends shall be socket welded.	NTPC is requested to note that Deep Stuffing box and lantern ring are provided for critical applications only as per the feedback received from vendors. Hence, Bidder proposes to remove the requirement for fuel oil valves. Kindly confirm acceptance.	Noted. Shall be finalised during detail engineering.
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	6.05.02	PAGE 6 OF 9	Globe valves for sizes up to and including 40 NB shall be of class 800 forged carbon steel valves with plug type disc. Other particulars shall be same as 6.04.02 above.		
1178	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	6.00.00	PAGE 27 OF 28	Provision for ready plant for methanol firing The methanol as produced above (refer cl. 5.00.00) shall be utilized, as a co-firing fuel/support fuel, for future firing in the boilers under the package scope. The provisioning of methanol as a future fuel shall be for 30% BMCR load. The same shall be done by providing/identifying required space including necessary provisioning for pipe routings, cables etc. and for this purpose loads to be factored-in for the trestle design, cable design. The required space for this purpose has been shown in GLP. The space for the pumps, tanks etc. shall be kept for the above in fuel oil pump house and boiler area also. Also refer space provisioning requirements referred elsewhere in the specifications..	NTPC is requested to clarify the extent of future provision for methanol firing as per mentioned below: 1. Whether LDO fuel provision will be kept along with Methanol or LDO firing system will be completely removed while implementing methanol firing system. 2.Whether all the LDO burners will be converted for methanol firing or some of LDO burner elevation will remain for LDO firing. 3. Kindly confirm whether methanol is envisaged as start-up fuel or not. Also bidder understands that LDO firing system shall be designed without considering any requirements related to Methanol firing. Igniters, flame-scanners, all valves and instruments at FOPH pumping location and boiler firing area shall be designed only for LDO system. NTPC is requested to confirm that both LDO tanks to be converted to methanol tank or any one of the tanks will be converted for methanol storage. LDO pumps are not envisaged to handle Methanol and space at FOPH can be considered for Pumps, piping and other system. NTPC is requested to furnish technical requirement for estimating space provision.	Bidder to note that the requirement of methanol is for future firing in the boilers and accordingly the provisions are to be for ready plant for methanol firing. The existing specified provisions for entire LDO system are standalone (which are to be complied) and independent of the methanol firing (which is envisaged for future).
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	8.00.00	PAGE 7 OF 9	LDO Unloading Pumps & LDO Transfer pumps :- 2. Type of fuel to be handled - LDO/Methanol		
1179	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	8.00.00	PAGE 7 OF 9	Sump Pumps :- 1.type of pump : vertical centrifugal submersible type . 7. Rated capacity in design viscosity range-10 m ³ /hr	NTPC is requested to note that as per centrifugal pumps vendor's feedback, Pump discharge flow rate is too less to meet the discharge head requirement mentioned in tech spec (50 MLC) . Increasing discharge flow capacity also is not recommended , considering pit size and operating time period of pumps. Hence, bidder proposes vertical single screw pumps for the application. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements as at Cl. 11.03.04, SS-A-02, part-B for the scope of Steam Generator & Auxiliaries.
	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	11.03.04	PAGE 31 OF 65	Sump pump :- (vi) Capacity of each pump - 10M ³ /hr (viii) Pump discharge head:- 50 MLC (minimum) or suiting site requirements whichever is higher.		
1180	SECTION-VI, PART-A	SUB-SECTION-IIA-13 FO Unloading system	1.04.00	PAGE 1 OF 2	One (1) number day oil tank of capacity 100 cu. meter for auxiliary boiler shall be provided. The day oil tank shall be fed from a separate set of transfer pumps and pipe line.	NTPC is requested to note that FOPH installation and auxiliary boiler are near to each other as shown in the GLP (9-F). Bidder proposes to remove day oil tank. Pump will be provided in pumphouse area suitable for oil firing system Aux. boiler. NTPC is requested to confirm acceptance.	Confirmed.
	PART – E (TENDER DRAWINGS) SECTION - VI GENERAL LAYOUT PLAN	GENERAL LAYOUT PLAN	DRG. NO. 4540-999-POC-F-001	-	FOPH & Auxiliary boiler location		
1181	SECTION-VI, PART-B	SUB-SECTION-D-1-6 CIVIL WORKS DESIGN CRITERIA	6.04.03	PAGE 22 OF 24	Painting of Steel Surfaces (Other Than Those Embedded In Concrete)- CORROSSIVITY CATEGORY: C3 & C5	NTPC is requested to confirm the Corrosive Category (C3 or C5) which is to be followed for Steel Structural items as the same is not clearly indicated as per Attachment 2 (Clause 6.04.03)	C3 - Bidder to refer Cl - 1.00.02 of Sub Section-IID, SectionVI, Part-A of Technical Specifications. Clarifications No. 01 to Technical Specifications Section-VI

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1182	SECTION – VI, PART-A	SUB-SECTION-IID CIVIL WORKS	1.00.00 / 12.	PAGE 6 of 13	Civil, structural, architectural works for fuel oil unloading & storage system namely fuel oil unloading cum pressurizing pump house with switchgear room, MCC cum control room and Fuel oil unloading system civil works including Fuel Oil tanker unloading platform, foundation and dyke wall and all associated works for LDO storage tank.	Bidder proposes combined building for Unloading and Pressurising pumps house. NTPC is requested to confirm acceptance.	Confirmed						
	PART – E (TENDER DRAWINGS) SECTION - VI GENERAL LAYOUT PLAN	GENERAL LAYOUT PLAN	DRG. NO. 4540-999-POC-F-001		GLP (9-F)								
1183	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	11.03.04	PAGE 31 OF 65	Design/Sizing of various pump shall be based on following Criteria:- (iv) Materials (a) Casing : Close grained Cast Iron/ Carbon Steel, as per the manufacturer's standard practice. (b) Shaft : Carbon steel	NTPC is requested to note that the MOC of casing and pump internal shall be as per vendor manufacturing standard for vertical pumps (Drain oil pump, dirty oil pump & sump pump) applicable in Fuel oil system. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements as at Cl. 11.03.04, SS-A-02, part-B for the scope of Steam Generator & Auxiliaries.						
	SECTION-VI, Part-B	SUB SECTION A-19 FO UNLOADING SYSTEM	8.00.00	PAGE 7 OF 9	PUMPS (As applicable) 13. Materials of construction a. Casing b. Rotor/Impeller c. Shaft d. Pump Motor Base plate								
1184	SECTION – VI, PART-B	SUB SECTION-A-03 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	13.01.05	38 OF 65	The ducts shall be of rectangular cross-section and shall be of all welded construction. Circular ducts are not acceptable. Following requirements shall be complied with: (a) Min. 8 mm thick steel plates for gas ducts upto ESP and min 6mm thick steel plates for gas duct after ESP. (b) Min. 5 mm thick steel plates for air ducts.	Based on bidder's experience and proven practice, Bidder proposes to use Min. 6 mm thick steel plates for flue gas ducts in line with previous NTPC executed project. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.						
1185	SECTION – VI, PART-B	SUB SECTION-A-03 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	13.02.05	42 OF 65	13.02.01(b), (g) & (i) .gas tightness efficiency without seal air fan is 99.80% & with seal air 100%	These clauses are not inline. Bidder proposes to follow the requirement as per clause no 13.02.01(b), (g) & (i), gas tightness efficiency without seal air fan is 99.80% & with seal air 100%. NTPC is requested to confirm acceptance.	The requirements at two different referred clauses are specific to corresponding area gate/damper. Bidder to comply the specifications requirements.						
	SECTION – VI, PART-B	SUB-SECTION-A-04 SELECTIVE CATALYTIC REDUCTION	5.11.00	10 OF 22	The motor operated gates shall be guillotine gate type and shall be provided with 2x100% pressurization fans to achieve 100% sealing efficiency.Leak tightness efficiency of gate on flow shall be 99.95%.								
1186	SECTION – VI, PART-B	SUB-SECTION-A-04 SELECTIVE CATALYTIC REDUCTION	5.11.00	10 OF 22	Alternatively, Bidder can provide Biplane damper with sealing arrangement at SCR outlet duct as per its standard and proven practice Pneumatic operated control damper and motor operated gate shall be provided in economizer bypass duct for regulation and isolation of economizer bypass flow. The motor operated gates shall be guillotine gate type and shall be provided with 2x100% pressurization fans to achieve 100% sealing efficiency. Leak tightness efficiency of gate on flow shall be 99.95%.	NTPC is requested to note that there is discrepancy in the clause highlighted for Biplane damper. We understand that the specification requirement mentioned in clause no 13.02.02 &13.02.05 will be followed. NTPC is requested to confirm acceptance.	Bidder to note that for SCR related dampers the details for performance are to be referred from the corresponding SCR chapter.						
	SECTION – VI, PART-B	SUB SECTION-A-03 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	13.02.02 &13.02.05	PAGE 42 OF 65	ii)As an alternate to the damper at SCR outlet duct as inClause 13.02.01 (h), Bidder can provide Bi- planedamper with sealing arrangement at SCR outlet duct asper its standard and proven practice. <table><tr><th>Damper at locations</th><th colspan="2">Min. Guaranteed Gas tightness Efficiency</th></tr><tr><th>As per Clause No.</th><th>Without Seal Air</th><th>With Seal Air**</th></tr><tr><td>13.02.01 (e), 13.02.02(ii) & 13.02.02 (iii)</td><td>99.50%</td><td>100%</td></tr></table>			Damper at locations	Min. Guaranteed Gas tightness Efficiency		As per Clause No.	Without Seal Air	With Seal Air**
Damper at locations	Min. Guaranteed Gas tightness Efficiency												
As per Clause No.	Without Seal Air	With Seal Air**											
13.02.01 (e), 13.02.02(ii) & 13.02.02 (iii)	99.50%	100%											
1187	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	13.01.06	39 OF 65	Material of construction : (iii) Pipe struts, trusses, bracing : ASTM A 53 or equivalent seamless steel pipe.	NTPC is requested to note that Material of construction shall be as per IS standards: (iii) Pipe struts, trusses, bracing : IS 1161 /ASTM A 106 NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements. Further, material conforming to equivalent Indian standard shall be acceptable. Refer amendment in this regard.						

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1188	SECTION – VI, PART-B ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	4.02.01	4 OF 22	The reactor casing shall be fabricated from all welded reinforced, 6 mm minimum thickness, carbon steel plates conforming to ASTM A36.	NTPC is requested to note that the reactor casing shall be fabricated from all welded reinforced, 6 mm minimum thickness, carbon steel plates conforming to ASTM A36 or equivalent grade. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements. Further, material conforming to equivalent Indian standard shall be acceptable. Refer amendment in this regard.
1189	SECTION – VI, PART-B ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	4.02.06	5 OF 22	Each catalyst elevation shall be provided with grated platform inside the reactor housing to support and place the catalyst modules. The opening of the grating shall be sufficiently large to prevent ash pluggage / accumulation. The elevation of platform outside the reactor shall match the elevation of inside the reactor platform to facilitate the easy removal/placement of catalyst modules.	NTPC is requested to note that based on bidder's experience and proven practice, the requirement of grated platform inside the reactor housing to support and place the catalyst modules is not envisaged. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements. Further detailed aspects shall be reviewed during detail engineering.
1190	Sec VI Part-A	Sub Sec- IB Project Information	Table 1-A	8 of 15	Ultimate Analysis	Following fuel properties are not specified in the specification and same is required for the design/selection of Steam generator & Auxiliary equipment. 1. Arsenic 2. Chlorine 3. Fluorine NTPC is requested to provide above inputs.	Bidder to take these value as on conservative side based on the type of coal as furnished.
1191	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	Annexure- IV-6	page 12 of 15	METHANOL CHARACTERSTICS	As per specification, Methanol firing will be implicated in future and not now. We understand that the analysis specified here for bidder information only. NTPC is requested to confirm acceptance.	Bidder's understanding is correct. However, the design of Steam generator & related auxiliaries shall factor-in such provisioning.
1192	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	Annexure- IV-7 (A)	page 13 of 15	Torrefied Pellet	NTPC is requested to note that HGI of the biomass (Torrefied pellet) is not furnished in the specification. NTPC is requested to furnish the same.	Bidder to refer the type of biomass & its constituents along with the properties as specified towards deriving the HGI value. Further, ISO 5074 or equivalent method may be referred for testing standard.
1193	SECTION – VI, PART-A	SUB-SECTION-IB PROJECT INFORMATION	Annexure- IV-7 (A)	page 13 of 15	Torrefied Pellet	NTPC is requested to furnish few photograph and sample of Torrefied Bio-mass for further study by Bidder. In addition to this, NTPC is requested to furnish the manufacturing process of biomass torrefied pellet.	Bidder to refer the type of biomass & its constituents along with the properties. Further, the process parameters are given in the corresponding Annexures.
1194	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.13.01	page 9 of 28	(7) Stall detection probe along with stall duration integrator	NTPC is requested to note that there is no specific hardware for such application and hence same will be implemented in DCS. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.
	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.13.02	page 9 of 28	(7) Stall detection probe along with stall duration integrator		
	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.15.04	29 OF 65	(7) Stall detection probe along with stall duration integrator		
1195	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	2.14.01 (11)	10 of 28	On-Load High Pressure Water Washing System with pump, piping and nozzle etc. at cold end only.	NTPC is requested to note that SRDS is implemented for this project. High pressure washing pump is required for SCR. Hence, high pressure washing pump will not be supplied. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements. Further detailed aspects shall be reviewed during detail engineering based on specific equipment selected design.
1196	SECTION-VI, PART-A	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	6.00.00	27 of 28	Provision for ready plant for methanol firing The methanol as produced above (refer cl. 5.00.00) shall be utilized, as a co-firing fuel/support fuel, for future firing in the boilers under the package scope. The provisioning of methanol as a future fuel shall be for 30% BMCR load.	Bidder understands that the provision for ready plant for methanol firing is for co-firing fuel/support fuel and not for the start up fuel. NTPC may clearly state that once the methanol co-firing fuel / support fuel starts, there is no LDO firing.	Bidder to note that the requirement of methanol is for futur firing in the boilers and accordingly the provisions are to be for ready plant for methanol firing. The existing specified provisions for entire LDO system are to be complied with which are standalone and independent of the methanol firing as envisaged for future.
1197	SECTION-VI, PART-A	SUB SECTION-IIA-02A SELECTIVE CATALYTIC REDUCTION SYSTEM	2.00.00	2 of 3	The above is described towards only design, engineering, of the complete system while further manufacturing, supply, erection and commissioning scope shall only be limited to the works required for SCR ready/Hybrid ready plant as per annexure SG-04 as attached.	NTPC is requested to note that the design, engineering of the complete system will be carried out by bidder to an extend possible. However, equipment which are supplied by Sub-Vendor will be excluded from bidder scope. NTPC is requested to confirm acceptance.	Bidder to refer the scope as defined in the specifications. Accordingly, sub-vendor supplied equipment's design & engineering as per package scope is included in bidder's scope. Bidder to comply the specifications requirements.

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1198	SECTION-VI, PART-A	SUB SECTION-IIA-02A SELECTIVE CATALYTIC REDUCTION SYSTEM	Annexure-SG-04	3 of 3	Contractor shall be required to share the complete design and engineering data/drawings/other inputs to enable the owner to procure the SCR reactors/Hybrid System and Ammonia/Urea Unloading, Storage, Handling and Injection system.	NTPC is requested to note that Ammonia / Urea Unloading, Storage, Handling system is Sub-Vendor Item and hence the design, engineering of Ammonia / Urea Unloading, Storage, Handling system is excluded from bidder scope. NTPC is requested to confirm acceptance.	Bidder to comply with specification requirements.
1199	SECTION-VI, PART-A	SUB-SECTION-IIA-17 MILL REJECT HANDLING SYSTEM	1.01.02	2 OF 2	1.01.02 Mechanical conveying system:	This section is repeat of clause no 1.01.02 of page 1 of 2. Please delete this section	1.01.02 may be ignored as it is repeat clause.
1200	SECTION-VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.00.01	2 OF 73	1. For Cat-I Performance / Acceptance tests to be conducted along with the initial operation: After the conductance of Performance test, the test results shall be calculated automatically by the server/software provided by the contractor. The correction curves shall be fed/inbuilt in the PG test program/software. Provision of manual entry of offline data which cannot be captured online (such as Relative humidity, Atmospheric pressure etc.) and necessary for calculation of PG Test result shall also be provided. The contractor shall submit the detailed test evaluation report of Performance test results to Employer promptly but not later than 7 days from the date of conductance of Performance test.	NTPC is requested to note that there are several manual input like ambient condition (temperature and relative humidity), coal analysis, UBC, flue gas outlet temperature (grid result), flue gas analysis (grid result) etc. to calculate boiler efficiency during PG test. Hence NTPC is requested to clarify this requirement.	The requirement is specified towards calculation of the results in auto mode in order to ensure accurate results. Further, bidder to refer complete clause wherein manual entry is referred.
1201	SECTION-VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.00.01	5 OF 73	GUARANTEES UNDER CATEGORY - I xiii) LD for 0.1% increase in APH Leakage against the shortfall (as per part-B guarantee condition description).	NTPC is requested to note that as per contract, the boiler efficiency will be calculated as per EN_12952-15-Acceptance tests which include the air heater leakage. It means that LD will be applicable twice for boiler efficiency (plant heat rate) as well as separately for APH leakage. Hence, we request NTPC to remove the APH leakage from Category-I guarantee and remove the LD.	Bidder to comply the specifications requirements.
	SECTION-VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.00.02(xiii)	7 OF 73	(xiii) LD for 0.1% increase in APH Leakage (as per part-B guarantee condition description) US \$ 129864 (US Dollar One Lac Twenty Nine Thousand Eight Hundred and Sixty Four only) for every 0.1% point increase from the guaranteed or specified		
1202	SECTION-VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.01.03.02	11 of 73	55% TMCR - 115 degree C or as predicted by the Bidder whichever is higher	Bidder understands that the flue gas temperature at 55% TMCR is 115 degree C or as predicted by the Bidder whichever is higher as per SCR ready design system and hence without SCR operation. NTPC is requested to confirm the same.	Confirmed.
1203	SECTION - VI PART-B	SUB SECTION G-04 - STANDARD PG TEST PROCEDURE		5 of 224	Note - Boiler efficiency & Turbine cycle heat rate will be determined during SG PG Test and TG PG Test respectively	Boiler efficiency test method is not furnished here. NTPC is requested to furnish the Boiler efficiency test procedure.	The aspects related to boiler efficiency test are provided in the specifications. Further the detailed boiler efficiency test procedure shall finalized during detail engineering.
1204	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.04.00 (a,b)	3 of 101	Step load change: Minimum $\pm 10\%$ per minute	Bidder understand there is some typo error, The Step load change : Minimum $\pm 10\%$ and not per minute. NTPC is requested to confirm acceptance.	Refer amendment A-SG-14 in this regard.
1205	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.02 (e) (v)	PAGE 7 OF 101	Upto & above 610 degree Celsius: Austenitic stainless steel, SA-213 UNS S30432 Shot Peened, TP347H FG or approved equivalent.	As per bidder experience, all SA-213 UNS S30432 material needs not be shot peened. The SA-213 UNS S30432 shot peened material will be used at SH and final RH out let where the high steam temperature is experienced. The length of the shot peened SA-213 UNS S30432 will be decided by bidder during detail engineering stage based on bidder experience. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.
1206	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.06.02 (iv)	10 of 101	Load Range - 60% BMCR with design / best / worst coal and max moisture	Since all axial fans are designed for 60% TMCR, the RAPH will be also designed for 60% TMCR operating condition. NTPC is requested to confirm acceptance.	Pl. refer amendment A-SG-15 in this regard.
	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.06.02 (6)	10 of 101	1 RPM or actual whichever is higher RAPH rotation speed	NTPC is requested to note that it is understood from the specification that NTPC intends to operate RAPH at lower speed below 1 rpm. We would like to clarify that the RAPH speed will be decided by OEM as per standard design.	Bidder to note that the intent is to select the optimum speed for maximizing heat recovery. Bidder to comply the specifications requirements.

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1207	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	9.01.03	17 OF 65	(iv) One of the drive of each of the air preheater shall be provided with VFD for speed regulation from full design rotational speed or 1 rpm, whichever is higher, to about 0.3 rpm. The Contractor shall carry out a test after commissioning to detect the optimum speed of the air preheater to maximize gas temperature reduction at its gas side outlet. Optimum rotation speed for 100% TMCR, 80 % TMCR and 60% TMCR unit loads shall be recommended by the contractor based on such tests. The test shall be made by incrementally reducing the speed in steps of 0.1 rpm from its present maximum operating speed onto the minimum specified speed. Suitable soaking time at each speed step shall be given during the test before recording the temperatures and other performance parameters. Test procedure shall be furnished during detail engineering.	Design: NTPC is requested to confirm acceptance.	
1208	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.07.02	12 of 101	Design SCAPH and connected air ducts to handle flows corresponding to 60% BMCR loads with one of the two streams working...	NTPC is requested to note that all axial fans are designed for 60% TMCR. The SCAPH will be designed for 60% TMCR operating condition. NTPC is requested to confirm acceptance.	Pl. refer amendment A-SG-16 in this regard.
1209	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.13.03	18 of 101	The fans shall also fulfill following sizing criteria in addition to those mentioned at Clause 1.05.13.02 above Each fan to be sized for 50% TMCR flow calculated taking into following conditions occurring together. FD ID (i) Margin over 100% BMCR flow: 20% (ii) Margin over 100% BMCR pressure requirement: 44%	NTPC is requested to note that discrepancy is observed for fan sizing and it's operating condition. In this clause, it is indicated that each fan will be sized for 50% TMCR flow calculated taking into the conditions occurring together. However, it is also indicated below that margin is required at 100% BMCR. As per bidder understanding, it should be 100% TMCR and not 100% BMCR. NTPC is requested to confirm acceptance.	Refer amendment A-SG-17 in this regard.
1210	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.01	23 of 101	Minimum catalyst volume per reactor per layer(m2) with plugging margin: 150	As per bidder experience, the requirement of minimum catalyst volume per reactor per layer(m2) with plugging margin specified here is higher. As per NTPC previous tender and as per bidder experience in NTPC executed project, minimum catalyst volume per reactor per layer(m2) with plugging margin is 120 m2. NTPC is requested to revise the same.	Bidder to comply the specifications requirements.
1211	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.02	24 of 101	SCR efficiency for control of NOx emission (%): 92	As per NTPC previous tenders and as per bidder experience in NTPC executed project, the SCR efficiency at guarantee point is 80%. Bidder proposes the same for Talcher project also. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.
1212	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.02	24 of 101	Max flue gas pressure drop across SCR system (mmwc): 150	NTPC is requested to note that discrepancy is observed in the SCR pressure drop specified in the specification. SCR pressure drop as specified in the clause no 1.05.13.02 shall be considered for SCR design. NTPC is requested to confirm acceptance.	Refer amendment A-SG-34 in this regard.
	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.13.02 (vi)	PAGE 17 OF 101	Pressure drop through SCR System 100 mm WC or actual whichever is higher		
1213	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.03	25 of 101	Height of catalyst module (maximum)(mm): 1300	NTPC is requested to note that the catalyst height of 1300 mm is not sufficient for the minimum catalyst volume per reactor per layer(m2) with plugging margin: 150. Hence, NTPC is requested to revise the catalyst volume per reactor per layer(m2) with plugging margin from 150 to 120m2.	Refer amendment A-SG-18 in this regard.
	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.01	23 of 101	Minimum catalyst volume per reactor per layer(m2) with plugging margin: 150		
1214	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.04	26 of 101	1.05.19.04 Ammonia Unloading, Storage & Handling System (Common for all two units):	NTPC is requested to note that the ammonia handling system is turnkey package for bidder. Since SRDS is proposed for Talcher project, design and engineering of the sub-vendor package is not possible and hence excluded from bidder scope of work. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.
1215	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	1.05.19.04	26 of 101	Capacity of each compressor Min 1100 LPM, Reciprocating, oil free type	There are limitation on the compressor capacity for Ammonia application. Hence, NTPC is requested to revise the compressor capacity to min 560 LPM inline with statutory requirement. NTPC is requested to confirm acceptance.	The capacity constraints, if any, on account of statutory requirement shall be considered.

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1216	SECTION - VI PART-B	SUB SECTION A-01 - EQUIPMENT SIZING CRITERIA	3.14.02.01	82 of 101	5. For each Unit of Ash handling system, Silo Utility & its auxiliaries (Continuous): E	NTPC is requested to note that the instrument air for Ash handling system will be taken from Ash handling compressor and not from the plant compressor as followed in NTPC executed projects. The requirement specified here for instrument compressor sizing will not be considered by bidder. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements.
1217	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	1.00.00	1 OF 65	The specified requirements shall be complied for the most stringent conditions resulting either from the range of coals (design/worst/best/adequacy) specified or from the range of operating conditions specified (like 100% BMCR or HP Heaters out of operation etc.), or from both occurring simultaneously, unless specifically mentioned otherwise by the Employer.	a) The requirement of Adequacy coal operation is deleted in the clause no. 1.01.01. However this requirement of adequacy coal is not deleted from other clause in tender specification. Hence, we request NTPC to kindly issue amendment to inform deletion of adequacy coal requirement from other clauses of tender specification. b) Bidder has observed discrepancy in the steam generator and it's auxiliary sizing. We understand that the steam generator and it's auxiliary sizing shall be sized as per the 3.03.13 specification requirement. NTPC is requested to confirm acceptance.	1. The deleted clause reference with the envisaged requirements as specified is not clear. Bidder to note that the requirement of adequacy coal is there in line with the specified requirements. Bidder to comply with the specifications requirements. 2. The discrepancy as referred by the bidder is not mentioned. Corresponding sizing clauses may be referred towards specifications compliance.
	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	1.01.01 (d)	1 OF 65	(d) Not Applicable		
	SECTION-VI, PART-B	SUB-SECTION- G-06 PRE-COMMISSIONING & COMMISSIONING ACTIVITIES	3.03.13	9 OF 14	Contractor shall demonstrate the capability of Steam generator and its auxiliaries to operate at rated parameters safely and on sustained basis at TMCR load while firing range of Indian coal(s) as specified in Table-1(A), Annexure-IV-2, sub section-IB, Part-A of Section-VI blended with imported coal up o 30% by weight specified in Table-4, Annexure-IV-4, sub section-IB, Part-A, Section-VI. Such demonstration shall be for 72 hours of continuous operation		
	SECTION-VI, Part-B ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	ANNEXURE-SS1 SELECTIVE CATALYTIC REDUCTION	3.00.00	4 OF 9	The specified requirements shall be complied for the most stringent conditions resulting either from the range of coals (design/worst/best/adequacy) specified or from the range of operating conditions specified for the steam generator (like 100% BMCR), or from both occurring simultaneously, unless specifically mentioned otherwise by the employer.		
1218	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	5.01.00 (b)	PAGE 9 OF 65	Steam Separator construction shall have: Fusion welded construction with welded hemispherical dished ends.	Bidder understands that steam Separator and Drain collection vessel with forged construction is also acceptable to NTPC inline with Bidder's earlier experience in NTPC projects and supplies made by bidder for NTPC projects. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements. Further, detailed aspects shall be reviewed during detail engineering based on selected specific equipment.
1219	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	7.01.01 (c)	PAGE 11 OF 65	(c) Ensure even temperature distribution at gas and steam side by criss-crossing the steam paths between LHS and RHS.	Bidder's boiler design employs twin fire vortex for uniform heat absorption across the furnace. Further steam temperature control can be achieved by individual right/left spray control system for the superheater and with the help of gas biasing damper control for Reheater temperature balancing. Hence criss-cross arrangement in SH and RH line are not necessary for twin fire vortex furnace design and hence not envisaged. In our all operating units in India with above said boiler configuration the temperature imbalance is within 10 deg. C for both RH & SH. NTPC is requested to confirm acceptance.	Bidder to ensure the imbalance of temperature within the specified limits for both SH & RH (Super heater & Re-heater). Suitable space provision shall be provided during the engineering stage for future criss cross arrangement or any other measure (if required) in order to meet the specified requirements.
1220	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	7.01.00	13 of 65	10 Space Provision Keep provision of space for atleast 20% addition of additional economizer and 10% for the reheater surfaces in future.	NTPC is requested to note that Bidder has achieved the rated RH outlet temperature in all previous installation. Moreover as per bidder design RH temperature is control / achieved by gas biasing damper. Hence there will not be any issue to achieve the rated RH temperature. The requirement of RH additional surface is not applicable for bidders design. NTPC is requested to confirm acceptance.	Bidder to comply the specifications requirements
1221	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	8.02.00	15 OF 65	(d) Supported by steam or water cooled hanger tubes forming part of Steam circuit with hanger tubes designed for a minimum of 2 times the calculated load so as not to cause any dislocation/damage to the tube banks/setting. Necessary calculations in support of this shall be furnished by the bidder. Structural type hanger support will not be acceptable.	NTPC is requested to note that the economiser support by steam or water cooled hanger tubes will be new supporting arrangement for bidder as compare to the previous installation. Bidder would like to clarify once again that Economiser coils are supported by structural arrangement as per proprietary and proven standard design, which will not interfere the normal operation and maintenance of the boiler. Further bidder confirms that the structural support arrangement shall be designed taking care of erosion problems for fly ash. Further the supporting arrangement shall be designed for a minimum of two times the calculated load so as not to cause any dislocation/ damage to tube bank / sections. Hence, we request NTPC to accept structural type hange support also.	Bdder to comply the specifications requirements.
1222	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	9.01.09(I)	18 of 65	(I) Leakage control system - sector plate (s) system with drive unit & accessories shall be provided at hot end to reduce the hot end leakage and energy loss. This shall also online maintain the seal gap/radial seal clearance based on pre-set temperature and thereby ensure leakage control at various loads.	As per OEM proven design, RAPH seal plate arrangement Automatically actuated hot end radial sealing system via gas duct temperatures. Bidder understanda this will fulfil the specification requirement. NTPC is requested to confirm acceptance.	Further, detailed aspects shall be reviewed during detail engineering based on selected specific equipment. Bidder to comply the specifications requirements.

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1223	SECTION – VI, PART-B	SUB SECTION-A-02 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	14.01.06 (iii)	22 of 65 44 of 65	Pulverizer Sound level Shall not exceed specified values. While selecting lagging, background noise from adjacent mills, drive system and other secondary & stray noises shall be taken into account.	NTPC is requested to note that the pulveriser noise level is not specified in the specification. NTPC is requested to specify the noise level for the pulveriser as well as for the Axial Fan.	It is already specified in Part-C. Pl. refer part C in this regard.
	SECTION – VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.02.00	26 OF 73	Noise		
1224	SECTION – VI, PART-B	ANNEXURE-SS1	9.05.01	PAGE 15 OF 22	Vaporizer shall be designed to supply ammonia vapour to SCR reactor under all operating conditions. The vaporizer shall be shell and tube type heat exchangers. Auxiliary steam shall be used as heating source which will transfer heat to secondary Glycol/Water/Glycol-Water cycle which in turn would supply heat to ammonia. Glycol/Water/Glycol-Water mixture as intermediate heat transfer medium shall be circulated in closed cycle. Either of options shall be used as a working fluid in heating system of Ammonia vaporizer as per bidder's proven practice.	Bidder proposes instead of forced circulation system, Water bath type natural circulation system for heating of ammonia based on proven practice. Hence, the water will be directly heated through auxiliary steam and heat in water will be transferred to ammonia. NTPC is requested to kindly confirm acceptance.	Bidder to comply with specification requirement.
1225	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION- IIA-08 LOW PRESSURE PIPING	1.10.00	Page 11 of 19	(a) All high points in piping system shall be provided with vents. All low points shall be provided with drains. Provisions of drains on steam piping shall be as per ASME code TDP-1. (b) For all Power cycle piping systems, minimum inside diameter of drain pipe selected shall not be less than 19mm.	NTPC is requested to note that the drain pipe size for boiler and critical piping will be decided by the bidder as per proven design and best engineering practice. NTPC is requested to kindly confirm acceptance.	Bidder to comply specification requirements.
1226	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB – SECTION – A-03 STEAM GENERATOR AND AUXILIARIES INCLUDING ESP	17.01.02	PAGE 50 OF 65	The platforms shall be all along the length of soot blower control station, Fuel oil control station, SH & RH spray control stations, SCAPH control station, steam/water sample coolers, APH lube oil station etc. Access through Elevator, staircase and main access walkways for reaching the platforms shall be provided. The above equipment including scanner air fans should be located at firing floor elevation for ease of operation and maintenance.	Bidder requests NTPC to keep the soot blower control station, SH & RH spray control station at higher elevation as per bidder standard Practice. Soot Blower Control Station shall be located above Soot blowers as per Bidder standard Practice. NTPC is requested to kindly confirm acceptance.	The detailed aspects shall be reviewed during detail engineering based on specific sub-system selection without compromising the ease of O&M.
1227	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION-A-08 Power Cycle Piping	1.08.00	Page 7 of 19	2.0-b Construction Gate valves Solid/flexible wedge below 100 NB Flexible wedge for 100 NB & above	2.0 Construction Gate valves Solid/flexible wedge below 100 NB Flexible wedge/parallel slide for 100 NB & above. NTPC is requested to kindly confirm acceptance.	Bidder may please refer Note 3 mentioned in Clause No. 1.08.00, Sub-section: A-08, Part-B of Technical specification, which mentions "Gate valves below 100 NB shall be solid wedge / flexible wedge type, valves of size 100 NB and above shall be of flexible wedge type. However, for sizes 100 mm NB and above and with class above 600, parallel slide valves are also acceptable."
1228	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION-A-08 Power Cycle Piping	1.08.00	Page 10 of 19	18. Unless otherwise agreed, all valves shall be fitted with the spindle in upright position.	NTPC is requested to note that valve will be installed in horizontal pipeline with stem upright and in vertical pipeline will have horizontal stem. NTPC is requested to kindly confirm acceptance.	Bidder's suggestions in vertical lines may be considered during detailed engineering.
1229	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION-A-08 Power Cycle Piping	1.08.00	Page 10 of 19	19. The minimum inside diameter for valves shall be as per requirements of ASME B16.34. For valves beyond the listed sizes & rating in Table-A of non-mandatory Appendix-A of ASME B16.34, the minimum diameter of valve flow passage shall not be less than 90% of pipe inside diameter. However, reduced port valves are also acceptable for sizes 65NB and below.	NTPC is requested to note that ID of the valves shall be in line to ASME B16.34 requirements i.e. Table-A of non-mandatory Appendix-A of ASME B16.34. NTPC is requested to kindly confirm acceptance.	Bidder's Understanding is correct, however, Bidder also to note that, for those valves beyond the listed sizes & rating, requirement has been clearly specified in the clause.
1230	TECHNICAL SPECIFICATIONS SECTION VI –Part – A BID DOC NO. CS-4540-001A-2	SUB-SECTION- A-9 (LOW PRESSURE PIPING)	2.12.02	PAGE 10 OF 19	For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.	NTPC is requested to note that as per bidder as per proven design and best engineering practice following material will be followed: Pipe sizes 65 mm NB & above - Carbon Steel (Cast body + Galvanised body) Pipe size sizes 50 NB and below - Carbon Steel (Forged Body)	Bidder may please refer Clause No. 2.13.01 (d), Sub-section: A-09, Part-B of Technical specification, which mentions "Forged carbon steel & Forged stainless steel valves are also acceptable in place of Gun metal valves."
1231	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 13 OF 38	VALVES	We understand that in case any of the specified mandatory spares / Items are not covered in the actual design / supply, then that spares / Items may be treated as "not applicable". NTPC is requested to confirm that our understanding is correct.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1232	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 1 OF 3	Power Cycle Piping	We understand that in case any of the specified mandatory spares / Items are not covered in the actual design / supply, then that spares / Items may be treated as "not applicable". NTPC is requested to confirm that our understanding is correct.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.

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1233	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 13 OF 38	A. Spares for Steam Separator Safety valves- 4. Locking pin set	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1234	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 13 OF 38	B. Spares for SH Safety Valves 10. Set of washers 4. Set of locking pins	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1235	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 14 OF 38	C. Spares for Hot RH safety Valves 10. Set of washers 4. Set of locking pins	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1236	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 14 OF 38	D. Spares for Cold RH safety Valves 10. Set of washers 4. Set of locking pins	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1237	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 14 OF 38	E-1. Spares for Electromatic Relief Valves 2.2 Spring for main valve 2.4 Seal bushing for main valve 2.6 Bushing for pilot valve 2.8 Seal ring	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1238	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.14.00	PAGE 14 OF 38	E-2. Spares for Electromatic Ball Valves	NTPC is requested to note that either Electromatic Relief Valves or Electromatic Ball Valves shall be supplied for the project. Mandatory spare shall be supplied accordingly.	In such case, Bidder shall supply mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1239	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.18.00	PAGE 15 OF 38	Boiler Feed Check Valve 4. Gland packings	NTPC is requested to note that these spares shall be supplied only if applicable as per OEM Standard. Supply of this component shall be discussed and finalized accordingly.	In such case, Bidder shall supply equivalent mandatory spares pertaining to their offered design. Bidder to comply the specifications requirements.
1240	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	1.17.00	PAGE 15 OF 38	Spares for boiler main steam stop valve 1. Boiler main stop valve assy	NTPC is requested to note that Boiler main stop valve ASSY without valve body shall be supplied.	Bidder to note that assembly shall include valve body also. Bidder to comply the specifications requirements.
1241	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 1 OF 3	7-Complete gate valves assembly up to the size of 50 NB	Kindly note that these spares are not applicable as there are no Gate valve in Bidder design below DN50.	In such case, Bidder shall supply mandatory spares applicable for their offered design as per specification requirement, and accordingly Schedule of Prices to be filled.Bidder to comply the specifications requirements
1242	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 2 OF 3	15b) Steam trap & Y strainer above 25 NB & up to 50 NB	Kindly note that these spares are not applicable as there are no Steam trap & Y strainer above 25 NB & up to 50 NB in Bidder design.	In such case, Bidder shall supply mandatory spares applicable for their offered design as per specification requirement, and accordingly Schedule of Prices to be filled.Bidder to comply the specifications requirements
1243	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 2 OF 3	15c) Steam trap & Y strainer above 50 NB	Kindly note that these spares are not applicable as there are no Steam trap & Y strainer above 50 NB in Bidder design.	In such case, Bidder shall supply mandatory spares applicable for their offered design as per specification requirement, and accordingly Schedule of Prices to be filled.Bidder to comply the specifications requirements
1244	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 3 OF 3	Additional Note -If there is one no valve only of particular type , class and size then only one no is required. If there is one no valve only of particular type , class and size then only one no is required	Kindly note that if there is one no. valve only of particular type, class and size then only one no. of mandatory Spare shall be supplied. NTPC is requested to kindly add this note in the PCP valve section also like LP section.	Bidder's Proposal not acceptable. Bidder to comply specification requirements.
1245	TECHNICAL SPECIFICATION SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER – 06 PIPING	2	PAGE 3 OF 3	Additional Note -In case any of the above specified mandatory spares / Items are not covered in the actual design / supply, then that spares / items may be treated as “not applicable”.	We understand that if these Items are not covered in the actual design then these spares / items will be treated as “not applicable”.	Bidder.s Understanding is correct
1246	SECTION – VI, PART-A	SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	2.04.7	8 of 18	Requirements of Station LAN architecture DDCMIS vendor shall upgrade/ update all DDCMIS system along with Station LAN to the latest version/ release of DDCMIS system software/ patches, meeting the system software requirements as mentioned in Part-B, SUB-SECTION-IIIC-02 DDCMIS. This shall include the latest OS and its corresponding latest version/ release of DDCMIS system software/ patches.The upgrade/update shall be checked for and carried out six months before the completion of AMS of DDCMIS. Any change in hardware and the requisite services (Engineering/ Erection/ Commissioning / Documentation) required for the same shall also be carried out by the contractor within the contract price	Software Patches/ updates for softwares supplied along with DDCMIS shall be provided free of cost to the customer till AMC. However, any upgrade in software/ hardware shall be provided on chargeable basis.	Bidders understanding is not correct. Bidder to comply the specification requirements

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1247	SECTION – VI, PART-A	SUB-SECTION-II-C CONTROL & INSTRUMENTATION SYSTEM	4.00.00(ii)	12 OF 18	For monitoring signals of Boiler SH/RH metal temperature & Generator Core/ Slot temperature measurements Profi Bus / Foundation Field Bus Compatible temperature transmitters / Wireless temperature transmitters are acceptable. For Generator Core/ Slot temperature measurements, Modbus connectivity to DDCMIS is also acceptable. In case Wireless temperature transmitters are provided, the requirements specified at Sub Section – IIIC-18, Wireless Instruments & System including fieldbus instruments, Part-B, Sec-VI and corresponding clauses in Part-A, F & C will be applicable	Bidder will considered Profi Bus/ Foundation Field Bus Compatible temperature transmitters/ Wireless temperature transmitters for metal thermocouple except for temp transmitter used for MFT	Bidder's understanding is correct . Please also see the complete referred clause for detail.
1248	SECTION – VI, PART-A	Annexure C to IIC Contract quantity-	2.04.00	5 of 24	Stand-Alone DDCMIS The Control System of Stand-Alone DDCMIS shall comprise of following process blocks. The major equipment/ control loops in each block are indicated below. i) Compressor Block including Air compressor for Mill reject system: The control, operation and monitoring functions of all compressors (IAC and PAC and Air compressor for Mill reject system being supplied by Contractor as well as employer's IAC and PAC) shall be implemented in this FG. The control scheme shall be finalised during detail engineering. ii) NOx Storage system block: This block consist of control of NH3 unloading.	Bidder clarify that compressor will be controlled by OEM supplied proprietary control system which will be linked to DCS through Modbus for monitoring only	Bidder clarification is acceptable.
1249	SECTION – VI, PART-B SUB-SECTION-IIIC-02 DDCMIS		15.00.00	3 of 17	Triple/ Dual measurement schemes shall be provided for triple / dual redundant sensors used in closed loop and open loop controls. The triple / dual measurement schemes for closed loop control shall provide median /average outputs. The operator shall be able to select any of the transmitters or the median/average value from the LVIS/ OWS.	In case of compressor, 2 no's of duplex PT-100 RTD per bearing and the clarification as below. As per IEC 60034, OEM can accept 3/ micron RMS vibrations on motor bearing housing. But for centrifugal compressor there vibrations are too high. Please note centrifugal compressor rotates more than 45,000 rpm. As per API 541, OEM needs to maintain motor vibration less than 12.5 micron P-P on motor shaft tip and 25 micron P-P on motor bearing housing. The selected motor is in line with this vibrations. In case, we make additional drills on motor bearing housing to fit additional sensors, then it will increase motor vibrations. As per API 672, OEM needs to maintain compressor shaft vibration less than 50 microns P-P for healthy operation. Under such condition OEM can't accept motor vibrations more than specified limit as per API. Bidder request NTPC accept the same for compressor application and also other OEM proven equipment	For RTDs of Compressor motor, Bidder to refer Clause no-7.07.00 of Sub Section-II-B-02, Section -VI, Part-B of Technical Specification.
1250	SECTION – VI, PART-B	SUB-SECTION-IIIC-02 DDCMIS	29.00.00	16 of 17	1. The Bidder shall provide an unlimited warranty on all equipment and software during the Defect liability period. This warranty shall include repair, replacement or correction of identified software or hardware discrepancies at no cost to Employer. 2. The Bidder shall provide warranty spares and an exhaustive list of warranty spares including components for system hardware and instrumentation and peripherals based on (and keeping adequaten margin over) normally experienced failure rate shall be submitted by the Bidder for Employer's review regarding adequacy of the same. The warranty spares as per the list mentioned above will be dispatched by the Bidder along with the main equipment consignment. The Bidder shall also provide expandable items for the warranty period. 3. In case of any hardware failure which hampers normal operation, the Bidder during the warranty period must provide on-site technical expertise to repair/rectify the problem within a week and if any component is not available at site, the Bidder must arrange to supply these components at site within additional 48 hours. If a software problem is identified, this problem shall be corrected within two weeks. 4. After six months of DDCMIS operation the Bidder shall provide the list of parts and expendables utilized for the period. The same information will be provided at the conclusion of the warranty.	Request NTPC to clarify below points: i) Define unlimited warranty ii) Bidder will submit Exhaustive list of warranty spares including components for system hardware and instrumentation and peripherals to NTPC for reference purpose only. Bidder doesn't envisage any Comment/ approval from NTPC on the submitted list. iii) Bidder understands that on completion of warranty period, the unused spares will be handed over to bidder.	i) Bidder to comply specification requirement. ii) Bidder to comply specification requirement. iii) Bidders understanding is correct.
1251	SECTION VI, PART-B	SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02G	3.00.00	3 of 4	SAT (Site Acceptance Test) for Performance Testing: Site acceptance test shall be conducted for evaluating the performance of the APC software.....	Bidder clarify that Performance Requirement of the Closed Loop Control System depends on the dynamic characteristics of the boiler, turbine and its Auxiliary equipment. In view of that the requirement of the clause cannot be met.	Bidders understanding is not correct. While PG test of CLCS shall be dealt as per Performance Gaurantees Chapter, The Annexure calls for additional control system to meet flexibilization requirement of Indian Grid , Corresponding requirement is also mentioned in mechanical chapters. As mentioned in Specifications, SAT Parameters shall be finalized only during detailed engineering.

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1252	SECTION-VI, PART-B	SUB-SECTION-IIIC-08 CONTROL VALVES, ACTUATORS & ACCESSORIES	7.01.00	6 OF 7	POSITIONER WITH INTRINSIC PARTIAL STROKE TEST (PST) FACILITY FGD Bypass Damper is very critical for the safe evacuation of flue gas when FGD is not in operation. Normally it shall be in CLOSED condition most of the times when FGD is in operation. But during emergency need, if it fails to OPEN, it can lead to high furnace pressure and subsequent MFT. Therefore, a PARTIAL STROKE TEST for the Bypass damper to be carried out in AUTO at regular intervals.	Bidder clarifies that SMART ON/ OFF electrical actuator with partial stroke test facility is used for FGD Bypass damper. However, the SMART ON/ OFF actuator doesn't have a Positioner.	Bidder understainga is not correct. Bidder to note that pneumatic operated biplane damper is envisaged for FGD Bypass Damper as indicated in Tender Drg Part-E of Technical Specification. Positioner of that actuator shall have PARTIAL STROKE TEST (PST) FACILITY. Bidder to comply specification requirement.
1253	SECTION – VI, PART-B	SUB SECTION-II-B-02 MOTORS	7.07.00	3 of 4	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with three numbers duplex RTDs connected to three numbers dual input transmitters with display. However for air compressor, being high speed drive, each motor bearing shall be provided with minimum two numbers of duplex RTDs connected to two numbers dual input transmitters with display unit	Bidder is proposing 3 Nos Duplex RTD per Bearing for all Mill and Fan HT Motors due to the following reasons 1. Due to the space constraint Maximum 3 Nos Duplex RTD can be provided and extra DTT cannot be accommodated and this is as per many OEM recommendations 2. NTPC to please note that 3Nos Duplex RTD provided in all previous executed Project like TANDA and KHARGONE.	Bidder's understanding is correct
1254	SECTION – VI, PART-E SECTION – VI, PART-E	-	4540-001-POM-A-020 4540-101-POM-A-018b	-	Scheme for pulveriser SCHEME OF AIR & FLUE GAS PATH WITH INSTRUMENTATION	Bidder have considered the flow measurement as per bidder standard practice as follows: 1. Mill inlet air flow is as per bidder proven practice based on slant orifice flow measurement. This proven OEM design has been successfully executed in Power projects in India and accepted by esteemed customers like NTPC, NLC, RRVUNL, MPPGCL, Mahagenco & Jaypee. 2. FD/ID/PA fans inlet flow based on Pressure measuring Annular pipes at inlet box opening and inlet cone.	Bidder's proposal for "Bidder's standard & proven practice" is also acceptable.
1255	SECTION – VI, PART-F	SUB-SECTION-VI CHAPTER -01 SG & AUXILIARIES	2.01.00(6)	24 OF 38	6. Furnace and Flame viewing system- 6.2 Electronic Modules	Furnace TV Mandatory Spares: Electronic Modules of Furnace Camera are not user replaceable, hence Camera Electronics is not considered part of Mandatory Spare, however complete Camera is offered as per Mandatory Spare. Accordingly commercial rebate shall not be applicable for such items.	Bidder's proposal is not acceptable. Bidder to comply specification requirement.
1256	TECHNICAL SPECIFICATION SECTION – VI, PART-A/ BID DOC. NO CS-4540-001A-2	SUB-SECTION-I INTENT OF SPECIFICATION	4.02.00	PAGE 5 OF 8	<u>Pre-commissioning and commissioning activities:</u> The contractor's scope shall include all pre-commissioning and commissioning activities, materials and services as detailed in other portion of technical specifications including supply of all consumables (except coal, oil and limestone), temporary equipment and pipings, instruments, labour / skilled manpower's etc. The scope includes complete requirement of flushing oils including fresh oil refilling during the pre-commissioning and commissioning activities and subsequent initial operation.	Kindly note that as per Annexure-SG-04, Ammonia handling and Storage system and Catalyst for SCR system are excluded from Bidder's scope. Hence, we understand that the 'supply of Anhydrous Ammonia' and 'Catalyst' as envisaged for the operation of SCR system & Ammonia Storage & Handling System will be excluded from bidder's scope. NTPC is requested to delete this requirement and cover in the exclusion list.	Bidder to refer the amendment A-SG-36 in this regard.
	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-4540-001A-2	SUB SECTION-II A-01 STEAM GENERATOR & AUXILIARIES INCLUDING ESP	1.03.03	1 OF 28	Supply of all consumables (except coal oil and limestone) like chemicals for chemical cleaning, passivation, inhibition etc., Catalysts, fuel oil & coal for firing be-yond declared quantity (during bid stage as per SS-I, part-A), oil for line flushing, nitrogen for blanketing, consumables for air/ gas tightness tests and any other consumable as may be required for above pre-commissioning/ commissioning activities. And the total required limestone shall be issued free of charge by the employer for		
1257	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO.: CS-4540-001A-2	SUB-SECTION-I-A / PROVENNESS	4.24	18 OF 36	Provenness criteria for critical equipment(s) and bought out items for SCR system 4.24.1 Ammonia handling and storage system for SCR 4.24.2 Catalyst for SCR system	Kindly note that as per Annexure-SG-04, Ammonia handling and Storage system and Catalyst for SCR system is excluded from Bidder's scope. Hence, we understand that the given provenness clause for 'Ammonia handling and storage system for SCR' and 'Catalyst for SCR system' are for reference only and will be applicable for SCR system scope mentioned in Annexure-SS1. Kindly confirm that our understanding is correct.	Bidder to refer the scope as defined in the specifications. Accordingly, sub-vendor supplied equipment's design & engineering as per package scope is included in bidder's scope. Bidder to comply the specifications requirements.
1258	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO: CS-4540-001A-2	SUB-SECTION-I-A	1	PAGE 1 OF 25	ATTACHMENT - 3K for Provenness of various auxiliaries	Kindly note that NTPC has provided a list of approved sub-contractors/sub-vendors for the items covered under provenness category (such as a) PA Fan / ID Fan / FD Fan, Coal Pulverizer, Raw Coal Feeder, Boiler start up drain re-circulation pumps, Air Pre-Heater, Auxiliary Boiler, etc.). We understand that Bidder is not required to submit any provenness document (attachment-3K) for the qualification for these approved vendors. Bidder is required to submit provenness documents (Attachment-3k) in case new vendor (which are not covered in NTPC approved vendor list) are being proposed by Bidder for these applicable items/system/equipment. Kindly confirm that our understanding is correct.	Bidder to note that regarding the provenness, variable requirements (like technology licensing/collaboration etc.) need to be taken up for further processing as applicable.
	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-4540-001A-2	SUB-SECTION-E-60 INDICATIVE VENDOR LIST		PAGE 43 OF 50	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL: Approved vendor names are provided for following packages under provenness category:		
1259	TECHNICAL SPECIFICATION/ SECTION-VI, PART-A/BID DOC NO.: CS-4540-001A-2 / SUB-SECTION-I-A/ PROVENNESS		10.0	35 OF 36	Balance equipment's/ systems The Bidder at its option can source the balance of plant equipment/systems not covered in clause 3.0, 4.0, 5.0, 6.0, 7.0 8.0 & 9.0 above. However for such balance of plant equipment/systems, the Employer reserves the rights to satisfy himself on the provenness of the equipment and capability and capacity of the manufacturers.	We understand that sourcing for balance of plant equipment/systems, which are not covered in clause 3.0, 4.0, 5.0, 6.0, 7.0, 8.0 & 9.0 shall be referred as per NTPC approved sub-vendor list. No other provenness of the equipment and capability and capacity of the manufacturing will be required by NTPC for such equipment/system.	Bidder understanding is correct for Balance of Plant items sourcing. However, regarding provenness requirements, bidder to comply with the specification requirements.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1260	TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION- E-60 INDICATIVE VENDOR LIST	1.1	1 of 2	Reasonable efforts have been made to collate the sub-vendors proposed by the various main contractors from time to time against different Projects/Packages and accepted by NTPC for various items. However, in case of error/omission, if any, and represented by the successful bidder this will be addressed during the execution of the contract based on the material evidence available with NTPC / Main Contractor.	a) Bidder has observed that the indicative vendor list provided by NTPC in this sub-section (sub-section E-60, Section-VI, Part-B) is preliminary and does not include some of the sub-vendors/suppliers/manufacturers/sub-contractors who are approved by NTPC. We understand that the sub-vendors / suppliers / manufacturers / sub-contractors, who are already approved by NTPC / have executed NTPC projects / are executing NTPC projects for various system / equipment / items / services, but not covered in indicative vendor list, are considered to be approved by NTPC for Talcher project. Kindly confirm that our understanding is correct.	a) PI refer clause no 1.1 of E-60 b)Indicative vendor list attached with the tender specification shall be considered as final for bidding . C) Indicative vendor list attached with the tender specification is updated one d) Items which are not appearing in the indicatice vendor list, but critical in nature found during detailed engg will be discussed & finalised mutually for vendor control & inspection control.
	TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION- E-60 INDICATIVE VENDOR LIST	1.2	1 of 2	The approved sub-vendor list drawn is not based on NTPC driven enlistment process but based on the sub- vendors proposed by various Main Contractors. As such, it is possible that some of the Suppliers/Manufacturers who may be involved in similar work/process may not be appearing in the list as such sub-vendors may not have been proposed by Main Contractors against NTPC Contracts.	b) Bidder proposes to discuss and finalize vendor list before single stage bid submission so that the price offer can be submitted based on the vendor list. The vendor list finalized based on the discussion with NTPC will become part of Contract (Appendix-5) in case of award to bidder.	
	TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION- E-60 INDICATIVE VENDOR LIST	1.7	2 of 2	The list of sub-vendors is periodically revised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.	c) NTPC is requested to kindly share the latest list of banned sub-vendors / suppliers / manufacturers / sub-contractors for our understanding. d) The sub-vendors/suppliers/manufacturers/sub-contractors which are not covered / mentioned in the indicative list shall be sourced from Main Contractor approved sources with inspection cat-III.	
	TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION- E-60 INDICATIVE VENDOR LIST	1.3	1 of 2	In case the successful bidder chooses to propose additional sub-vendors with relevant experience after the award of the contract such sub-vendors will be considered in terms of Clause no: 19.1 of GCC, provided the proposals are received sufficiently in time: 90 days prior to ordering date of a Bought Out Items/Start of Manufacturing so as not to impede the progress of the contract.		
	EPC PACKAGE SECTION – IV (GCC)	-	19.1	30 of 71	Appendix 5 (List of Approved Subcontractors) to the Contract Agreement specifies major items of supply or services and a list of approved Subcontractors against each item, including vendors. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract.		
1261	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-IID CIVIL WORKS	2.02.00	12 OF 13	2. Construction Power Scope of supply of construction power is specified in SECTION – VI, PART-B, SUB SECTION B-19 of Technical specification.	We understand that the contruction power clause referred in clause no. 2.02.00 (Page 12 of 13), sub-section-IID, Section-VI, Part-A is not correct. We understand that bidder to refer Sub-section B-18, section-VI, Part-B (Construction Power) in this regard. Kindly confirm that our understanding is correct.	Bidder's understanding is correct. Please refer Amendment no. D1-35
	TECHNICAL SPECIFICATION SECTION - VI/PART-B	SUB-SECTION-B – 19	-	-	BATTERY		
	TECHNICAL SPECIFICATION SECTION - VI/PART-B	SUB-SECTION-B – 18	-	-	CONSTRUCTION POWER		
1262	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-4540-001A-2	SUB-SECTION-IID CIVIL WORKS Clause - 1.00.01	1.05.08.03	13 of 101	All steel structures shall be fabricated in factory, transported and erected at site. All factory-fabricated structures shall have bolted field connections. Coal bunkers with hoppers, CW ducts and chimney flue liners can either be fabricated at factory in segments, transported and welded at site before erection or fabricated at site.	NTPC is requested to allow fabrication of Ceiling Girder, Backend structure, Pipes support structure, secondary structure at site also.	Bidder to adhere to Technical Specifications.
1263	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2	GENERAL TECHNICAL REQUIREMENTS	17.00.00	28 OF 114	The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.	NTPC is requested to note that in case these tools and tackles are used by the Contractor during erection, commissioning or initial operation, the same shall be refurbished repaired/replaced as required to the satisfaction of the Employer before handing over to the Employer. All the tools and tackles shall be of reputed make acceptable to the Employer.	Bidder to comply the specifications requirements.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1264	SECTION - VI PART – E (TENDER DRAWINGS)	P&ID of Start up Drain System	DRG.NO. 4540-001-POM-A-019	-	Motor operated valve upstream of control valve at flash tank inlet	The water separator drain control valve is critical for boiler start up system. Warm up connection is required for instant operation of valve during plant operation. A control valve is shown at the down stream of the motor operated isolation valve. Due to this valve, proper warm up can not be provided to the control valve. Hence, bidder proposes the motor operated valve will be provided at down stream of the control valve instead of upstream as per tender P&ID. NTPC is requested to confirm acceptance.	Detailed aspects w.r.t. the valve location shall be reviewed during detail engineering based on the selected specific equipment/sub-system.
1265	TECHNICAL SPECIFICATION SECTION – VI, PART-A	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	2.02.0	PAGE 2 OF 4	GPS tracking for Over Dimension Consignment (ODC) All ODC shipments in SCOPE of EPC contractor to be covered.	Bidder requests NTPC to reconsider this requirement as most of the Boiler supply comes under ODC. Bidder requests NTPC to consider the tracking of critical consignments only. The list of critical consignment may be discussed with NTPC during detail engineering stage. NTPC is requested to confirm acceptance.	Bidder's proposal is not acceptable. Bidder to comply specification requirement.
1266	TECHNICAL SPECIFICATION SECTION – VI, PART-A	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	4.00.00	PAGE 3 OF 4	T&P tracking & Equipment monitoring. All T&P equipment deployed by contractor to be covered.	We understand that T&P tracking & Equipment monitoring system is required to deploy for heavy equipments such as Cranes, Hydras, JCB only. Small tools such as grinding machines, winch machines, welding machines etc and similar other tools & plants are not required to cover for tracking. NTPC is requested to confirm acceptance.	Bidders understanding is correct. However, if any additional heavy equipments are being provided by bidder as a part of T&P, the same shall also be included for tracking and equipment monitoring.
1267	TECHNICAL SPECIFICATION SECTION – VI, PART-D	ERECTION CONDITIONS OF CONTRACT	44.21.00	30 OF 72	The Contractor shall abide by the following during Construction and Erection activities: I. Chain pulley block shall not be used for loads more than 2 (Two) tonne.	Bidder would like to clarify that suitable capacity of chain blocks shall be used for lifting based on the loads considering the safety margin as per Bidder's standard practice. NTPC is requested to confirm acceptance.	Bidder to comply with Specification requirement complying safety requirements.
1268	TECHNICAL SPECIFICATION SECTION – VI, PART-D	ERECTION CONDITIONS OF CONTRACT	6.01.00	PAGE 3 OF 72	Each steam and water tubes shall be blown with compressed air and shall be subjected to 'ball test' before erection to ensure that no obstructions exist.	Bidder understands that sponge test may also be accepted in place of ball test at site. Sponge test is a safe working practice and used in NTPC previous projects also. NTPC is requested to confirm acceptance.	Ball pass is carried out at shop after fabrication of tubular product to ensure the obstruction /cleanliness inside the panel/Coil due to excess penetration of weld & bend area . However ,at site, sponge test is carried out with compressed air inside the tubular product if no further action is carried out at site before erection.
1269	TECHNICAL SPECIFICATION SECTION – VI, PART-F BID DOC NO: CS-4540-001A-2	SUB-SECTION–VI MANDATORY SPARES	-	4 OF 38	CHAPTER -01, SG & AUXILIARIES	We have reviewed the mandatory spares list and found that many of the spares requested by NTPC are not inline with Bidder's/OEMs standard practice/offers. Bidder would request NTPC to discuss and finalize mandatory spares list before single stage bid submission so that the price offer can be submitted based on the agreed mandatory spare list.	In case the specified item is not applicable/ not inline with Bidder's/OEMs standard practice/offers, equivalent mandatory spares pertaining to the offered design shall be offered and supplied by the bidder. However, in case these items are found applicable at a later date, these shall be supplied by Bidder at no extra cost to the owner.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1270	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2	GENERAL TECHNICAL REQUIREMENTS	Annexure-I	PAGE 69 OF 114	(C) Thermal Sector Minimul Local Content defined for various auxiliaries for boiler, ESP, Turbine, Generator, CHP, C&I, AHP, Raw Water Intake & supply system, CW & ACW system, Air Condition & Ventilation System, FGD.	NTPC is requested to note that Talcher Thermal Power Plant Tender Specification is issued on EPC turnkey package basis. Bidder can confirm the Minimum Local Content percentage for EPC turnkey package basis only and not for individual items/auxiliaries as mentioned in Clause no. (C) (Thermal Sector), Page 69 to 114, Annexure-I to General Technical Requirement.	Bidder to comply with Specification requirement.
	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2	GENERAL TECHNICAL REQUIREMENTS	Annexure-I	PAGE 72 OF 114	(E) Minimum Local Content Percentages in Engineering, Procurement & Construction (EPC) / Turnkey Project In case the Contract is awarded through the EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local supplier. In addition, MLC for complete EPC project may also be prescribed as below: 1) Pacakge based work (Boiler) - Minimum local content 60% 2) TG System (Water Cooled Condenser) - Minimum local content 60% -----	Therefore, NTPC is requested to clarify that the Minimum Local Content will be applicable on EPC package basis only as defined in Clause no. E (Minimum Local Content percentages in EPC/Turnkey package), Page 72 of 114, Annexure-I to General Technical Requirement.	
	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2	GENERAL TECHNICAL REQUIREMENTS	40.00.00	57 OF 114	j) All equipment/materials/parts/items required in this package which are domestically manufactured with sufficient domestic capacity as identified in Annexure-I of MOP order dated 16/11/2021 including its subsequent revisions (copy attached as Appendix-II) shall necessarily be sourced from the class-I local suppliers only as per the extant provisions of the Public Procurement (Preference to Make in India) Orders issued by DPIIT and MoP. Any violation w.r.t Make in India and minimum local content (MLC) requirements as specified shall be sole responsibility of the Bidder.		
	TECHNICAL SPECIFICATIONS SECTION VI, PART-C BID DOC. NO.:CS-4540-001A-2	GENERAL TECHNICAL REQUIREMENTS	Annexure-II	PAGE 73 OF 114	13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respectice Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).		

Sr. No.	Section / Part / Chapter / Volume	Sub Sec	Clause No.	Page no.	Bid Specification Stipulation	Bidder's query	Owner's Reply
1271	TECHNICAL SPECIFICATION SECTION – VI, PART-B	Part-7 Drawing No 4540-999-POE-J-001	-		Single line diagram of SG package- Compressor house/Aux boiler switchgear	Bidder clarify that MRHS compressor / Instrument air compressor /service compressor are HT drives as per past project experience which shall be considered as part of Main HT switchgear located at TG building . LT drives of compressor house will be connected to compressor MCC. Compressor MCC will be fed from nearest building PMCC LT drives of Aux Boiler house will be connected to Aux Boiler MCC. Aux boiler will be fed from nearest building PMCC	Bidder is refering in correct. Bidder to refer EPC SLD enclosed in the Tender.
1272	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	SUB SECTION-II-B-02 MOTORS	-		Motors 3.3/6.6 KV motors shall be offered with dust tight phase segregated double walled (metallic as well as insulated barrier) Terminal box. Contractor shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4mm (non magnetic material for single core cables) shall be provided.	Bidder clarify that this requirement cannot be followed for all HT motors due to layout restriction. The type of terminal box will be provided suiting OEM standard and meeting layout restrictions	Bidder proposal is not acceptable. Bidder to comply Technical specification.
1273	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	SUB SECTION-B-2	7.08.00	3 of 4	Motor body shall have two earthing points on opposite sides	Earthing points shall be as per proven OEM design and OEM stand guarantee on the safety of the equipment.	Bidder proposal is not acceptable. Bidder to comply Technical specification.
1274	TECHNICAL SPECIFICATION SECTION – VI, PART-B	SUB SECTION-B-10 CABLING, EARTHING & LIGHTNING PROTECTION	5.04.00	12 of 21	33kV/11kV/6.6kV/3.3 kV/switchgear equipment and 415V switchgear-- 65 x 8mm GS flat		
1275	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	SUB SECTION-B-2	MOTORS-7.07.00	3 of 4	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with three numbers duplex RTDs connected to three numbers dual input transmitters with display. However for air compressor, being high speed drive, each motor bearing shall be provided with minimum two numbers of duplex RTDs connected to two numbers dual input transmitters with display unit	Bidder is proposing 3 Nos Duplex RTD per Bearing for all Mill and Fan HT Motors due to the following reasons 1. Due to the space constraint Maximum 3 Nos Duplex RTD can be provided and extra DTT cannot be accomodated. 2. NTPC to please note that 3Nos Duplex RTD provided in all previous executed Project like TANDA and KHARGONE.	Bidder proposal is acceptable which is inline Technical specification.
1276	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING-	4.00.00 (6)	6 of 18	LED Luminaires shall be used for the lighting of all the indoor & outdoor areas inbidder's scope. However for DC lighting, hazardous areas & aviation lighting etc.conventional type luminaires shall be used.	Bidder clarify that LED illuminaires for DC lighting can be used as per market availability	Bidder proposal for LED illuminaires for DC lighting is acceptable
1277	TECHNICAL SPECIFICATIONS SECTION VI, PART-B				General clarification	Bidder proposes that Boiler related MCC panels are considered at Boiler MCC room located in TG building. MCC panels of , compressor, ammonia,FOPH, Aux boiler,, are located in respective building/Area as applicable. Sootblower MCC & Valve DB are considered to be located at Boiler platform.	Sootblower MCC & Valve DB shall belocated at BMCC room of TG Building.
1278	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB-SECTION : B-03 VFD	-		VFD	Bidder clarify that VFD of coal feeder , RAPH and sootblower will be as per proven OEM design	Bidder proposal is acceptable which is inline Technical specification.

Sr. No.	Section / Part / Chapter / Volume	Sub Sec	Clause No.	Page no.	Bid Specification Stipulation	Bidder's query	Owner's Reply
1279	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB SECTION-B-2 MOTORS	-		Motors	This specification is not fully applicable to BCP motor which is being a wet motor is special kind of motor & will be as per vendor standard. BCP motor which will be a HT motor, without any winding & bearing temperature detectors, the class of insulation for the BCP motor will be class Y. It will be water cooled and water filled, wherein the bearing and the windings both will be water cooled, bearings will be water lubricated as well. Space heater for the BCP motor will not be applicable as it is a wet type motor.	Bidder proposal is not acceptable. Bidder to provide protection and monitoring devices, RTD, thermometer, flow switch etc as per the system requirement and as per the specifications and same shall be discussed during detail engineering.
1280	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	-		LT SWITCHGEARS & LT BUSDUCTS	Bidder has considered Soot blower MCC, which consists of Two Incomer with electrical contactor operated changeover facility. The Soot Blower motor is having maximum rating of 1.1KW. As per SB operation, maximum of Two No's of Soot blower can be operated at a time and load consumed is 2.2 kW maximum. The soot blower MCC incomer rating is only 32A. Bidder has considered sootblower MCC in boiler platform located at RHS & LHS of boiler. Hence, bidder shall be allowed to consider the MCCB type incomer with electrical contactor operated changeover facility.	Soot Blower MCC shall be installed at BMCC room located in TG building. The MCCB type incomer with electrical contactor operated changeover facility is acceptable.
1281	TECHNICAL SPECIFICATION SECTION – VI, PART-B	Sub Sec A-02 4.01.01 e	4.01.01 e	9 of 65	Steam Generator casing/pent house shall:Be provided with boiler roof arrangement of proven design & architecture. The boiler main roof arrangement shall be provided with monitor for ventilation and light. The overlap between the monitor and the main roof should be such that it prevents ingress of rain to the.....	NTPC shall clarify exact requirement for the following The boiler main roof arrangement shall be provided with monitor for ventilation and light.	The boiler main roof arrangement shall be provided with arrangements for monitoring, ventilation and light. Further bidder to refer cl. 7.00.00, SS-II-A-01, part-A.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1282	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIIC CONTROL & INSTRUMENTATION	17 of 18	21.00.00 (2)	Bidder is to provide an Augmented reality/virtual reality-based training model along with all its hardware, software components and required licenses (5 Nos.). The training models shall comprise of dismantling, overhauling, and re-assembling modules up to its last sub-component for major equipment's of Boiler, Turbine, Generator, AHP, CHP. The individual equipment models shall be true to the scale to all its sub-component level. Details of equipment to be covered shall be finalized during detail engineering.	a) Since the Specification is sketchy and intention of NTPC is not coming out from the specification. Bidder request Owner to inform if the requirement is to provide Digital twin i.e. replica of the actual proposed major equipments of Boiler, Turbine, Generator, AHP, CHP in AR/VR mode. Please confirm. b) Bidder request Owner to confirm that training model is required only for Major equipments of Boiler, Turbine, Generator, AHP, CHP and not for all the equipments. Please confirm. c) Bidder request Owner to confirm if total 5 nos. VR workstation, 5 nos. VR goggles, 5 nos. Joysticks, 5 nos. License are required. Please confirm. d) Bidder request Owner to inform if training on dismantling, overhauling, and re-assembling modules up to its last sub-component shall be using hardware such as VR goggles, Sensors, Joysticks, VR workstation. Please confirm. e) Bidder wish to inform that development of AR/VR based training models requires 3D models of internal components also. As per discussions with various equipment suppliers (including AHP & CHP) 3D models of the internals cannot be provided by them. However, to meet the Customer expectations, Bidder will try to develop AR/VR based training model only for Bidder's inhouse manufactured major equipment as listed below, on best effort basis: 1) Steam Generator: Coal Pulveriser, Air Preheater (APH), Axial Fans (PA,FD, ID), Coal Burner and Boiler Soot blower 2) Turbine: Main Turbine (HP/IP/LP) 3) Generator	a) Bidder's understanding is not correct. Bidder to note that specification under the referred clause is given functional, with clear mention of the intent of requirement. The intent is to create an exact replica training model of the target equipments. Please also refer NTPC's Clarifications on similar query vide query no. 578 of lot 4. b) Bidder understanding is correct. c) The quality of all hardware, software and licenses are five number (5 nos) each. Please also refer NTPC's Clarifications on similar query vide query no. 578 of lot 4. d) Kindly refer reply given in query no. 578 of Lot 4 and also point c above. e) Bidder's understanding is not correct. All major equipment shall be considered in the model. However the exact count of the same shall be finalized during detailed engineering.
1283	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	SUB-SECTION-IIIC CONTROL & INSTRUMENTATION	17 of 18	21.00.00	a. IIoT Solutions for Real-time Equipment and Process monitoring and for condition monitoring	a) Bidder understands that 16 nos. vibration sensors & 16 nos. Temperature sensors shall be permanently installed on non-critical equipment (LT drives) which are not considered in Vibration monitoring system. Please confirm. b) Bidder understands that 32 nos Portable Wireless vibration sensors and 32 nos. Portable Wireless Temperature transmitters shall be provided which are not permanently mounted on any equipment. Please confirm. c) Bidder understands that there is no requirement of Vibration analysis for these IIOT solution and only vibration/temperature measurement readings collected from IIOT sensors are to be monitored. Please confirm. d) Bidder understands that viewing shall be web browser based on Owner's PC and no separate workstation is required for IIOT sensor monitoring. Please confirm.	a) Bidder understanding is correct. b) Bidder understanding is correct. c) Bidder understanding is correct. d) Bidders understanding is correct. Bidder to also follow Clause 2.00.00,General Solution Outline, Sub-Section IIIC - 18, Part B.
1284	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure C to IIC Contract quantity SUB-SECTION-IIIC-18 IIOT, DIGITAL HELMET AND AR/VR MODEL	24 of 24 1 of 2	0 1.3	Latest technology based Wireless Infrastructure for main plant area (exact area to be finalized during detail engineering) Industrial Wireless Network:	a) Bidder understands that Wireless infrastructure is required only for connectivity of IIOT sensors and Digital Helmet. Please confirm. b) Bidder understands that the wireless coverage is required only for Boiler area, TG Building and CW pumphouse. Please confirm.	a) Bidder understanding is correct. b) Bidder understanding is correct.
1285	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	6 of 18	2.03.02	Same make DDCMIS is to be provided for all DDCMIS systems indicated above including control system for SG, TG & BOP systems of Unit DDCMIS defined above.	It is not recommended to use unproven Control system for STG. Turbine Control System (TCS) and Turbine Protection System (TPS) are provided by OEM based on their long experience in various Thermal Power Plants. For Other DDCMIS (SG, BOP, FGD etc.), Bidder shall provide same make. In view of above, Bidder proposes that Make of TG DDCMIS may be different than the make provided for other DDCMIS (SG, BOP, FGD etc.). However, Bidder will provide Unified HMI. Request NTPC's acceptance.	Bidders proposal is not acceptable. Bidder to comply specification requirement.
1286	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC CONTROL & INSTRUMENTATION SYSTEM	17 of 18	22.00.00	Make of IP based CCTV camera and VMS under scope of this package (CCTV system for O&M and CCTV system for safety control room) shall be same.	1) Bidder wish to clarify that CCTV for Safety shall be ordered at very initial stage of the project and by that time specifications of CCTV for O&M shall not be ready. Readiness of specification of CCTV for O&M requires Finalized plot plan, Building layouts, GA drawings etc. which will take sufficient time. Hence, make of CCTV for Safety and CCTV for O&M may not be same. 2) Bidder request Owner to provide specification of various items for CCTV for Safety viz. Camera, Server, workstations etc.	1) Bidder proposal is not acceptable. Bidder to meet specification requirement. Make of CCTV system for O&M and CCTV system for safety control room should be same. 2) Bidder to refer Part B for specification of various items.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1287	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	1 of 4	2.00.0	Contractor shall ensure all its OEM/suppliers must affix RFID tags/Trackers on the item & punch the same before dispatch with RFID reader/BLE beacon & enter details of item associating with RFID tag no./Tracker no. For low value items QR code-based solution shall also be acceptable. Exact selection of type of tagging based on type & size of equipment/consignment/package will be decided during detail engineering.	a) Since "low value item" is not defined, Bidder may consider the low value items as per Bidder's understanding. Please confirm. b) Bidder shall consider RFID tagging for ODC items which are high value items and for balance low value items QR code based solution shall be provided. Please confirm.	Bidders understanding is not correct. RFID tags/Trackers with RFID reader / BLE beacon is to be provided for all the items. As an exception for some of the low value items, QR code shall be acceptable subject to Employers approval during detailed engineering.
1288	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A BID DOC. NO. CS- 4540-001A-2	Annexure-B to subsection II C SMART PROJECT MANAGEMENT SYSTEM	-	-	SMART PROJECT MANAGEMENT SYSTEM	a) Bidder understands that requirement of SPMS workstation and user license is to be based on Bidder's design. Please confirm. b) Since there is no requirement from Owner, Bidder shall consider 1 no. workstation and 1 user license for SPMS.	a) Bidders understanding is correct. Hardware and software proposed should meet requirement mentioned in Annexure-B to subsection IIC, part A. b) Bidders understanding is not correct. Detail requirements for SPMS and its subsystem has been specified in Annexure-B to subsection IIC, Part A. The requirement of license shall include all the system / sub system as mentioned in the above annexure. Also refer 7.00.00, Annexure-B to subsection II C, Part A for Hardware and software requirement.

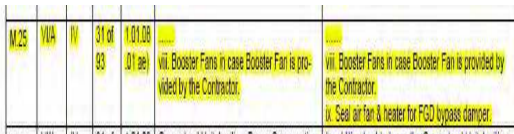
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1289					General	Owner is requested to allow selective utilization of pond ash for backfilling in low lying areas within the plot area of Stage III TPS.	Backfilling using pond ash is not allowed
1290	Section VI, Part B	D-I-2 (I)	1 of 4	Annexure - (I)	This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area 'A', 'B' & 'C' has been identified for this purpose.	Bidder requests Owner to allow alternative laydown area within 20 km radius from plant boundary with proper fencing & security to avail the payment linked with "receipt" of material/equipment under Supply contracts. Please confirm.	Bidder to refer Amendment no. D1-36 and D1-37
1291	Section VI/ Part-B	Sub section- D-1-5	8 of 120	5.02.08	The level of the bottom chord (bottom of steel) of the gallery shall be at least 3.0m above the finished paving level in general.	Bidder understands that pipe / cable trestle in the outlying area, pipe and cables can be routed on trestle with headroom of 2m or on pedestals inline with Layout requirement. Please confirm bidder understanding.	Bidder understanding is correct . Unless otherwise specifically height requirement of trestle is mentioned .
		Sub section- B-10	4 of 21	3.02.05	The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level.		
		Sub section- G-03	10 of 15	1.03.00 (39) (ii)	In the outlying area, pipe and cables can be routed on trestle with headroom of 2m or on pedestals		
1292	Section VI/ Part-B	Sub section- D-1-5	37 of 120	5.05.09	All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method excepted by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines.	a) Bidder understands that over head crossing of Stage III ash slurry pipes shall be considered for existing railway lines. Similar scheme was also followed for existing stage-I and Stage-II ash pipes. Please confirm. b) Further, Owner is requested to provide location details of future envisaged rail line crossings for estimating RCC box culvert quantities. Please confirm.	a) As per Clause no 5.05.09 ,All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method "accepted" by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines. The railway track crossings are to be designed in accordance with railway Standard/RDSO guidelines and all necessary approvals from the concerned Railway authorities shall be obtained by the Bidder, without any financial implications to the owner b) This shall be dealt during detail engineering
1293	Section VI/ Part-B/	Sub section- D-1-5	11 of 120	5.02.09	Inside the main power house building, brick masonry wall (and fire proof doors) shall be provided for switchgear rooms, cable spreader rooms, MCC rooms, AHU rooms, Air Washer room & Oil rooms and all other rooms where fire protection is envisaged.	As per specification, modular type air washers are envisaged. In view of this, Bidder understands that air washer room inside main power house is not applicable. Please confirm Bidder's understanding.	Bidder's understanding is correct.
1294	Section VI/ Part-B	Sub section- D-1-9	1 of 31	9.03.01	Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided for each building and pump house. Polyethylene water storage tanks conforming to IS:12701 shall be used. The tanks shall be complete with all fittings including lid, float valve, stop cock, vent pipe, etc. Service water tank shall be of RCC construction	Bidder shall consider the make of service water tank as PVC / Polyethylene inline with past project. RCC service water tank at roof of buildings is not envisaged. Please confirm.	Bidder to refer Amedendment no. D1-18
1295	Section VI/ Part-B/	Sub section- D-1-9	2of 31		All buildings shall have minimum one toilet block each.	Toilet block shall be decided based on no of users, presence of operation staff during normal condition etc. Please confirm	Bidder is requested to follow technical specification.
1296	Section VI/ Part-B/	Area Drainage study report	7-12		Catch drains and foot drains shall be provided to safely discharge the storm runoff to natural drains (tributaries of Bangaru nala). Local drainage is controlled by a small seasonal nala flowing northerly in the western part of Jagannath block	Road along ash garlanding pipes shall be constructed along with one sided drain and storm water runoff shall be discharged to mine void vide this drain. Hence no separate drainage arrangement shall be considered in mine void area. Please confirm.	Drains shall be provided as per technical specifications wherever required.

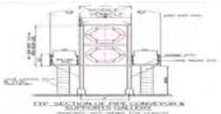
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1297	Section VI/ Part-B/	Area Drainage study report	07-Mar	7.2	For each of the filled ash dyke (A, B, C, D, E, F) following conceptual drain design shall be followed. i) Low Height Peripheral Embankment: The dyke area will have a 1 to 3 m high earthen embankment around it.	a) Space is not available around existing ash dyke (A,B,C) for construction of temporary embankment, toe drain etc. Hence Bidder shall consider temporary drainage arrangement as their layout and design requirement for laydown area. Please confirm. b) Drainage arrangement for remaining dyke (D,E,F) not included in EPC scope of work. Please confirm.	a) Bidder to follow technical specifications. b) Confirmed.
1298	Section VI/ Part-B	Sub section- G-03	12 of 15	1.03.00 (52)	Bidder to route ash slurry pipe lines on pedestal and pipe culverts shall be provided at rail/road crossings.	Bidder understands that existing Stage I and II ash pipelines are having over head road/railway crossings, therefore Bidder shall consider similar type of crossing for Stage III ash pipes also. In case Owner has envisaged culvert for Stage III ash slurry lines, then location details for the same may please be specified.	As per Clause no 5.05.09 ,All ash handling system/ ash water recirculation system pipe crossings with Railway Lines including MGR lines shall be laid by method accepted by concerned railway authorities for existing rail lines & by cast in situ RCC box culvert for future envisaged rail lines. The railway track crossings are to be designed in accordance with railway Standard/RDSO guidelines and all necessary approvals from the concerned Railway authorities shall be obtained by the Bidder, without any financial implications to the owner
1299	Section VI/ Part-B/	Sub section- A-01	38 of 101	1.05.22.01	In any case the height of the chimney above the plant grade level shall be at least 275 meters for Single-flue chimneys and at least 275 meters for Multi-flue chimney.	Since it is wet chimney, bidder proposes to consider 150 Meters for single flue or 220 meters twin flue Chimney. Please confirm.	Bidder understanding is not correct. Bidder to comply the specification requirement of 275 meters height of chimney.
1300	Section VI/ Part-A	Sub section-III	3 of 3	5.05.00	The area will be handed over as is & where is basis	Please clarify meaning of "as is & where is basis" as demolition of superstructure is in Owner's scope of work.	Demolition of superstructure is also involved in some area. Please refer Cl 1.00.00 in Part-A
1301	General			GLP, 4540-999-POC-A-015, Rev 0	Raw water piping routed through stage I and stage II existing facility	a) Bidder understands that the raw water pipeline from raw water reservoir to PT plant of Stage III shall be routed in pedestal. Please confirm. b) Any existing facility fouling with the aforesaid pipeline route shall be demolished by Owner. Please confirm. c) Bidder understands that encumbrance free corridor for the raw water pipeline from raw water reservoir to PT plant of Stage III shall be made available on the date of NOA.	a) Bidder to note that complete scope of work within plant boundary is in Bidder's Scope, so Bidder is free to plan the routing either over pedestal / underground along the Raw Water Piping Corridor indicated in GLP considering movement, roads and other interferences etc. In this regard Bidder to refer Clause 39 of Sub Section G3 of Part B and Clause 2.09.00 of Sub Section A-09 of Part B. b) Dismantling is in bidder's scope. c) Bidder to refer Cl. 5.00.00 of Section VI, Part-A, Sub-Section-III.
1302	VI/Part-B	Sub-sec-D-1-5	55 of 120	5.17.01.02.04	c) The columns shall be designed based on working stress method except for the forces from DL+1.5 WL which shall be designed as per limit state of strength method of IS:456.	We understand that racker column shall be designed based on the working stress method (considering allowable steel stress 275MPa) as per IS 456 and limit state method as per IS 456. No separate steel stress limit for crack width control or crack width check is required. Kindly confirm	Bidder's query is not clear. Bidder to follow technical specifications.
1303	VI/Part-B	Sub-sec-D-1-5	55 of 120	5.17.01.02.06	(a) The design of all liquid retaining / conveying structures of cooling tower like C. W. basin , sump , outlet channel , sludge drain , pits and pedestals for raker column shall be designed by working stress method as outlined in Clause 4.5 of IS: 3370 (Part 2) : 2009.	As per latest IS code IS: 3370 (Part 2) -2021 , the design of all liquid retaining / conveying structures shall be done in accordance with limit state method. So no working stress design method is mentioned as per latest code. Please confirm whether we can use latest code IS:3370 (Part2) -2021 for design of all liquid retaining / conveying structures of cooling tower like C. W. basin , sump , outlet channel , sludge drain , pits. Kindly confirm. Also the pedestal of raker column is outside of basin area . So design of pedestal of raker column shall be done in accordance with limit state method of IS:456-2000 same as Tower shell supporting foundation and not as per latest code IS:3370 (Part2) -2021. Please confirm .	Bidder to follow provisions of Technical Specifications.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1304	VI/Part-B	Sub-sec-D-1-5	55 of 120	5.17.01.02.06	(b) The design of all structures other than liquid retaining/conveying structures of cooling tower above Cold Water basin slab such as Raker Columns, Shell structure, fill/drift eliminator support columns, beams, walkways, slabs, partition wall, precast beams etc. shall be carried out by limit state method as outlined in Clause 4.4 of IS: 3370 (Part 2). Further, for limiting the crack width, the stress for the reinforcement steel shall be limited to 130 MPa (on all faces) as per clause 4.4.3.1 of IS: 3370 (Part 2): 2009 using the partial safety factor for serviceability condition as per clause 4.4.1.3.	a) As per IS 3370(Part2):2021 , Cl.No. 4.3.1, "Structural elements that are not exposed to retained liquid shall be designed in accordance with IS 456 and IS 1343, as applicable." Hence, Structures of cooling tower above Cold Water basin slab such as Raker Columns, Shell structure, fill/drift eliminator support columns, beams, walkways, slabs, partition wall, precast beams etc. shall be designed by limit state method as per IS 456 and no stress limit in steel is required to control crack width. kindly confirm the design methodology. b) Raker columns design procedure in CL.No. 5.17.01.02.04 (in SI.No. 3) & 5.17.01.02.06 (in SI.No. 4) are contradictory. Kindly clarify which one to be adopted.	a) Bidder to follow provisions of Technical Specification b). There is no contradiction in Specification. Bidder is requested to refer Clause No. 5.17.01.02.06 for raker column design and CL.No. 5.17.01.02.04 for raker column pedestal design
1305	VI/Part-B	Sub-sec-D-1-5	113 or 120	5.29.00	Owner's Construction Office The floor area for Owner's Construction office shall be 1025 sqm. The building should be as per the tender drawing.	Tender drawing indicates floor area of 1400 sqm whereas 1025 sqm mentioned in tender specification. Owner to kindly clarify.	Floor area of Owner's Construction office shall be 1025 sqm.

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1306	SECTION-VI, PART-B	SUB SECTION B-05(A) MV SWITCHGEAR	3.00.00 (h)	6 of 7	Wireless temperature monitoring system to be provided and same shall be integrated to DDCMIS/ separate HMI. Position of such sensors shall be decided at the time of detailed engineering.	Bidder proposes that the position of temperature monitoring sensors shall be as per OEM design. Each phase shall have one sensor irrespective of no. of cable runs. Owner may please confirm.	Temperature sensor shall be installed in all relevant joints, contact points etc. as per the standard OEM Practice.
1307	SECTION-VI, PART-B	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCTS	2.03.00	3 of 18	5) Horizontal Busbar & Jumper Connection: High Conductivity Aluminium Alloy/Copper 6) Vertical Busbar: Copper Only	There are very limited supplier available who can supply product with vertical copper busbar, and those supplier having vertical aluminium alloy busbar design are not qualifying. Bidder proposes to provide Aluminium Alloy conductor for both Horizontal and Vertical Busbar of LT Switchgear as per standard industry practice. Owner may please confirm.	only Copper vertical busbar shall be accepted. Bidder must comply the specification.
1308	SECTION – VI, PART-B,	SUB-SECTION- IIIC-19 ROBOTICS BASED CLEANING OF CABLE TRAYS	1.00.00	1 of 2	Robotics Based Cleaning of Cable Trays Intent of the Specification: The specification intends to identify and procure an automatic solution based on Autonomous robotics for inspection and cleaning of cable trays	Owner specified following probable supplier for "Robotics Based Cleaning of Cable Trays" during prebid meeting: 1. Mitsubishi 2. Hyundai 3. ABB 4. GE 5. Rockwell 6. Yokogawa 7. Boston Dynamics Bidder has discussed with manufacturers to check the availability of product and solution for "Robotics Based Cleaning of Cable Trays", however it is found that none of the above mentioned suppliers are having the same. Also, there are no such references available where similar item was installed in thermal power plant across the world. Since, the product and solution for "Robotics Based Cleaning of Cable Trays" is not available commercially with any of the supplier, Bidder request to delete the requirement of "Robotics Based Cleaning of Cable Trays" from tender specification.	Bidder proposal is not acceptable Bidder to comply Technical specification.

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1309	SECTION – VI, PART-B	SUB-SECTION-B-17 SWITCHYARD	2.09.00	11 of 60	The enclosure shall be manufactured and tested according to the pressure vessel code (ASME/CENELEC code for pressure Vessel.)	1. Bidder would like to clarify that material codes shall be country based codes as per OEM design. 2. As recommended by OEM, all pressure test for enclosures shall be conducted as per Cl. 6.103-IEC 62271-203:2011. Owner may please confirm.	Bidder shall comply the clause no: 2.09.00 of Sec-VI, Part-B, chp-17 of specification.

Sr. No.	Section / Part / Chapter / Volume	Sub-Section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
1310	TECHNICAL SPECIFICATIONS SECTION – VI, PART-A	SUB-SECTION-IV FUNCTIONAL GUARANTEES	1.01.07.01	18 of 73	1.01.07.01 - Unit Auxiliary power consumption ad) FGD System --	NTPC may please note that, in NTPC Lara & Singrauli projects, FGD bypass damper seal air fan and heater have been included by NTPC in the list of "continuously running auxiliaries" for aux. power consumption guarantee vide Amendment#1. However, in current NTPC Talcher EPC tender, FGD bypass damper seal air fan and heaters have not been included in the list of "continuously running auxiliaries" for aux. power consumption guarantee. NTPC is requested to update the list of "continuously running auxiliaries" for Talcher project in line with Lara/Singrauli project.	Bidder to note that while guaranteeing the auxiliary power consumption the bidder shall necessarily include all the continuously operating auxiliaries. The auxiliaries indicated in the list are minimim requirement and any continuous operating auxiliaries shall be included in the Guarantee Aux power consumption in line with the specifications.
	NTPC Lara Singrauli: Amendment#1						Further, since current list of "continuously running auxiliaries" does not include FGD bypass damper seal air fan and heaters, Bidder understands that the current limit of Unit aux. power guarantee as mentioned in sr.no. (x) of cluase 1.01.02 of SUB-SECTION-IV SECTION – VI, PART-A, does not include the above mentioned auxiliaries. Hence, NTPC is requested to issue an Amendmdnt updating the limit of Unit Aux. power guarantee to include FGD bypass damper seal air fan & heater.
1311	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	3.03.01	5 of 28	 Motorized Guillotine type gates shall be provided at (i) hot gas inlet to Absorber (in case booster fan is not provided by the bidder) and (ii) cold gas outlet from Absorber.	As per specification requirement NTPC has asked for Guillotine type gates at absorber outlet duct & Quick opening Bi-plane damper in bypass duct. Bidder want to clarify that their is a huge gap between opening & closing time of Quick opening Bi-plane damper & Guillotine damper. if we provide different type of dampers in absorber outlet and bypass duct than during emergency condition (i.e FGD in Bypass operation) there is a possibility to pass the hot flue gas in the absorber side and damage the absober internals including mist eliminator.	Bidder to ensure that absorber and its internals remain protected in all cases of operating conditions/ scenarios.
	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-A-05 (FGD)	3.03.02	5 of 28	Quick opening Bi-plane motorized/pneumatic damper along with 2x100% seal air fans & 2x100 electrical heaters shall also be provided in the by-pass duct.	In view of the above concern, bidder request NTPC to kindly review the requirement of Guillotine gate damper or Bi-plane damper at absorber outlet based on their plant operation experience to protect the absorber internals including Mist eliminator and issue a necessary amendment for consideration of quick closing Bi-plane damper instead of Guillotine gate at absorber outlet or both quick opening Bi-plane damper & Guillotine gate dampers at absorber outlet.	The guillotine gates are envisaged to ensure the absorber maintenance as well as protection during O&M. In case bidder's require to have additional bi-plabe damper to ensure the protection of absorber inernals then they have to provide the quick opening damper in addition to the gates at absorber (inlet & outlet). Accordingly, bidder to ensure that if quick acting biplane damper is required to be provided at absorber (inlet & outlet) then bidder to provide the same , in addition to the guillotine gates, based on the specific design adopted.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1312	Section VII/ Part-B/ Sub section- A-16	1 of 7	1 of 7	1.04.00	Dedicated air receivers shall be provided to meet the instrument air requirement of ash handling System.	Owner is requested to please provide the location of ash handling system instrument air receiver.	Bidder shall decide the locations of Instrument air receivers for ash handling system during detail engineering, complying functional requirement in line with Technical specifications.
1313	Section VII/ Part-E / 4540-001-POM-A-041			Cross Country Coal conveyour Routing from NTPC Plant to coal mine area	2. PIPE CONVEYORS AND UNITS/PREMISES AT MINE END INDICATED ON THE DRAWING IS TENTATIVE THE SAME SHALL BE FINALIZED AFTER SURVEY WORK AND TE-UP WITH MCL. 3. SILO LOCATION AT MINE END IS TENTATIVE AND DISTANCE OF SILO FROM PLANT END MAY VARY UPTO 5% IN ANY DIRECTION. THROUGH CONVEYOR LENGTH UPSTREAM OF SILO IS ALSO TENTATIVE AND MAY VARY UPTO 5% IN ANY DIRECTION. NO ADDITIONAL CLAIM SHALL BE ENTERTAINED FOR THE ABOVE VARIATION. 4. NUMBER OF PIPE CONVEYORS INDICATED ARE TENTATIVE. BIDDER MAY OPTIMIZE NUMBER OF PIPE CONVEYORS BASED ON THE TECHNICAL FEASIBILITY. BIDDER HAS TO PROVIDE MORE NUMBER OF PIPE CONVEYORS, IF REQUIRED HOWEVER PROVISION SHALL BE THERE AT ETP-2 FOR POSSIBLE COAL RECEIVE FROM JAGANNATH AREA.	Bidder understands that "Note No. 2, 3 & 4" are not relevant to scope of work in Talcher EPC Stage III tender. Please confirm bidder understanding.	Confirmed. Referred drw. have been withdrawn from Technical Specification. Amendment No : A-MH-1
1314	Section VII/ Part-E /	4540-001-POM-A-041 'Cross Country Coal conveyour Routing from NTPC Plant to coal mine area			5. NECESSARY HEADROOM SHALL BE PROVIDED BELOW PIPE CONVEYOR AT ROAD/RAIL/RIVER CROSSINGS. NECESSARY CLARENCE OF CONVEYOR STRUCTURE WITH THE HT/LT LINES TO BE PROVIDED.	Since complete Conveyor system is not in Bidder scope of work, Owner is requested to delete this Note from drawing.	Cross-country coal conveyor is not in the scope, hence referred Drw. have been withdrawn. Amendment No : A-MH-1
1315	Section VII/ Part-E /	4540-001-POM-A-041 'Cross Country Coal conveyour Routing from NTPC Plant to coal mine area			6. ASH SLURRY AND AWRS PIPES SHALL BE ROUTED BELOW PIPE CONVEYOR GALLERY WHERE SEPARATE SPACE FOR SLURRY CORRIDOR IS NOT AVAILABLE. CROSS-OVER SHALL BE PROVIDED AT CAGE LADDER LOCATIONS FOR CROSSING SLURRY OF PIPES. 	Owner is requested to provide the following pointwise details/confirmation as complete external coal handling is not a part of Bidder scope of work. 1. Space requirement for proposed pipe conveyor 2. Cross section indicating Employers' pipe Conveyor and ash slurry piping & AWRS piping 3. Support location of employer pipe conveyor 4. Load data of employer pipe conveyor wherever combined foundation is envisaged by Owner. 5. Additional space with ROW for parallel running of conveyor and AWRS/Ash slurry lines. 6. Please clarify the scope of foundation in case of combined structure of conveyor and ash slurry piping 7. No electrical load provision in transmission line of AWRS system (from Plant to mine void) is considered for external coal handling system by Bidder.	External Coal Handling Plant is not part of the Scope of work. Hence 1. Only Space provisions shall be kept along with Ash slurry & AWRS Corridor in line with 4540-001-POM-A-030.. 2. Shall be explored during detail engineering. 3. Support locations (if required) shall be provided during detail engineering. 4. Combined foundations is not envisaged.. 5. Space shall be as per the detail survey carried out by the successful bidder during execution. 6. Combined structure shall not be considered. 7. No electrical load of external Coal handling system shall be considered on transmission line coming under the Package.
1316	Section VII/ Part-B/ Sub section- A-12	1 of 12	1 of 12	1.00.00	HVAC to be provided considering " GREEN BUILDING" for following buildings. 1. Service building 2. Admin building c. Canteen Building	Requirement of Green building is not specified in Civil scope of work. Owner is requested to please confirm weather GREEN Building to be considered for HVAC design for Service, Admin and canteen building.	Certification of referred buildings as "Green Building" has not been envisaged. However, Bidder to comply with specification requirements regarding mechanical/ electrical/civil/C&I aspects as specified.
1317	Section VII/ Part-B/ Sub section- A-17	23 of 30	23 of 30	8.02.00	Air washer units shall be started/stopped by initiation from Main DDCMIS based control system of A/C plant (provided by contractor) for Main plant area and ESP/FGD/AHP control rooms. Starting/stopping of pumps shall be automatic upon such initiation.	As per tender scope of HVAC, Air washer /UAF is not envisaged for AHP control rooms, hence, Bidder understands that Air washer units as mentioned in referred clause is not applicable in AHP control building. Please confirm Bidder's understanding.	Bidder's understanding is correct that air washer /UAF units have not been envisaged for ventilation of AHP control control building.
1318	Section VII/ Part-B/ Sub section- A-18	1 of 15	1 of 15	2.00.00	Hydrant system shall consist of hydrant pumps, pressurization arrangement, water mains network, hydrant valves, landing valve, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose houses etc.	Center hose house is not envisaged in out door area as per practice followed in NTPC projects. Hence, Hose box shall be considered for outdoor area. Please confirm acceptance.	Hose Boxes/Central Hose houses shall be provided as per TAC guidelines. Bidder to comply with requirements of technical specification.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1319	General				Coal Shed Fire protection system	Bidder has envisaged only outdoor hydrant / water monitor system for coal shed. Also, Stacker cum reclaimers water spray system shall be provided as per technical specification requirement. Owner to please confirm.	Indoor hydrants shall also be provided for Coal Shed. Bidder to comply with requirements of technical specification.
1320	Section VII/ Part-B/ Sub section- A-18	1 5of 15	1 5of 15	Annexure-II	In case of front mill configuration, fire water spray booster pumps shall not be provided if found not required during detailed engg. However, in that case, TDH of main spray shall be 120MWC (minimum).	Bidder requests Owner to allow option to consider spray water pump with 105 mWC and booster pump as an alternate to only main spray pump in case of front mill arrangement. Please confirm acceptance.	Bidder to comply with requirements of technical specification.
1321	Section VII/ Part-B/ Sub section-D-1-5	113 of 120	113 of 120	5.27.00	The number of fire tenders shall be provided as per CISF norms. The number of fire tenders/equipments shall be provided as given in else where in specification.	No fire tender scope is mentioned in fire protection system scope of work. Owner is requested to please clarify on scope of work for fire tender / equipments and provide detail specification for the same.	Fire tenders & fire station equipments have not been envisaged in subject package.
1321	Section VII/ Part-A/ Sub section-III	3 of 3	3 of 3	5.10.00	Stage-III Reservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.	Owner is requested to please clarify / provide input for following. 1. Availability of Power supply for Stage-III Raw water pumps and PT plant during initial operation 2. As ash slurry pump will not be ready during initial operation of stage-III PT plant, sludge disposal arrangement during those period 3. Chemical consumption scope , O&M during initial operation of Stage-III PT plant 4. Readiness of CIO2 plant requirement and its chemical consumption during initial operation 5. Fire protection requirement of PT plant when Stage-III fire protection system is in construction phase.	1. All of these are in Bidder scope and bidder to decide accordingly. 2. All of these are in Bidder scope and bidder to decide accordingly. 3. All of these are in Bidder scope and bidder to decide accordingly. 4. All of these are in Bidder scope and bidder to decide accordingly. 5. Fire Detection & Protection System of entire project including Stage-III PT plant area/equipments/buildings is in the scope of the Bidder. Bidder to comply with specification requirements.
1322	Section VII/ Part-A/ Sub section-III	3 of 3	3 of 3	5.10.00	Stage-III Reservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.	As ash slurry pump will not be ready during initial operation of stage-III PT plant, Owner is requested to clarify the sludge disposal arrangement during those period.	All of these are in Bidder's scope & Bidder to decide accordingly.
1323	Section VII/ Part-A/ Sub section-III	3 of 3	3 of 3	5.10.00	Stage-III Reservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.	Owner is requested to please clarify the scope of chemical consumption and O&M during initial operation of Stage-III PT plant and PT CLO2 System.	All including chemical consumption are in Bidder scope.
1324	Section VII/ Part-A/ Sub section-III	3 of 3	3 of 3	5.10.00	Stage-III Reservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.	As Stage-III, fire protection system shall be in construction stage during initial operation, Owner is requested to clarify the fire protection requirement and arrangement of Stage-III PT plant for that duration.	Fire Detection & Protection System of entire project including Stage-III PT plant area/equipments/buildings is in the scope of the Bidder. Bidder to comply with specification requirements.
1325	Section VII/ Part-A/ Sub section-IV	38 of 73	38 of 73	1.03.14	Turbidity : less than 10 NTU	With inlet Turbidity of 2000 NTU as mentioned in tender specification by Owner and treatment envisage by Owner, Outlet guaranteed turbidity of less than 10 NTU at outlet of clarifier may not be possible. In view of above higher turbidity , Bidder requests Owner to suggest treatment scheme/ Equipment considering 2000 NTU inlet and less than 10 NTU outlet turbidity for clarifier to keep all Bidder's at par.	Bidder to design the complete Pre-treatment system for the specified inlet turbidity of 2000 NTU while guaranteeing the outlet turbidity from the clarifier as less than 10 NTU in line with specification requirement. Bidder shall provide additional treatment system, if any, required to meet the guarantee.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1326	General					Bidder understands that make up water for Stage -III reservoir during initial operation will be available from Stage-I / Stage II make up water system till the readiness of Stage-III make up water system. Please confirm Bidder's understanding. Also, Owner is requested to furnish the make up water analysis of existing stage-I & II plant for treatment of the same in Stage -III PT plant.	Bidder's understanding is not correct. All the facilities should be made ready and available before initial operation of Stage -III. Bidder to note that make up water analysis is same as raw water analysis provided in specification.
1327	Volume VI/Part-A/	Sub-sec IIA-11	2 of 4	1.02.01 (10)	Flushing lines with davit type valves in each branch at the end of hot water distribution pipes to enable removal of debris from the system at the start of commissioning.	Bidder understands that a suitable flushing provision need to be provided at the hot water riser pipes (two (2) nos per tower before the isolation valves. So that during commissioning the isolation valve shall be closed and the circulating water shall be diverted to the CW basin. This will avoid foreign particles entering the water distribution network and the fill media. Kindly confirm.	Bidder's understanding is correct.
1328	Volume VI/Part-B/	Sub-sec A-15	12 of 31	8.00.00	Inlet Louvers	Please note that the inlet louvers are not applicable in NDCTs. To avoid splashing of water outside the cold water basin, the cold water basin diameter shall be provided suitably. Owner to confirm the bidder's understanding.	Louvers are also applicable for NDCT. However, bidder has the alternate option to avoid water loss as specified.
1329	Volume VI/Part-B/	Sub-sec A-15	13 of 31	10.00.00 (2)	Provision shall be made for easy flushing or cleaning of all troughs/pipes	End cap shall be provided in each of the hot water distribution pipes to enable flushing. Owner to confirm the bidder's understanding.	Bidder's understanding is correct.
1330	Section VI/ Part-B/	Sub section- A-09	15 of 19	2.17.02	Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650.	Bidder will consider design of vertical atmospheric storage tanks considering IS 803 / API 650.	Noted. Bidder to refer Clause 2.17.01 of Sub Section A-09 of Section VI Part B, which mentions " as the case may be".
1331	Section VI/ Part-E /	4540-001-POC-A-007			Raw water Reservoir Layout 1200 mm dia pipe indicated at outlet of Reservoir to pump sump	Bidder proposes to consider close channel from Raw water reservoir to Raw water pump sump inline with past executed project Please accept.	Bidder to comply with provisions of technical specifications.
1332	Section VI/ Part-B/ Sub section-G-07		1 of 2	2.00.00	Auto Archive of drawing Category mention as AA in MDL	Bidder understands that Category mentioned as AA is auto archive of drawing. Please confirm Bidder's understanding. Further, Bidder understands that particular drawing in AA category or A category shall be decided by the Bidder. Please confirm Bidder's understanding.	Bidder's understanding is correct for AA Category i.e Auto Archive. Bidder understanding is not correct regarding drawing in AA Category or A category, this shall be decided by the owner as already specified.
1333	Section VI/ Part-B	Sub section- D-1-12-1	1 of 4	1.02.00	Suitable measures to avoid fugitive dust emission shall be adopted within the preassembly area and adjoining area.	Owner is requested to provide scheme for fugitive dust emission system envisaged in laydown area.	Fugitive dust emission scheme has to be developed by the Bidder.
1334	Section VI/ Part-B	Sub section- D-1-12-1	1 of 4	1.7.0	In order to meet Construction Power requirement for this area and construction water, the EPC Contractor shall make its own arrangement.	Bidder proposes to consider construction water from Stage-II PT plant Please confirm . Further, Owner is requested to please provide routine and ROW for construction water from plant boundary to proposed laydown area.	Bidder to refer Cl 2.02.00 of Section VI, Part-A, Sub-Section-IID for clarity.

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S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
1335	SECTION – VI, PART-E	4540-001-POM-A-021	PAGE 31 OF 31	LIST OF TENDER DATA	Refer specification for terminal points and exclusion as marked in P&ID (4540-001-POM-A-021)	Details has not been provided in terminal points and exclusion section. Please confirm the location of terminal point for waste water pump outlet.	FGD waste water to discharged into ash disposal slurry sump
1336	SECTION-VI, PART-A	SUB-SECTION-III	Page 1 to Page 3	NA			
1337	SECTION – VI, PART-A	SUB-SECTION-IIA-04	PAGE 1 OF 7	1.02.00			
1338	SECTION-VI, PART-A	SUB-SECTION-VI CHAP-TER-02 STEAM TURBINE GENER-ATOR	PAGE 31 OF 31	7	Control & Instrumentation Mandatory Spares for specific sub-systems such as hydrogen generation plant and Condensate Polishing Unit (if applicable), the spares shall be governed by the spares indicated against the corresponding specific clauses only.	No specific details have been provided for hydro-gen generation plant in tender specification. Further Qualifying Requirements for the Hydrogen Generation Plant has been strike-off. Please confirm whether hydrogen generation plant is applicable or not. If yes, please provide details of hydrogen generation plant.	Hydrogen Generation Plant has not been envisaged in subject tender.
1339	ATTACHMENT - 3K		PAGE 256 OF 411	NA	Sub-Qualifying Requirements for the Hydrogen Generation Plant		
1340	SECTION – VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL	1 of 15	1.02.00	Under weak grid condition the minimum fault level of 2500 MVA shall be considered at 400 KV.	We understand that weak grid condition (with minimum fault level of 2500 MVA) shall be used for MDBFP starting simulation. Please confirm.	Bidder understanding is not correct. Bidder Shall be consider MDBFP and IDBFP starting simulation.
1341	SECTION – VI, PART-B	SUB-SECTION B-0 GENERAL ELECTRICAL SPECIFICATION	9 of 15	3.06.00 (m)	Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5 mm2	We understand that control cable > 10 Core can be supplied by bidder (if required)	Bidder proposal is not acceptable. Bidder to comply with Standard control cable sizes shall be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5
		SUB SECTION-B-10 CABLING, EARTHING & LIGHTNING PROTECTION	10 of 21	4.04.15	Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: Minimum number of spare cores required to be left for interconnection in control cables shall be as follows: No. of cores in cable No. of spare cores 2C,3C NIL 5C 1 7C-10C 2 14C and above 3		
1342	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	5 of 18	4.00.00 (6)	LED Luminaires shall be used for the lighting of all the indoor & outdoor areas in bidder's scope. However, for DC lighting, hazardous areas & aviation lighting etc. conventional type luminaires shall be used	LED Luminaires shall be used for the lighting of all the indoor & outdoor areas in bidder's scope. However, for DC lighting, hazardous areas & aviation lighting etc. conventional type luminaires / LED luminaires can be used. Please confirm	Confirmed.
1343	SECTION VI, PART-B	SUBSECTION-B-11 STATION LIGHTING	8 of 18	4.00.00 (10)	LP-3 : 1 No., 4A fuse 3 KVA transformer, 40A TPN MCB	Kindly clarify where LP3 is envisaged to be used	Please refer B-10 annexure-I. Bidder to comply technical specifications.

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1344	SECTION VI, PART-B	Sub Section IIB	Page 5 of 17	Sl. No. 1.08.00	Supply and installation of Robotic Tray Cleaning.....	Robotic tray cleaning system is not required & shall be excluded from scope of supply of bidder. Please accept	Presently this item may be considered as deleted from the scope. However, owner may like to get this item supplied and commissioned at a later date. Accordingly, bidder to indicate the price of this item as an optional item in schedule 12 of the bid.
1345	VI / B	A - 01	97 of 101	4.03.06	Sizing grid shall be provided in mill reject pyrite hopper to remove mill reject of size >40mm. The mill reject systems shall be designed for input size of 40mm.	Sizing grid are not applicable for Mechanical type Mill Reject system as conveyor is designed to take care of higher size i.e. size >40mm rejects also	The details shall be reviewed during detail engineering based on the specific design of the system offered by the bidder.
1346	VI / B	A - 02	24 of 65	10.05.22	Mill reject system shall automatically discharge the tramp iron and other non-grindable material through an outlet connection at a suitable height (to be approved by Employer) to a dense phase pneumatic conveying system.	Dense phase pneumatic conveying system is not applicable. Similarly, compressor or other components related to Pneumatic conveying system, mentioned elsewhere in tender specification, are not applicable. Please confirm.	Confirmed.
1347	VI / B	A -22	1 of 3	1.00.00	The transmitting vessel shall operate on level probe mode with timer back-up.		Requirement of 'Level probe with timer back-up' in case of Mechanical conveying system, shall be finalized during detail Engineering.
1348	VI / B	A -22	1 of 3	2.00.00	The discharged rejects from coal mill shall be collected in a dedicated pyrite hopper. Each pyrite hopper shall be provided with cyl-inder operated knife gate valves at inlet and outlet.	There are system which doesn't require pyrite hopper also in mechanical type Mill Reject system. Rejects from mill are directly discharged to Conveyor. Hence NTPC is requested to review and allow this type arrangement also.	Pyrite Hopper arrangement may not be required for Mechanical tpe Mill reject system, however same shall be finalized during detail engineering.
1349	VI / B	A -22	1 of 3	2.01.00 (2) a)	Pyrite Hopper: Tested quality mild steel plates of thickness not less than 10 mm (IS: 2062) and suitably stiffened with rolled steel sections.	Stiffened rolled steel sections is not required and desirable for pyrite hopper as per proven practice and application.	Shall be finalized during detail engineering.
1350	VI / B	A -22	2 of 3	2.03.00 (7)	Tensioning arrangement: Hydraulic/pneumatic	Tensioning arrangement are critical for mechanical conveyor and shall be as per proven practice of OEM. Screw type tensioning arrangement is used by some of OEMs which may also be allowed.	Tensioning arrangement for metallic conveyor shall be finalized during detail engineering based on the proven practices of similar type of application.
1351	VI/ A	VI/ CHAPTER 11	16 OF 18	18. CLARIFIER/ 7	Chlorine Water Booster Pump motor – CW System	Chlorine Water Booster Pumps are not applicable for ClO2 system. Please review and confirm this requirement of mandatory spare.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder
1352	VI/ A	VI/ CHAPTER 11	16 OF 18	18. CLARIFIER/ 8	Chlorine Water Booster Pump motor – PT System	Chlorine Water Booster Pumps are not applicable for ClO2 system. Please review and confirm this requirement of mandatory spare.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder
1353	VI/ A	VI/ CHAPTER 11	16 OF 18	18. CLARIFIER/ 9	Absorbant circulation Pump motor –Chlorine Leak Absorption system	Absorbent Recirculation Pumps are not applicable for ClO2 system. Please review and confirm this requirement of mandatory spare.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder

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1354	VI/ A	VI/ CHAPTER 08	11 OF 27	2.00.00/ Mandator	Absorbant circulation Pumps – CW Chlorine Leak Absorption system	Absorbant Recirculation Pumps are not applicable for ClO2 system. Please review and confirm this requirement of mandatory spare.	In case the specified item is not applicable, equivalent mandatory spares pertaining to the offered design shall be supplied by the bidder. For ClO2 system, Refer Amendment No : A-WS-2
1355	SECTION-VI, PART-B	SUB-SECTION-D-1-5	PAGE 10 OF 120	5.02.09 (iii)	In case of routing of bus-duct is done outside the A-row (part/full), there shall be a.... The metal cladding shall be designed to suit the aesthetics of the entire main plant building.	It is understood and also as per bidder standard practice, that no cladding is required below / bottom face of the outside A-row duct structure. Please confirm	Full cladding is to be provided as per Cl. 5.02.09 (iii)
1356	SECTION-VI, PART-B	SUB-SECTION-D-1-5	PAGE 10 OF 120	5.02.09 (iii)	In front of the power transformers, RCC fire barrier wall shall be provided as per functional requirement in lieu of brick wall at A-row. The above mentioned RCC wall shall be attached with single skin metal sheet on external face.	Bidder can provide either the RCC wall or 350 mm thick brick wall at this location. Please confirm.	Bidder to adhere to technical specifications
1357	SECTION-VI, PART-B	SUB-SECTION-D-1-5	PAGE 3 OF 120	5.02.01	The Mill-Bunker building roof shall be provided with Pre-fabricated insulated metal sandwich panels.	It is understood that Pre-Fabricated Insulated Metal Sandwich Panels to be manufactured on continuous-line in factory with suitable insulation type of 50 mm thick. Please confirm.	Confirmed.
1358	SECTION-VI, PART-B	SUB-SECTION-D-1-6	PAGE 14 OF 24	6.03.11	Permissible deflection for all purlins, cladding runners, roofing/cladding sheets and grating / chequered plates shall be span/250. However, the maximum vertical deflection of Grating/ Chequered plate shall be limited to 6 mm.	This deflection span/250 is too conservative for gratings, chequered plates. Please consider span/150. The maximum vertical deflection of Grating/ Chequered plate shall be limited to 10 mm. Please confirm	Bidder to adhere to technical specifications
1359	SECTION-VI, PART-B	SUB-SECTION-D-1-8	PAGE 9 OF 19	8.06.00	All gratings shall be electro forged types. Minimum thickness of the grating shall be 40 mm for indoor installation and 32 mm for outdoor installation.	Bidder can have the choice for providing stainless steel SS-409-M welded or MS electro forged gratings of 40 mm (indoor) and 32 mm (outdoor) as per the actual design for imposed load of 500 Kgs/Sq.m. Please confirm.	Bidder to adhere to technical specifications
1360	SECTION-VI, PART-B	SUB-SECTION-D-1-9	PAGE 7 OF 31	9.08.01	a) Wall Cladding & Roofing Material- COLOUR COATED AND OTHER SHEETING WORK. either of steel with minimum 0.6mm bare metal thickness, or of minimum 0.5mm BMT, or of steel of minimum 0.4mm BMT.....	Considering the long life, better corrosion protection etc. it is proposed to have the stainless steel (SS) sheeting option also. Bidder can provide either stainless steel (SS) or M.S / High tensile steel metal cladding. Please confirm.	Bidder to adhere to technical specifications
1361	SECTION-VI, PART-B	SUB-SECTION-D-1-9	PAGE 9 OF 31	9.08.06	Pre-Fabricated Insulated Metal Sandwich Panels- Plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets.	Please inform about the type of insulation to be provided in the Factory-made Insulated Metal Sandwich Panels.	Bidder to refer Amendment D1-19

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1362	SECTION-VI, PART-B	SUB SECTION-A-01	PAGE 38 OF 101	1.05.22.01	CHIMNEY -The chimney flue liner cladding shall be made of 1.5 mm thick Titanium (Grade 2 as per ASME SB265) or C-276 (ASTM B575, UNS N10276) alloy over 8 mm thick (minimum) mild steel base metal of flue liner..... Alter-natively, Contractor can also provide chimney of 8 mm thick (minimum) mild steel with Borosilicate Glass Block Lining of minimum 38 mm thickness...	Super Duplex SS-32760 plate as per ASTM-A 240/480 is also technically suitable for chimney flue liner & is available indigenously. Considering various initiatives taken by GOI for 'Aatma Nirbhar Bharat', 'Make in India' etc. bidder can provide either borosilicate / Super Duplex SS-32760/ C276/alloy 59/Titanium Clad plate. Please confirm.	Bidder to comply with the specifications requirements.
1363	SECTION – VI, PART-A	SUB-SECTION-IV	3 of 73	1.01.01 (iii)	TG Output: Continuous TG output of 693 MW unit load (i.e. 105% of rated load) under rated steam conditions at 77 mm Hg (abs) condenser pressure with zero make-up.	Customer has envisaged excessive margins for the design of condenser cooling water system. This has resulted in 25% increase in the sizing of entire cooling water system and auxiliary power consumption. As per specification, the TG cycle is guaranteed for condenser back pressure of 77 mmHg (abs). However, the condenser cooling water system is specified to be designed with following conditions:	Bidder proposal is not acceptable. Bidder to comply specification requirement.
1364	SECTION-VI, PART-B	SUB SECTION-A-01	45 of 101	2.02.03 (ii)	Design cold water temp.: 33 Deg. C	- The design back pressure for condenser is 65 mmHg, approx 18% margin over the TG cycle guarantee back pressure of 77 mmHg. - The condenser is designed for 33 deg C cold water temperature, whereas cooling tower outlet is guaranteed for 32.5 deg C, approx 3% margin over condenser design back pressure of 65 mmHg or approx 21% margin over TG cycle guaranteed back pressure of 77 mmHg. - The CW Pump is specified with 2 MWC additional pressure drop in addition to 10% margin in friction drop to increase the design CW flow rate by approx 10% during operation.	
1365	SECTION-VI, PART-B	SUB SECTION-A-01	45 of 101	2.02.03 (vi)	Guarantee Condenser pressure: To be optimised by bidder but not exceeding 65 mmHg (abs).	This condition will further improve the back pressure by approx 6.5% margin over design condenser back pressure of 65 mmHg or approx 25% margin over TG cycle guaranteed back pressure of 77 mmHg.	
1366	SECTION-VI, PART-B	SUB SECTION-A-01	56 of 101	3.02.00 (g)	Design Cold water temperature at cooling tower outlet: 32.5 Degree C	- NTPC is requested to please review the above excessive margins envisaged in design of condenser cooling water systems, as it is leading to increase in sizes of all components of CW system such as condenser, CW Pumps and especially NDCT and also increase in Aux power consumption of CW pumps by approx 10%. - Following is suggested to limit the margin to a nominal value of approx 10%:	
1367	SECTION-VI, PART-B	SUB SECTION-A-01	56 of 101	3.02.00 (c)	Quantity of water to be cooled by Cooling Towers of One Unit: CW Pumps Flow per Unit + 10% margin		
1368	SECTION-VI, PART-B	SUB SECTION-A-01	55 of 101	3.01.00 (e)	Total Head of the CW pump at rated flow: Sum of static lift from minimum water level in CW pump house sump up to the centerline elevation of hot water distribution header at Cooling Tower + 110% of friction drop in the entire CW system + pressure drop across Condenser with 2 MWC margin (minimum).		

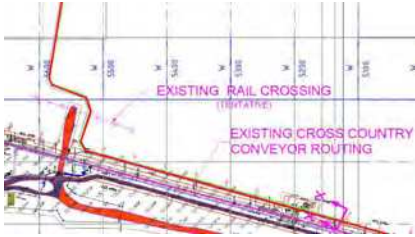
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1369	VI/B	E-60 INDICATIVE VENDOR LIST	2 of 2	1.7	The list of sub-vendors is periodically re-vised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.	For some of the items mentioned in this indicative vendor list (updated vendor list to be shared with successful bidder immediately on award), QR or Sub-QR requirements are also mentioned in Part A, Sub-section IA, like TG Hall EOT crane, brought out items for FGD, etc. It is understood that for approved vendor of such items, QR or Sub-QR related documents shall not be required. Please clarify.	The bidder shall submit project specific documents for sub-QR items.
1370	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS- 4540-001A-2	SUB-SECTION-A- 25 SOLAR P.V.	1 of 26	1.3	Determination of optimal grid connected solar PV systems for south facing walls (BIPV) of different buildings of this package.	Since there are extremely limited number of contractors capable of executing BIPV in line with safety standards in the country, it is requested to please remove BIPV from the scope of the bidder.	Refer Amendment No F-1
1371	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS- 4540-001A-2	SUB-SECTION-A- 25 SOLAR P.V.	10 of 26	13	BIPV (BUILDING INTEGRATED PHOTOVOLTAIC)	Since there are extremely limited number of contractors capable of executing BIPV in line with safety standards in the country, it is requested to please remove BIPV from the scope of the bidder.	Refer Amendment No F-2

S. No.	Specification Reference				Specification Requirement	Bidder's Query	NTPC's Clarification
	Sec/Part	Sub Sec	Page No.	Clause No.			
1					Requirement of Road around periphery of Mine Void 4	We understand from our discussion during site visit that the EPC Contractor needs to construct peripheral road along ash pipelines around Mine Void 4. In this context, please note that the proposed area surrounding the mine is highly undulated with overburden, which makes it difficult to construct motorable road around periphery of Mine Void 4. We, therefore, request NTPC to review the requirement of road around periphery of Mine Void 4.	Bidder to refer Amendment No. D2
2	VI/A	IID	9 of 13	1.00.00 (34)	Railway Siding and its associated facility	We request NTPC to delete Railway Siding and associated facilities from the scope of the bidder.	Bidder to refer Amendment No. D2
3					Dismantling scope	Suitable modification in the scope of complete dismantling within / outside plant boundary.	Bidder to refer Amendment No. D2
4					Depackaging	We request NTPC to adopt de-packaging philosophy for the subject tender and also not to include the following civil oriented packages (including outside the plant boundary) in the current tender. -Railway Siding -Make-up water intake system along with transmission line -Dismantling of cross-country coal conveyor -Ash disposal to mine voids and AWRS along with transmission line -Development of laydown area in abandoned ash dyke -Coal Shed -Dismantling of the super-structures and sub-structures of various facilities/buildings specified in the bidding document	Bidder to refer Amendment No. D2
5					Employer's Responsibilities	We request Employer to kindly arrange/complete following fronts/activities prior to issuance of Notification of Award (NOA): 1)Availability of encumbrance free land 2)Availability of Approach Road including access to site through the Railway Over Bridge (ROB) 3)Completion of rerouting of transmission lines between the two ash dykes i.e. dyke no. B and C (laydown area) 4)Availability of additional space by dismantling the adjacent TPS Stage-II BOP facilities (like railway siding, store and ash water reservoir etc.) for carrying out pre-assembly work, crane movement for erection of Main Plant equipment, temporary storage etc.	1)Complete encumbrance free land would be available. Bidder to refer area handover and dismantling schedule as detailed in Clause 5.00.00 of Sub-Section-III Section VI, Part-A and Sub-Section-IID, Section VI, Part-A for area availability schedule and plan accordingly. 2)Approach road to the plant is available through a level crossing. For ease of movement, construction of balance work of Rail Over Bridge (ROB) is under construction by R&B department, Govt. of Odisha. In addition to this, Anugul Talcher State highway can also be used for transportation and approach to TTPS site directly. Further for approach to the designated laydown area in abandoned ash dyke, ROB is not required. 3)Rerouting of existing 132kV transmission line is not feasible and hence not envisaged. The transmission line is sufficiently above the existing ground level and sufficient headroom is available. 4)Dismantling of existing Railway Siding inside plant boundry and Ash water reservoir is in the scope of EPC Package. Above ground structures of Stores would be dismantled by Owner. However, dismantling of below ground structures of stores i.e. foundations etc. is in the scope of EPC Package. Please refer Technical Specifications for clarity. Additionally, 75 acres of land is available for Laydown & Pre-assembly and an additional 10 acres are available for Batching Plant within plant boundary. Bidder to plan accordingly.

						5)Availability of front for AHP facilities proposed within the existing power station area 6)Re-location of area earmarked for Carbon capture facilities to make space for ESP and FGD 7)Alternative arrangement of water supply, so that Contractor can dismantle the existing raw water reservoir 2 and PT plant from start of the project 8)Availability of front for Coal stockpile and coal shed falling in existing TPS Stage-II ETP facility 9)Right of Way (RoW)/Right of Use (RoU) for Make up Water Pump House facilities 10)Right of Way (RoW)/Right of Use (RoU) for Make up Water corridor for Piping & Transmission line 11)Completion of Land Acquisition for Railway Siding 12) Availability of Construction Power & Construction Water	5)Bidder to refer Cl. 5.00.00 of Part-A, Section-VI, Sub Section-III and plan accordingly. 6)The space allocated for FGD & ESP in the layout is based on the earlier experiences of NTPC for the space requirement. In view of space constraint, single control room is planned for both the units near chimney. Separate space identified for lime and gypsum handling to address the issue of space constraint for FGD. For carbon capture 3000 Sq.M. area is identified near to chimney to meet the technical requirement. Further additional area of around 50,000 Sq.M. is also identified for Hydrogen & Methanol handling which will be made available progressively with dismantling of existing units. Considering above, bidder may plan their facilities within the space provided. Further, the bidder has flexibility to the extent that the width of the area of carbon capture may be reduced to minimum 40 m from existing 50 m shown in tender drawing while maintaining the total area of 3000 m2. Also, minor shifting of the area may be done to the extent that the distance from chimney may not increase by more than 20 m from the existing distance shown in GLP. 7)Bidder to refer Cl. 5.00.00 of Part-A, Section-VI, Sub Section-III and plan accordingly. 8)Dismantling of ETP shall be in Bidder's scope. Bidder to refer Amendment to technical specifications in this regard. 9)Bidder to refer Amendment D2 in this regard 10)Bidder to refer Amendment D2 in this regard 11)Bidder to refer Amendment D2 in this regard 12) For availability of Construction water and Construction power bidder is requested to refer to Cl. 2.02.00 of Section VI/Part-A, Sub-Section-IID.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
6	SEC-VI/PART-B	D-1-7	3 of 12.	7.02.02	For the new facilities to be constructed after dismantling existing facilities; founding level of new facilities shall be taken at least 1.0m below the existing founding depth of the dismantled structures in case of soil and 0.6m below the existing founding depth of the dismantled structures in case of rock	We request customer to kindly furnish the foundation drawings of the existing structures to enable us to decide foundation depth.	Foundation drawings are not available. However, drawings developed using GPR for some structures are being provided. Refer amendment no D2 Additionally, bidder can visit site to make its own assessment.
7	SEC-VI/PART-E		4540-001-POM-A	TENDER DRAWINGS	PROPOSED ROUTING OF ASH DISPOSAL & AWRS PIPING AND ASSOCIATED FACILITIES 	Please refer attached snapshot. During our site visit, we found that the location marked as "Existing Rail Crossing" now has many new buildings/structures/roads/retaining walls/rail tracks erected by Mahanadi Coalfields in last 1-2 years, which are completely fouling with the existing ash slurry pedestal routing. Routing the ash slurry pipes as Section X-X marked for this area, is certainly not possible. We request NTPC to kindly provide us with latest survey drawing with contour levels for this rail crossing area.	Ash slurry corridor outside plant & AWRS upto plant boundary shall be excluded from the scope of the Pkg.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
8	SECTION-VI, PART-E	TENDER DRGS	4540-001-POC-A-012		In Make-up Water Pump House Plan and Section, TWS is shown at the suction of each make up water pumps.	Customer may please clarify whether TWS is to be envisaged at the suction of make-up water pumps or not. If it is to be envisaged, please provide the detailed technical specification, design criteria, MOC etc.	Bidder to refer Amendment No. D2
9	SECTION-VI, PART-E	TENDER DRGS	4540-001-POM-A-061		In Scheme of make-up water system, TWS is not shown at the suction of make-up water pumps.		
10	SECTION-VI, PART-B	D-1-7	3 of 12	7.02.02	Open Foundations h) During design the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report and as per the values furnished in Table-1.	Allowable bearing pressure shall be adopted as per approved geotechnical investigation report during contract stage. Please confirm.	Bidder to refer Amendment No. D2
11	SECTION-VI, PART-B	D-1-7	4 of 12	7.03.00 ii)	Pile shall be socketed into weathered rock. A socketing length of Five meter into rock shall be ensured.	As per the bore log details, type of rock is weathered sandstone. In case of pile foundation, socketing of 5m inside rock is technically not required. Socketing inside the rock shall be done as per design requirement during contract stage. Please confirm.	Bidder to refer Amendment No. D2
12	SECTION-VI, PART-B	D-1-7	4 of 12	7.03.00 ii)	The uplift and lateral load capacity shall be respectively restricted to 35% and 5% of the allowable load capacity in vertical compression.	In case of pile foundation, the uplift and lateral load capacity shall be adopted as per approved geotechnical investigation report during contract stage. Please confirm.	Bidder to refer Amendment No. D2
13					General	Geotechnical details for make-up water pipe line, pump house, forebay etc may please be furnished including following details: a) Bore logs b) Field and lab test results c) Chemical analysis soil/water d) ERT results	Bidder to refer Amendment No. D2

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
14		ESLD 4540-001-POE-J-001-A			33KV COMMON SERVICE SWGR: 4NOS. FDR. OWNER'S USE 11KV MISC SWGR: 4NOS. FDR. OWNER'S USE Balance feeders on the above swbd in-clude: 2 nos. fdr for Ext. CHP (customer scope), 2 nos. fdr for MUW system, 2 nos. fdr for AWRS system, 2 nos. fdr for COLONY (uncabled), 2 nos., fdr for 33/11.5kV (7.5MVA) trafo.	1) Please provide the load to be considered for the O/G feeder from 11kV Station SWBD for feeding the 11/34.5KV Com-mon service transformer. The same is re-quired for the sizing of the station Trans-former. 2) Except for the 2 nos. feeders for AWRS, we understand balance 16 nos. feeders mentioned in the list & 2nos. feed-er/section spare each for 33kV & 11kV SWGR shall suffice to owner's require-ment & no additional. feeder shall be en-visaged further for this requirement.	1. Refer amendment no. B-20 2. Bidder's understanding is correct.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
15	Part-A	SUB-SECTION-IIIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 9 OF 17	1.16.05	33kV Transmission Line	i) Kindly provide the preliminary route survey of 33kV Transmission line. ii) We understand that any ROW (Right of Way) , statutory clearances, coordination with external agency required for this 33kV line is not in scope. Please confirm.	Please refer amendment no. B-22.
16	Part-A	SUB-SECTION-IIIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 9 OF 17	1.16.05	33kV Transmission Line The scope covers supply, erection, commissioning of 33kV Transmission Lines on Towers (narrow based lattice towers with fully galvanised structure) and associated equipments as shown in the single line diagram.	Kindly confirm whether pole mounted 33kV line in place of lattice tower is also acceptable or not.	Please refer amendment no. B-22.
17	Part-A	SUB-SECTION-IIIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 9 OF 17	iv)	33kV Transmission Line: 33 kV Transmission Line of 28 Km length (approx.) with (2nos) Single Circuit towers (narrow based lattice towers with fully galvanised structure) from TTPS plant boundary to Make Up water pump house . The route is along the Make up water pipe corridor.	Kindly confirm whether 33kV cable is also acceptable from TTPS plant boundary to MakeUP water pump house.	Please refer amendment no. B-21.
18	Part-A	SUB-SECTION-IIIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 13 OF 17	1.21.00	OVERHEAD LINES Transmission line to AWRS Pumphouse: Two number 11kV or 33kV single circuit transmission line on poles for supplying power from plant to AWRS pumphouse The overhead lines for AWRS Pump house shall generally be laid along the AWRS route. However, exact routing shall be decided during detailed engineering. Scope of work includes route survey for line, civil works, design, supply, erection and commissioning of poles.	i) Any ROW for overhead line to AWRS is not in scope of Bidder. Please confirm. ii) Kindly provide the specification of this transmission line.	Please refer amendment no. B-23.
19	Section-VI	Sub Section-A-12	5 of 12	4.00.00	The Fire detection and protection requirement has not been envisaged for make up water Pump house at Samal Barrage discharge.	Bidder has not considered any Fire detection and protection system for make up water Pump house at Samal Barrage dicharge which is 28 km away from Main Plant boundary. Kindly check and confirm the same.	Fire detection & protection system for system/equipment/ rooms in areas like make-up water pump house, AWRS pump house, etc. outside plant boudary is not in the scope of the Bidder. Bidder to refer Amendment A-PU-8 to A-PU-15.

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

20	Section VI Part-A SubSection IIA 09		1 of 3	1.00.00 (7)	Supply and laying of 2x50% capacity mild steel pipes with 3-layer polyethylene (3LPE) coating and of required size to supply water from makeup water pump house located outside plant at upstream of the Samal barrage discharge on the River Brahmani to Raw water reservoir inside plant and complete with all bends, fittings, joints with specified coating, valves, instruments etc	Kindly confirm for the material of MUW pipe is MILD STEEL only. Whether other material like Ductile Iron or GRP or Carbon Steel may be utilised for manufacturing of MUW pipe?	Bidder to please refer amendment A-WS-12
21	Section VI Part-B SubSection A 01		68 of 101	3.10.00	MUW pipelines – 2 x 50 % 3LPE coated Carbon Steel pipes	Kindly confirm for the material of MUW pipeline is Carbon steel pipes only. Whether other material like Ductile Iron or GRP or Mild Steel may be utilised for manufacturing of MUW pipe?	Bidder to please refer amendment A-WS-24
22	Section VI Part-A SubSection IIA 09		3 of 3	1.03.01	Contractor's scope of services shall also include cost of meeting all statutory requirements (except where specifically excluded) and furnishing the required certificates.	Kindly confirm, all statutory fees/payments required to be deposited to the concern authorities for approval/permissions of rail/road/canal crossings shall be paid by NTPC. Also, confirm that obtaining approval for Right of way and Right of Use for MUW pipe laying is in the scope of NTPC	Bidder to please refer amendment A-WS-12
23	Section VI Part-A SubSection IIB		10 of 17	1.16.05 v)	EPC vendor shall optimize the corridor of MUW pipe and 33kV Transmission line in the width of the corridor.	Bidder is allowed to utilise total area of the corridor as allocated to bidder by Owner. Kindly confirm. In case area for laying of piping goes beyond the allocated corridor area, land & statutory approval for ROU to be obtained by NTPC for the additional area beyond allocated corridor.	Bidder to refer Amendment No. D2
24	SECTION – VI, PART-A SUB-SECTION- IID		7 OF 13	19	Make up water system	Right of way, land acquisition, tree cutting, statutory approval for road cutting/ diversion, blasting (if required), MOEF clearance etc. outside plant boundary should not included in Bidders scope and shall be taken care by NTPC. Please confirm same shall be arranged by the NTPC.	Bidder to refer Amendment No. D2
25	SECTION-VI, PART-B SUB-SECTION-D-1-5		84 OF 120	5.18.05	The deck of bridge has been sized for two (2) make-up water pipes, etc.	We understood that Intake of raw water is through Open channel. Therefore, Sizing of bridge deck for intake well is not required. Kindly confirm	Bidder to refer Amendment No. D2
26	SECTION – VI, PART-A SUB-SECTION- IID		3 OF 13	1.00.00 4) f)	Existing Stage-II reservoir & Stage-II PT Plant will be covered inside the existing Station premises since it would be operational for catering to (i) water requirement of existing plant & township and (ii) construction water requirement of Stage-III project.	We understand that Make up water line catering water requirement of Stage II reservoir area shall be utilised to cater water requirement for stage III reservoir till the construction of make up water system for feeding water in reservoir -III is completed for Stage-III plant	Bidder to refer Amendment No. D2
27	Section VI Part-A SubSection IID		9 of 13	34 (a)	The FSR (Feasibility Site Report) attached at Annexure D-1-12(N) is for bidding /reference purpose only. As it is in the process of approval from Indian Railways, the work shall be executed as per the Indian Railway Standards. Executing agency has to prepare the DPR, ESP, SIP & Other necessary drawings and get the approval from Indian Railways.	FSR may please be provided as it is not available in the tender documents.	Bidder to refer Amendment No. D2
28	Section VI Part-A SubSection IID		9 of 13	34	The scope of work & services for the proposed railway siding and augmentation of serving station	We understand that Serving station-Talcher is already an established station. Kindly provide the scope details of augmentation of serving station	Bidder to refer Amendment No. D2

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

29	Section VI Part-B SubSection D-1-5		115 of 120	5.32.1.1	The alignment of Railway Siding is to be accommodated within the available NTPC land as per the FSR. The assessment of additional land requirement (if any), which may crop up during preparation of Engineering scale plan/ construction stage of the Railway siding, including preparation of land requirement plan with details such as private, govt., forest etc. on Khasara map (including schedules & cadastral map) shall also be in the scope of the Bidder. Identification of structures/buildings required to be demolished and its cost estimate including compensation to be paid to the owner of structure/buildings, if any, shall also worked out by the Bidder and submitted to NTPC.	Kindly confirm that acquisition of additional land requirement for railway siding shall be taken care by NTPC. Bidder shall provide the assessment report for the requirement of additional land.	Bidder to refer Amendment No. D2
30	Section VI Part-B SubSection D-1-5		116 of 120	5.32.4.1 e) iv)	Design of bridge across canal shall be done as per requirements of the Water Resources Department of Odisha. In addition to obtaining approval of the Railways, the Bidder shall submit the detailed design of the bridge to WRD of Odisha and obtain their approval prior to start of the construction work.	NTPC to obtain the requisite approval from Railways/authority concerned for the bridge across canal. Kindly confirm	Bidder to refer Amendment No. D2
31	SECTION VI, PART-B	SUB-SECTION-IIIC-13 PUBLIC ADDRESS SYSTEM	----	----	General	PA system is not being envisaged for 'Make Up Water pump house'; since same is 28 kms away from main plant.	Bidder to refer Amendment No. D2
32	SECTION VI –Part – A	Sub-Section – IIA-09	Page 1 of 3	4)	One (1) No. 20 Tons (minimum) capacity EOT Crane for handling equipments in MUW pump house and 3 Tons (Min) capacity electric hoists for handling stop logs and trash racks in MUW pump house.	We have considered Gantry Crane for handling stop logs and trash racks in MUW pump house. However, type of crane (Gantry/Semi Gantry) shall be decided during detail engineering as per the final MUW pump house layout. Please confirm.	Bidder to refer Amendment No. D2
33	SECTION – VI, PART-E				Drg. No. 4540-001-POC-A-012: Make up water pump house plan & section. As per this drawing, 10T Gantry crane is to be considered for handling stop logs and trash racks in MUW pump house.		
34	General				Dismantling of Superstructure / substructure, as per specifications.	Bidder request NTPC to dismantle the super-structure / sub-structure of various facilities/buildings specified in bidding documents, as per specification and provide the encumbrance free land for complete facilities under the scope of bidder as on date of NOA. NTPC To confirm and issue suitable amendment.	Bidder to refer Amendment No. D2

EPC PACKAGE FOR TALCHER THERMAL POWER PROJECT, STAGE-III (2x660 MW)
Clarification No. 02 to Technical Specifications Section-VI of Bidding Document No.: CS-4540-001A-2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
35	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS		10 of 17	1.16.05 Vi)	33kV Transmission Line : Supply of all items for civil and structural works to include detailed route survey including survey for PTCC clearance, route marking, survey and selection of tower locations (including all crossings), route clearance / tree cutting, geo-technical investigation of soil, tower foundations for all types of soil at each location etc.	Preliminary route survey including tower location, tower profile for 33kV Transmission line for Raw Water Intake system is not available in tender specification. Owner may please provide preliminary route survey for transmission line.	Please refer amendment no. B-22
36	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS		13 of 17	1.21.00	OVERHEAD LINES Transmission line to AWRS Pumphouse: Two number 11kV or 33kV single circuit transmission line on poles for supplying power from plant to AWRS pumphouse The overhead lines for AWRS Pump house shall generally be laid along the AWRS route. However, exact routing shall be decided during detailed engineering. Scope of work includes route survey for line, civil works, design, supply, erection and commissioning of poles.	Preliminary route survey including pole location, pole profile for 33kV or 11kV overhead line for Ash Water Recovery system is not available in tender specification. Owner may please provide preliminary route survey for overhead line.	Please refer amendment no. B-23
37	Section VI, Part B, Sub-Section D-1-1		1 of 2	1.01.00	Preliminary geotechnical investigation in the proposed are has been carried out by the Owner and the bore-log data is furnished as Annexure C	Bore hole details of the following areas are not available. a) Intake channel, pump house and piping corridor b) Ash piping corridor outside plant boundary c) Existing reservoir area which is overlapping with CHP facilities Owner to share the recent soil investigation which is being carried out at proposed Talcher TPS site.	Bidder to refer Amendment D-2
38	Section VI, Part A, Sub-Section IID		7 of 13	19	Makeup water system All civil, structural & architectural works associated with Makeup water system	Owner to furnish bathymetry survey of samal reservoir with respect to intake channel.	Bidder to refer Amendment D-2
39	Sub Section IID, Civil works		9 of 13	34	The FSR (Feasibility Site Report) attached at Annexure D-1-12(N) is for bidding /reference purpose only. As it is in the process of approval from Indian Railways, the work shall be executed as per the Indian Railway Standards. Executing agency has to prepare the DPR, ESP,SIP & Other necessary drawings and get the approval from Indian Railways.	Feasibility site Report is not available with tender specification. Owner to furnish the same. Also alongwith FSR, Owner to kindly furnish additional input like Engineering scale plan, L-Section, Details of Enroute RUB/ROB, etc.	Bidder to refer Amendment D-2
40	Section VI, Part A, Sub-Section IID		2 of 13	4a viii and 4a xiv	Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- I Raw water reservoir Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- II Raw water reservoir	Owner to furnish the underground pipe routing for the below mentioned pipeline: a) Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- I Raw water reservoir b) Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- II Raw water reservoir	The overground portion of the pipeline is shown in Tender drawing 4540-999-POC-A-015 - Titled "EXISTING FACILITIES, BUILDING WITHIN STAGE-III PLANT AREA". However, the underground portion of pipeline has to be located by the bidder using pipe locator before start of work.

EPC Package for Talcher Thermal Power Project, Stage-III (2x660 MW)

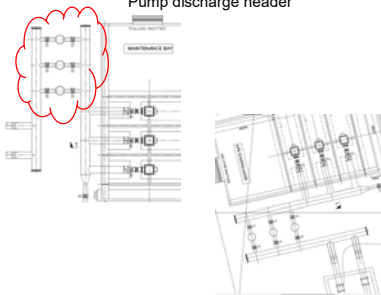
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply (EPC)
46	SECTION-VI / PART-B / Book 4 of 5 - Civil Works/ Sub-Section-D-1-5	5.18.06	85 of 120	Make-Up Water Pipe Crossings At National Highway / State Highway / Railway Pipe crossing through culverts (Culverts to be constructed by Owner) There are two railway crossings (TP 132 to TP133 and TP 24 to TP25), one no. road crossing (TP 35 to TP 36), and one no NH Crossing (TP 101 to 102), as mentioned in tender drawing no 4540-001-POC-A-010) for which culverts (Box culvert/pipe culvert) will be constructed by the Owner, However, pipe line laying along with associated RCC pedestal/thrust block and RCC pits at entry/ exit points shall be in bidder's scope.	Bidder understand that Make-up water pipe crossings at National Highways / State Highways / Railway are scope of Owner and excluded from EPC scope of work. Please confirm.	Bidder to refer Amendment no. D2
47	SECTION-VI / PART-E /Tender Documents	-	-	Drawing number 4540-001-POC-A-013 "MAKE-UP WATER SYSTEM AND ASSOCIATED CIVIL WORKS PACKAGE - PIPE BRIDGE CROSSING AT IRRIGATION CANAL,NALLAH & RESERVOIR SUBMERGENCE AREA"	Bidder understand that this drawing is indicative only. Pile foundation indicated below foundations. Bidder may consider open or pile foundation as per Geotechnical Investigation report. Please confirm.	Bidder to refer Amendment no. D2
48	SECTION VI / PART E/ Tender Drawings	-	-	-	Bidder request Owner to Kindly provide Road Layout drawings near MUWPH.	Bidder to refer Amendment no. D2
49	Dredging				Bidder understand that dredging is not included in EPC scope of work for the areas beyond the start point of intake channel. Please confirm	Bidder to refer Amendment no. D2
50	Historical water level data of barrage				Bidder request Owner to provide historical water level data of Samal barrage	Bidder to refer Amendment no. D2
51	SECTION VI / PART E/ Tender Drawings				4540-001-POC-A-010 (sht-1 of 23): RL near proposed make up water pump house at Bhaktipal is indicated as EL. 77.25m etc. near TP0 (CH. 0.0) 4540-001-POC-A-011: RL near proposed make up water pump house at Bhaktipal is indicated as EL. 82.50m etc. near TP0 (CH. 0.0) As there are mismatch of RL, Bidder request Owner to confirm which drawing to be followed or provide revised topographic survey details near proposed make up water pump house at Bhaktipal	Bidder to refer Amendment no. D2
52	SECTION VI / PART E/ Tender Drawings				Bidder request Owner to provide the details of any underground pipe line or other utilities (if any) along the pipe line area.	Bidder to refer Amendment no. D2

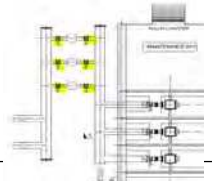
Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
53	SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS SECTION – VI, PART-A, SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS SECTION – VI, PART-E, TENDER DRAWINGS	1.04.00 _____ 1.05.01 _____ 1.05.02 _____ -	2 of 17 _____ 2 of 17 _____ 2 of 17 _____ -	The preferred standard Transformers ratings shall be as indicated in a typical key single line diagrams Drgs. No 4540-999-POE-J-001 enclosed in Tender drawings. _____ (a typical key single line diagram for Aux Power Supply Drawing No 4540-999-POE-J-001 enclosed). _____ (a typical key single line diagram for Aux Power Supply Drawing No. 4540-999-POE-J-001 enclosed) _____ Single Line Diagram Drg.no. 4540-001-POE-J-001 Rev.A.	The drawing number of Single Line Diagram as per Section-VI, Part-E is 4540-001-POE-J-001 Rev.A. The referred clauses specifies drawing number as 4540-999-POE-J-001 for Single Line Diagram. Owner may please review and update specification. Bidder is following Drg.no.4540-001-POE-J-001 Rev.A as per Section-VI, Part-E.	Bidder's understanding is correct. Please refer amendment no. B-31
54	Section-VII-Book 2 of 3 Price Bid SECTION – VI, PART-E, TENDER DRAWINGS	PRICE SCHEDULE SCHEDULE- 10 Sr.no.26 _____ Drg.no. 4540- 001-POE-J- 001 Rev.A	- _____ -	one complete 400KV GIS Dia (Line-III-TIE-Line-IV) Along with Associated GIS duct, AIS equipment, Termination, cable, cabling, control & protection and metering , civil works etc complete in all respect as per SLD and Technical specification. # # 4. ONE COMPLETE 400KV GIS DIA (LINE-III-TIE-LINE-IV) ALONGWITH ASSOCIATED GIS DUCT, AIS EQUIPMENT, TERMINATION, CABLE, CABLING, CONTROL & PROTECTION AND METERING , CIVIL WORKS ETC. COMPLETE IN ALL RESPECT AS PER SLD AND TECHNICAL SPECIFICATION SHALL BE QUOTED SEPARATELY IN PRICE SCHEDULE.	Bidder understands that the scope of work related to "one complete 400KV GIS Dia (Line-III-TIE-Line-IV)" is included in base scope to be quoted under lumpsum bid price and the separate value quoted at Sr.no.26, Schedule-10 of Price Schedule will be used for deletion of scope during project execution. Owner may please confirm bidder's understanding. If the above understanding is correct, Owner may ask separate quote under Schedule-9 (Schedule of Take Out Price) instead of Schedule-10 (Schedule of Unit Rates).	bidder's understanding is correct. The bidder shall quote in schedule -09 as a take-out price for "one complete 400KV GIS Dia (Line-III-TIE-Line-IV)". Please refer amendment no. B-4 and B-5
55	SECTION – VI, PART-E, TENDER DRAWINGS	Drg.no. 4540- 001-POE-J- 001 Rev.A	-	33kV Line for MUWPH Plant side equipment - 33kV Isolator, Earth Switch, and Lightning arrestor	(1) Bidder request Owner to clarify the location for installation of Plant side 33kV equipment comprising 33kV Isolator, Earth Switch, and Lightning arrestor. (2) Bidder understands that the Plant side 33kV equipment comprising 33kV Isolator, Earth Switch, and Lightning arrestor are Outdoor equipment. Owner may please confirm.	Please refer amendment no.B-31
56	SECTION – VI, PART-E, TENDER DRAWINGS	Drg.no. 4540- 001-POE-J- 001 Rev.A	-	33kV Line for MUWPH MUWPH side equipment - 33kV Isolator, Earth Switch, Lightning arrestor and PT	Bidder understands that the MUWPH side 33kV equipment comprising 33kV Isolator, Earth Switch, Lightning arrestor and PT are Outdoor equipment. Owner may please confirm.	Please refer amendment no.B-31

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
57	General	-	-	-	Owner may please clarify about the requirement of illumination system/street lighting for approach road which is connecting the MUWPH to the nearest road.	Please refer amendment no.B-31
58	Technical Specification Section – VI, Part-B Bid Doc NO. : CS-4540-001-2 Sub section B-10, CABLING, EARTHING & LIGHTNING PROTECTION	Annexure-I	20 of 21	RECEPTACLES LOCATION ANNEXURE - 1 RECEPTACLES LOCATION	Owner may please specify the receptacles requirement at Makeup water pump house.	Please refer amendment no.B-31
59	Technical Specification Section – VI, Part-B Bid Doc NO. : CS-4540-001-2 Sub section B-11, LIGHTING	Annexure-A Annexure-B	18 of 18	DC Emergency Lighting average lux levels	Owner may please provide DC Emergency Lighting average lux levels for PUMP house in MUWPH.	Please refer amendment no.B-31

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
60	Section VII/ Part-A/ Sub section-IIA-12	4.00.00 (b)	5	19) Any other area/building required to be protected with hydrant system.	Scope of Fire protection and detection system for facilities proposed outside plant boundary i.e. make up water pump house, Ash Water recirculation (AWRS) area at Mine Void, External Coal Handling plant, laydown area & other facilities as applicable etc. is not specified in tender specification, hence, Bidder has not considered in scope of work. Kindly confirm.	Fire detection & protection system for system/equipment/ rooms in areas like make-up water pump house, AWRS pump house, etc. outside plant boudary is not in the scope of the Bidder. Bidder to refer Amendment A-PU-8 to A-PU-15.
61	SECTION-VI / PART-A /SUB-SECTION-A-12	4.00.00 (h)	7	e) Switchgear/MCC rooms/Battery Rooms/control rooms of Raw/Makeup water/other pump house (as applicable) located outside plant boundary.	As per specification, Bidder understands that apart from the scope specified in the clause, no other fire protection system like water based fire protection system, Panel injection system etc. envisaged for the pump houses which are located outside plant boundary, NTPC to confirm. Apart from the above, fire detection system shall be standalone and shall not be connected to the main plant fire detection system. Please confirm.	Fire detection & protection system for system/equipment/ rooms in areas like make-up water pump house, AWRS pump house, etc. outside plant boudary is not in the scope of the Bidder. Bidder to refer Amendment A-PU-8 to A-PU-15.
62	Section VI/ Part-A/Sub section -IID Section VII/ Part-B	1.00.00 5.13.02	8 47	19. Makeup water system 28. Civil, Structural works for pipe /cable /duct supporting structures, trestles and foundations, trenches, culverts, duct banks, pedestals, hume pipe & culverts, buried pipes, racks, culverts across rail/road tracks for pipes/ drains/ cables and any other facility and thrust blocks etc. associated with all systems covered under the scope. Civil Works for Fire Detection & Protection System in Ground Floor/ Paving In case of rail crossings, NP4 class hume pipe encased in RCC shall be used instead of NP3 class hume pipe.	Bidder understands that NP4 class hume pipe is to be considered for rail crossing for fire protection system.	Bidder to refer Amendment D-2
63	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA TECHNICAL SPECIFICATION SECTION – VI, PART-A SUB-SECTION-IB PROJECT INFORMATION	3.10.00 3.02.00	68 OF 101 1 OF 15	MUW Pumps a).Number of MUW Pumps – 03 x 50% (2W+1S) b). Capacity of each MUW Pump – 3000 Cu.m/hr. Make up water requirement for Talcher Thermal power project, Stage-III expansion (2x660 MW) would be about 40 Cusec with ash water recirculation system.	Discrepancy found between sated clauses. Owner to please clarify plant makeup water requirement.	Bidder to refer amendment A-WS-24 for number and capacity of MUW pumps
64	SECTION VI –Part – A Sub-Section – IIA-09 SCOPE OF SUPPLY & SERVICES FOR MUW	1.00.0	Page 1 of 3	3x50% of capacity Vertical turbine, wet pit type MUW pumps along with electrical motor drives (VFD) along with all accessories	Instead of VFD type motor owner to accept single frequency drive motor for make up pump.	Bidder to refer amendment A-WS-12
65	Part-B, Mechanical, Sub Section A-10				In the absence of inputs, we request Owner to provide the following details of make-up water arrangement for estimation. 1. Tentative locating coordinates of intake well and pump house 2. High flood level of samal reservoir 3. Maximum draw down level of reservoir 4. Maximum and minimum water level of reservoir 5. Soil Resistivity along the make-up pipe corridor	Bidder to refer Amendment D-2

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
66	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	Travelling water screen	In Part – E, section - VI, Tender drawing No. 4540-001-POC-A-012 (Make up water pump house plan & section), In Layout plan & section Travelling Water Screen (TWS) is Indicated along with stoplog gate and trash rack. - However in the scope , specification/ data sheet , detail technical requirement of Travelling water screen is not envisaged. - Please reconfirm the requirement of TWS for make up water system, if required, then detail technical specification of TWS shall be provided.	Bidder to refer Amendment D-2
67	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	Gantry crane	In Part – E, section - VI, tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) Gantry crane is mentioned for handling stop logs, trash racks and Travelling water screen. - However in tender document, section-VI, Part-A (EPC Package), subsection make up water system , at clause No.1.00.0, Pg.No.1 of 3, it is indicated to provide 3 Tons (Min) capacity electric hoists for handling stop logs and trash racks in MUW pump house. - Discrepancy in type material handling system (Gantry crane / electrical hoist) for stop logs, trash racks and Travelling water screen. bidder requests owner to confirm the requirement and also provide specification of gantry crane if gantry crane is required.	Bidder to refer amendment A-WS-12 wrt.technical specification section-VI, PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system Bidder to refer Amendment D-2
68	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	Pump bay	In tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section), 5 Nos pump bays are shown in key plan , However in plan view & section view 3 Nos of Pump bays are Indicated. - In technical specification section-VI, PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system at clause No.1.00.0, 3x50% of capacity Vertical turbine pump is Indicated. - Discrepancy in pump bay / quantity (3 or 5 Nos)shall be clarified. - If the Channel, forebay and Pump house needs to be designed for (4W+1S) pump bay requirements, then the revised layout with dimensions shall be provided.	Bidder to refer amendment A-WS-12 wrt.technical specification section-VI, PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system
69	Part – B, Mechanical Section – VI Sub section-A-01 Equipment sizing criteria	3.11.00	59 OF 10	"Cranes & Hoists should be sized to handle heaviest component to be handled with 25% margin (with minimum capacity if specifically indicated elsewhere for any system/equipment) and should comply to IS: 3177/IS: 3938 (as applicable)."	In Part – E, section - VI, tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) Gantry crane capacity is indicated as 10T. However in the tender document Part – B, Mechanical, Section – VI, Sub section-A-01 Equipment sizing criteria ,Pg. No 69 OF 101 (PDF Pg. No 1508 of 2672) at Clause No.3.11.00 of Technical requirements of MUW pumps and associated equipment's is indicated as EOT crane/hoists should be sized to handle heaviest component to be handled with 25% margin. Bidder presume that crane capacity shall be fixed based the design criteria specified. NTPC shall reconfirm the Bidder Understanding.	Bidder to refer amendment A-WS-25

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
70	section-VI Part – A Sub-Section – IIA-09 (Scope of supply & services for MUW system)	1.00.0	1 of 3	Non return valve at the discharge of each MUW pump is indicated.	In technical specification section-VI, Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system, Page 1 of 3 (PDF Pg. No. 548 of 2672) at clause No.1.00.0,Non return valve at the discharge of each MUW pump is indicated. - However in tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) Non return valves are not shown in section view. - NTPC shall confirm the requirement of Non return valve at make water pump discharge.	Bidder to refer amendment A-WS-12 wrt.technical specification section-VI,PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system
71	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-		In Part – E section - VI Tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) two Nos of motorised isolation valves with equipment are shown on 3 pipe lines. - Please explain the equipment in between motorised valves and provide it's technical details.	Bidder to refer Amendment no. D-2
72	Part – B, Mechanical, Section – VI Sub Section A-15 CW System Annexure-2 Vertical pumps	4.07.01	26 OF 31	"Adequate number of properly designed bearings shall be furnished. The type of lubrication i.e., self-water lubrication or forced water lubrication shall be provided."	In technical specification section-VI, Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system, Page 1 of 3 (PDF Pg. No. 548 of 2672), Two (2) Nos of lubrication pumps are indicated for MUW pumps. - In the tender document Part – B, Mechanical, Section – VI, Sub Section A-15 CW System ,Annexure-2 Vertical Pumps. No 26 OF 31 (PDF Pg.No.1824 of 2672) at Clause No.4.07.01 ,Either self-water lubrication or forced water lubrication is indicated. - Also in Part – E, section - VI, tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) lubrication pumps are not shown. - Bidder understands that lubrication pump requirements are based on pump vendor/OEM recommendations. - NTPC shall check and confirm the same.	Bidder understanding is not correct Bidder to provide Forced water lubrication system with required number of pumps wherever specified in the tender. Further, Bidder to refer amendment A-WS-12 wrt.technical specification section-VI,PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system
73	section-VI,Part – A Sub-Section – IIA-09 (Scope of supply & services for MUW system)	1.00.0	1 of 3	"Forced water lubrication system consisting... ..pressure sand filter (2 X 100%), air blower (2 X 100%), backwash pumps (2 X 100%), Overhead tank, all associated piping and fittings, valves etc. along with all required accessories to complete the system."	In technical specification section-VI, Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system, Page 1 of 3 (PDF Pg. No. 548 of 2672) at clause No.1.00.0 it is indicated as "Forced water lubrication system consisting... pressure sand filter (2 X 100%), air blower (2 X 100%), backwash pumps (2 X 100%), Overhead tank, all associated piping and fittings, valves etc. along with all required accessories to complete the system." - In the Pump house layout provided, The location of above equipments is not specified. Bidder presumes that , these equipments needs to be designed for outdoor environmental. - NTPC shall note and confirm the same.	Bidder to refer amendment A-WS-12

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
74	Part – B, Section – VI, Mechanical, Sub-Section- A-09 (Low Pressure Piping) SECTION-VI, PART-B SUB-SECTION-D-1-5 CIVIL WORKS	2.09.00 5.18.02.02.03	7 OF 19 PAGE 74 OF 120	"The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level." Trenching for Laying of pipe. Top of pipe shall be minimum 1.5 M below Finished Ground level (FGL) / Natural Ground Level (NGL) as the case may be.	In the tender document Part – B, Section – VI, Mechanical, Sub-Section- A-09 (Low Pressure Piping),Page.No.7 of 19 (PDF Pg. No 1696 of 2672)at Clause No.2.09.00 depth of buried pipe from finished ground level is indicated as 1 meter whereas in tender drawing.No.4540-001-POC-A-014 (MUW Pipeline Routing Below NH,SH & Railway Crossings) it is indicated as 1.5 meter. - NTPC shall confirm the minimum depth of soil cover requirements.	Bidder to refer Amendment no. D-2
75	section-VI Part – A Sub-Section – IIA-09 (Scope of supply & services for MUW system)	1.00.0	1 of 3	"Transient analysis of MUW system, supply and installation of required no. of ARVs (minimum 52 Nos.) of 200 NB size along with stubs & isolating valves."	In technical specification section-VI,PART – A , Sub-Section – IIA-09 Scope of supply & services for MUW system at clause No.1.00.0,Page 1 of 3 (PDF Pg. No. 548 of 2672) ,at subsection make up water system,52 Nos of ARVs are indicated. - Bidder understands that for twin pipe line { ~50 KM = 25 kmx2 } total 52 Nos of ARVs to be installed on both MUW pipes. Also number of ARV's shall be decided based on transient analysis only. - NTPC shall confirm the same.	Bidder to refer amendment A-WS-12
76	Part – B Section - VI Mechanical Sub Section- G-03 Layout requirements	1.01.02	1 of 13	"FFL of offsite buildings =500 mm above FGL of respective area"	In tender document Part – B,Section - VI, Mechanical, Sub Section- G-03 Layout requirements,Pg.No.2 of 15 (PDF No.1052 of 2672) at clause No.1.01.02 at point No.of (d) FFL for off site buildings is recommended to be 500 mm above FGL of respective area. - However in tender drawing No.4540-001-POC-A-012 , FFL for pumphouse is kept 1 meter above FGL. - Kindly check and advise on floor elevation.	Bidder to refer Amendment no. D-2
77	4540-001-POC-A-012 (Make-up water pump house plan & section)	-	-	Anchor requirements	In tender drawing, at both header portion and recirculation pipe lines bends are shown but anchors are not indicated. - Kindly clarify the requirements of anchors for bends (45 ,30, 22 and 11.5 degrees).	Bidder to refer Amendment no. D-2
78	Part – E section - VI Tender drawing No. 4540-001-POM-A-061	-	-	6 Nos of motorised isolation valves 	In Part – E section - VI Tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section) at pump discharge header , upstream and downstream of equipment, two Nos of motorised isolation valves are indicated. Three (3) of lines with total 6 nos of Motor operated valve are requested. - However in tender drawing Part – E, section - VI, Tender drawing No. 4540-001-POM-A-061 6 nos of MOV are not indicated. - Kindly check and clarify the discrepancy.	Bidder to refer Amendment no. D-2
79	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	Inlet channel cross section	In Part – E, section - VI, Tender drawing No. 4540-001-POC-A-012 (Make up water pump house plan & section),A cross section view at inlet channel shall be shown with details such as slope ,shape of channel (trapezoidal or square),retaining wall details,etc.,for better understanding.	Bidder to refer Amendment no. D-2
80	Part – E section - VI Tender drawing No. 4540-001-POC-A-007	-	-	Nos of MuW Pipes	In Part – E, section - VI, Tender drawing No. 4540-001-POC-A-007 (Layout and details of Raw water reservoir),At section view 5-5,MuW pipe OD diameter is indicated as 813 mm. - Bidder understands that Pipe can be sized based on the limiting velocity criteria as specified in the tender. - Kindly Confirm the understanding.	Bidder to refer Amendment no. D-2

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
81	Section – VI, Part – B Book 4 Of 5 – Civil Works, Sub-Section-D-1-9 Civil Works Architectural Concepts And Design	9.03.01 5.18.01.10	2 OF 31	"All buildings shall have minimum one toilet block each.....drainage and sanitation." Bio Toilet shall be opted for make up water facility area outside the plant boundary. Specifications of same shall be as mentioned elsewhere in technical specifications.	In the tender document, Section – VI, Part – B Book 4 Of 5 – Civil Works, Sub-Section-D-1-9 Civil Works Architectural Concepts And Design. No 2 of 31 (PDF Pg.No.187 of 649) at Clause No.9.03.01, it is indicated that all buildings shall have minimum one toilet block each. - In Technical specification section – VI, Part-B, sub-section-IID, Civil work, Pg. 07 of 13 (PDF Pg.No.735 of 2672) at Clause No.1.00.00, bio toilet block is requested only for the MCC cum control room. - Bidder understands that toilet block is not required for pump room as it is near by of control room where Toilet block is provided. - Kindly confirm.	Bidder to refer Amendment no. D-2
82	Technical specification section – VI, Part-B, sub-section-IID, Civil work	1.00.00	7 of 13	"MCC cum control room, foundation of all the transformers and associated transmission system including one Bio Toilet block"	In Technical specification section – VI, Part-B, sub-section-IID, Civil work, pg. 07 of 13 (PDF Pg.No.735 of 2672) at Clause No.1.00.00, bio toilet block is alone requested only for the MCC cum control room. - Bidder understand that dedicated sewage treatment system with aeration, dosing etc. is not required for the same. - Kindly confirm	Bidder to refer Amendment no. D-2
83	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	Desilting basin.	In Part – E section - VI Tender drawing No. 4540-001-POC-A-012 (Make-up water pump house plan & section), In notes No.7 it is indicated as "Desilting basin has to be constructed by bidder". However, Desilting basin is not shown in the drawings / layout and also not requested in the detail technical specification. - Desilting basin are normally envisaged for seawater intake systems due to high silt load. Since here intake system is near by barrage, siltation may be minimum and hence desiltation basin is not foreseen. Please confirm the bidders understanding.	Bidder to refer Amendment no. D-2
84	Part – B section - VI Sub-section-D-1-5 civil works Salient features and Design concept	5.18.01.02	56 OF 120	"All bays of MUWPH shall be provided with a removable trash rack including electrically operated hoisting arrangements and cleaning arrangements....."	In tender document Part – B, section - VI, Sub-section-D-1-5 civil works Salient features and Design concept, at clause No.5.18.01.02, Pg.No.66 OF 120 (PDF Pg. No 75 of 649), It is indicated to provide Cleaning arrangement for trash racks. - However in general engineering practice trash racks will be taken out of grooves using material handling system and kept on the floors then cleaning is done manually. - NTPC shall note the same.	Bidder to refer Amendment no. D-2
85	Part – B section - VI Sub-section-D-1-5 civil works Salient features and Design concept	5.18.01.02	56 OF 120	".....Moreover, one spare trash rack shall also be supplied for MUWPH. Steel embedment required for trash-racks shall be provided for all the bays.."	In tender document Part – B, section - VI, Sub-section-D-1-5 civil works Salient features and Design concept, at clause No.5.18.01.02, Pg.No.65 OF 120 (PDF Pg. No 75 of 649), It is indicated to provide one spare trash racks. - Trash rack is a set of multiple segmented and will be covered from invert level to Maximum water level. - for spare, Kindly clarify is it required to provide complete set { invert level to Max. W.L} or single segment of trash rack for spare.	Bidder to refer Amendment no. D-2

Sr. No.	Section / Part / Chapter / Volume	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
86	section-VI Part – A , Sub-Section – IIA-09 Scope of supply & services for MUW system	1.00.0	1 of 3	Requirement of sump model study	Bidder shall be follow HIS standards for sump & channel design and hence bidder will not perform sump model study. Bidder request owner to confirm.	Bidder to refer amendment A-WS-12
87	Part – E section - VI Tender drawing No. 4540-001-POC-A-013	-	-	Height between maximum water level and Bottom of steel beam	Part – E section - VI ,Tender drawing No.540-001-POC-A-013 ,Height between Maximum water level and Bottom of Bridge is not specified. - Request to kindly provide the same.	Bidder to refer Amendment no. D-2
88	tender drawing No.4540-001-POC-A-012				In tender drawing No.4540-001-POC-A-012 (Makeup water pump house plan and section) , Angle of floor slope is provided as 5 deg. However in plan view Angle of wall convergence at Forebay is not indicated. As per HIS standard this angle is recommended up to 10 degrees. Bidder understands that Wall convergence angle can be considered as per HIS recommendation. Please confirm.	Bidder to refer Amendment no. D-2

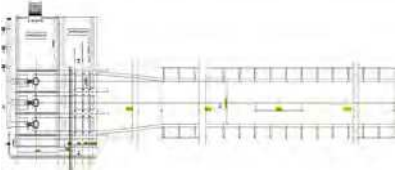
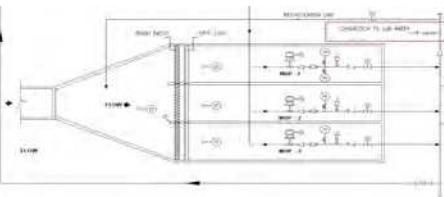
Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
89	Section-VI/Part-A		2 of 13	1.00.00	dismantling of existing railway siding (both inside and outside plant boundary) is also in the scope of the bidder.	a) Dismantling planning on below Rail track from Plant entry gate upto Track Hopper shall be in bidder's scope?. The same has not been shown in Annexure-P : Details of facilities to be dismantled. Please confirm. b)Owner to share the extent of dismantling of railway siding outside plant boundary. The same is not clear from the tender specification/drawing.	Bidder to refer Amendment No. D2
90	SECTION – VI, PART-A	D-1-1	2 of 13	1.00.00	In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline and external CHP corridor,	a) Bidder understands that dismantling of external CHP corridor shall be done only where required for laying ash pipeline. Else remaining overground and underground structures will not be dismantled if the same is not fouling with construction of ash pipeline. Please confirm Bidder's understanding. b) Also the ownership of dismantled item pertaining to CHP corridor shall be the property of Owner. Please confirm.	Bidder to refer Amendment No. D2
91	SECTION-VI / PART-A	/Sub-Section-IIA-09/Scope of supply & services for MUW system	2 of 3	2.00.01 - 1	Scope of services for laying of underground piping includes handling,..... draining and pumping out surface water (i.e. water other than water below ground water table),.....	Bidder understand that pumping of surface water, achieving dry working conditions as specified herein are specifically during execution time only if required. Please confirm.	Bidder to refer Amendment No. D2
92	SECTION-VI / PART-A	/Sub-Section-IIA-09/Scope of supply & services for MUW system	3 of 3	2.00.01- 5 (ix)	Bidder's/Contractor's scope for fabrication, erection, cleaning, flushing, blowing out, testing and commissioning of the piping systems shall include the following: ix) All temporary pipe work as required.	Bidder understand that this requirement is stated here only as construction requirement for temporary purpose (if any). Otherwise, no temporary pipe work is required. Please confirm.	Bidder to refer Amendment No. D2
93	SECTION-VI / PART-A	/Sub-Section-I /Intent of Specification	4 of 8	1.02.00	Solar PV Plants on Roof Tops	Bidder understand that this requirement is not applicable for Make up water Pump House (MUWPH), Make up water control building. Please confirm.	Bidder to refer Amendment No. D2

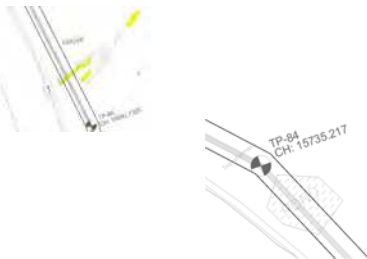
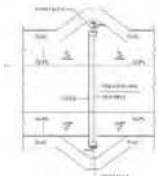
Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
94	SECTION-VI / PART-A	/Sub-Section-IID/Civil Works	7 of 13	1.00.00 19 (ii)	All civil, structural & architectural works associated with Makeup water system including: Intake structure in the river, RCC channel including desilting arrangement, forebay, sump, Stop-logs and Trash Racks, pump house for makeup water pumps including river bank protection .	Bidder understand that scope of work consists of RCC channel including desilting arrangement, forebay, sump, Stop-logs and Trash Racks, pump house for makeup water pumps including slope protection. No separate intake structure in river is needed as per the scope. Slope protection work shall be done around the made up area [FGL -RL(+)81.00m] dedicated for the pump house and MCC cum control room, the perimeter length of this protection will be approximately 300 m . Please confirm	Bidder to refer Amendment No. D2
95	SECTION-VI / PART-A	/Sub-Section-IID/Civil Works	8 of 13	1.00.00 19 (ix)	Boundary wall and gates and paving around all the facilities.	Bidder understand that these facilities are required only for make up water pump house building under Make up water system package as per Tender drg 4540-001-POC-A-011 Please confirm.	Bidder to refer Amendment No. D2
96	SECTION-VI / PART-E	TENDER DRAWINGS			4540-001-POC-A-010 (Sht 4) LAYOUT PLAN, L-SECTION AND CHAINAGE DETAILS FOR MAKE-UP WATER	Bidder understand that no intermediate support pier to be placed within canal between TP25 and TP26. Please confirm	Bidder to refer Amendment No. D2
97	SECTION – VI/ PART-E/	TENDER DRAWINGS			4540-001-POC-A-010 LAYOUT PLAN, L-SECTION AND CHAINAGE DETAILS FOR MAKE-UP WATER	a) Bidder request owner to kindly provide the canal cross sections for the following locations :-TP25 – TP26, TP47 – TP48, TP72 – TP73, TP104 – TP105, TP124 – TP125. b) Bidder request owner to confirm about the clearance distance required for foundation from the edge of the canal.	Bidder to refer Amendment No. D2
98	SECTION – VI/ PART-B/	CIVIL WORKS	85 of 120	5.18.06	As per technical requirement :- There are 4 no. road crossings (of PWD/R&B department) 1) TP 30 to TP 31, 2) TP 109 to TP 110, 3) TP 114 to TP 115, 4) TP 120 to 121, as mentioned in tender drawing no 4540-001-POC-A-010, shall be constructed by Bidder.	Bidder request owner to confirm whether hume pipe can be used for all the road crossings.	Bidder to refer Amendment No. D2

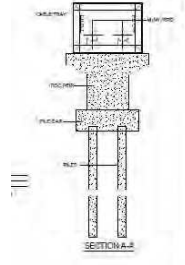
Sr. No.	Section / Part / Chapter / Volume	Sub Section	Page no.	Clause No.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
99	SECTION – VI/ PART-E/	TENDER DRAWINGS			4540-001-POC-A-010 LAYOUT PLAN, L-SECTION AND CHAINAGE DETAILS FOR MAKE-UP WATER	a. Bidder understand that Make up water pipe line route shown vide tender drawing number 4540-001-POC-A-010 will not change during detail engineering. Please confirm. b. Bidder understand that in case of any change in route of Make up water piping corridor with respect to the drawing provided in Tender document, the same shall be compensated to EPC contractor as per provisions of the Tender documents. Please confirm.	Bidder to refer Amendment No. D2

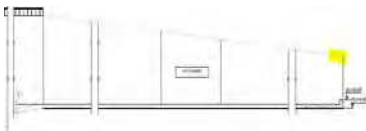
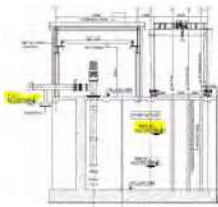
Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
100	SECTION – VI, PART-E, TENDER DRAWINGS SECTION – VI, PART-E TENDER DRAWINGS	- -	Drg.no. 4540-001-POE-J-001 Rev.A DWG. NO. 4540-001-POC-A-011, REV.A	- -	33kV Circuit Breaker Drawout type at MUWPH 33KV Switchgear room is shown at Make-Up water intake end.	1) Bidder understands that the 33kV Circuit Breaker is outdoor type, hence bidder will provide 33kV outdoor breaker panel at MUWPH end. Owner may please confirm. 2) If the 33kV Circuit breaker is Outdoor type, bidder understands that the 33kV Switchgear room is not required. Owner may please confirm. 3) If the 33kV Circuit breaker is Indoor type, bidder propose to place 33kV circuit breaker panel in HT switchgear room. Owner may please confirm.	Please refer amendment no B-31
101	SECTION – VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.16.02 (IV) & 1.16.05 (v)	10 of 17	33 kV Transmission Line of 28 Km length (approx.) with (2nos) Single Circuit towers (narrow based lattice towers with fully galvanised structure) from TTPS plant boundary to Make Up water pump house . The route is along the Make up water pipe corridor. EPC vendor shall optimize the corridor of MUW pipe and 33kV Transmission line in the width of the corridor.	The corridor for MUW pipe line along with transmission line is very narrow area and it is not feasible to place two towers along with pipe line, hence bidder proposes to use double circuit towers for 33kV Transmission line. Owner may please confirm.	Please refer amendment no. B-21 and B-22.
102	SECTION – VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.21.00	13 of 17	Transmission line to AWRS Pump house: Two number 11kV or 33kV single circuit transmission line on poles for supplying power from plant to AWRS pump house The overhead lines for AWRS Pump house shall generally be laid along the AWRS route. However, exact routing shall be decided during detailed engineering. Scope of work includes route survey for line, civil works, design, supply, erection and commissioning of poles.	The corridor for Overhead line from plant to AWRS pump house is very narrow as the corridor shall be occupied by other system/ equipment, hence bidder proposes to use the double circuit poles for overhead line . Owner may please confirm.	please refer amendment no. B-23.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
103	Sec-VI, Part-A,	Sub Section-IIA-16	14 of 18	1.03.01, h)	Thermal stress and transient analysis for the pipeline from mine void end pump house to ash water sump in the plant. Automatic air release valves (ARV) required for the complete piping system along with gate valves shall be provided as per recommendation of transient analysis study. Further based on thermal analysis, anchoring arrangement for the ash water recirculation pipe shall be provided wherever required. In addition to above compliance of all other recommendations of Thermal stress and transient analysis study shall be implemented by bidder.	Bidder understands that transient analysis for ash water recirculation pipe is not required. Kindly confirm Bidder's understanding.	Recirculation pipe from AWRS pump house to plant boundary shall not be under the scope of the package. Hence, Thermal stress & transient analysis for AWRS pipes is not applicable. Bidder to refer Amendment No-A-MH-44.
104	Sec-VI, Part-A,	Sub Section-IIA-16	14 of 18	1.03.01, h)	Thermal stress and transient analysis for the pipeline from mine void end pump house to ash water sump in the plant. Automatic air release valves (ARV) required for the complete piping system along with gate valves shall be provided as per recommendation of transient analysis study. Further based on thermal analysis, anchoring arrangement for the ash water recirculation pipe shall be provided wherever required. In addition to above compliance of all other recommendations of Thermal stress and transient analysis study shall be implemented by bidder.	Bidder understands that thermal stress for ash water recirculation pipe is not required as same having ambient temperature. Kindly confirm Bidder's understanding.	
105	Dwg No. 4540-001-POM-A-030, 4540-001-POM-A-031 Sec-VI, Part-A,	- Sub Section-IIA-16	- 13 of 18	- 1.03.01, C)	Six Barges are shown for Quarry no. 4. Two barges are shown as per drawing 4540-001-POM-A-031. Six (6) Nos (4W + 2S), Pontoon/ Barge floatable into Mine Void Pontoon/Barge shall be complete with all structural, electrical, instrumentation etc requirement.	Bidder understands that there shall be total Six (6) Nos (4W + 2S) Pontoon/ Barge pumps shall be in Bidder's scope. Kindly confirm Bidder's Understanding.	Barge mounted pumps shall not be under the scope of the Pkg. Bidder to refer Amendment No-A-MH-40.
106	Sec-VI, Part-B, Dwg No. 4540-001-POM-A-030	Sub Section-G-03 Dwg No. 4540-001-POM-A-030	12 of 16 -	1.02.00, 52) -	Bidder to route ash slurry pipe lines on pedestal and pipe culverts shall be provided at rail/road crossings. As per Y-Y section for few stretch, ash slurry piping area laid on steel structures.	There is ambiguities for laying of ash slurry piping from plant boundary to mine voids as per the stated tender clauses. Request Owner to revisit and provide clarity on ash pipe laying on rail/road crossings.	Ash slurry piping from plant boundary to mine void, shall not be scope under this Pkg. Bidder to refer revised Tender Drw. vide Amendment No-A-MH-56.
107	Dwg No. 4540-001-POM-A-030	-	-	-	Ash slurry pipe garlanding...	Bidder understands that the ash slurry piping shall be garlanded in the stretch as shown in Dwg No. 4540-001-POM-A-030 for quarry no. 4 only. Request Owner to confirm Bidder's understanding.	Ash slurry pipe garlanding shall not be scope under this Pkg. Bidder to refer revised Tender Drw. vide Amendment No-A-MH-56.
108	Sec-VI, Part-B,	Sub Section-A-01	88 of 101	4.01.02, I)	value of friction factor "C" for recirculation pipe is not mentioned.	In absence of input, request Owner to specify the value of friction factor "C" for recirculation pipe running from AWRS PH to plant area AWPB.	Recirculation pipe for AWRS pump house outside plant boundary shall not be under the scope of the package. Value of friction factor "C" may not be applicable.
109	Sec-VI, Part-B,	Sub Section-A-01	-	4.01.02	water quality for decanted water transferred from barge mounted pump to ash water recirculation pump house is not specified.	Request Owner to furnish the water quality (including suspended solids) of decanted water transferred from barge mounted pump to ash water recirculation pump house.	Please refer Amendment in this regard

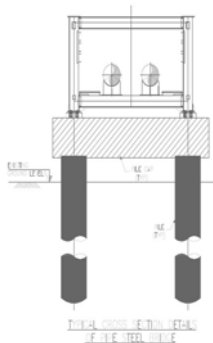
S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
110	4540-001-POC-A-012		PAGE 10 of 31		In 4540-001-POC-A-012 (Make-up water system and associated civil works package),  3 DIMENSIONS OF ALL BUILDINGS/ FACILITIES SHOWN HERE ARE MINIMUM DIMENSION ONLY. EXACT DETAILS SHALL BE FINALISED DURING DETAILED ENGINEERING STAGE.	Bidder understands that provided channel, forebay and sump and pump house dimensions are indicative only. Bidder can decide/ modify the channel, forebay, sump and pump house dimensions as per engineering requirements (i.e HIS standard, velocity criteria and layout requirement etc.). Owner to confirm.	Bidder to refer amnnendment A-WS-30
111	Part – E section - VI Tender drawing No. 4540-001-POC-A-061 (Scheme of makeup water system)		PAGE 62 of 73			Highlighted tapping for lube water is not required. connection for lube water is provided from MUW header to filters. Owner to check.	Bidder to refer amnnendment A-WS-30
112	TECHNICAL SPECIFICATION SECTION-VI, PART-B CIVIL WORKS TECHNICAL SPECIFICATION SECTION-VI, PART-B CIVIL WORKS	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	74 of 120 85 OF 120	5.18.02.02.05 5.18.06	"Route water pipe through NP-3/ NP-4 hume pipe culvert of internal diameter greater than 300mm of external diameter of water pipe by open-cut excavation and seal both ends of pipe with provision of vent pipes at cart road/ drain, local water body crossings and restore/ rectify cut roads, drain, Nalla, etc.." Make-Up Water Pipe Crossings At National Highway / State Highway / Railway Pipe crossing through culverts (Culverts to be constructed by owner) Pipe crossing through culverts (Culverts to be constructed by Bidder)	For Rail / Road crossing Hume pipe / box culverts / Encasing requirements are specified in different section of tender specification. However specific requirements are mention in (SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT, 85 OF 120, Clause no 5.18.06) - Bidder understands that clause No. 5.18.06 needs to followed . Kindly confirm .	Bldder to refer Amendment No. D2
113	TECHNICAL SPECIFICATIONS SECTION- VI, PART - B MECHANICAL	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA SUB-SECTION- A-9 (LOW PRESSURE PIPING)	69 of 101 2 of 19	3.11.00 1.13.00	Common Technical Requirement for systems like CW System, MuW,,,,,, Unless specifically mentioned, design criteria of Piping, Valves, rubber expansion, should be as per sub section LP Piping. "The recirculation pipe shall be sized for minimum 30%design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher"	As per tender specification / PID of make up water system, 2 Nos of pump will be working (2W+1S) and recirculation line is taken from the common discharge header. - Bidder understands that recirculation line needs to be sized for single pump minimum operational flow (30% design flow of single pump or pump manufacturer recommended minimum flow of single pump which ever is higher) - Kindly confirm bidder understanding.	For MuW system, bidder to refer amendment A-WS-25. For CW system, bidder to refer amendment A-WS-4

114	Part – E section - VI Tender drawing No. 4540-001-POC-A-010	-	-	-	 In tender drawing No. 4540-001-POC-A-013 for crossing nallah larger in size above ground steel bridge details are provided . - However In tender drawing.No.4540-001-POC-A-010 at layout plan between TP-85,CH:15892.574 and TP-86,CH:16080.7325 smaller nala crossing is indicated, details about nalla crossings are not provided. - a) For crossing of smaller nallah bidder understand that, hume pipe/pedestals can be considered for the Nallah width is less than free standing span of makeup water pipes. b)For pond crossing bidder request owner to provide the type of crossing required at near TP-84. -	Refer Amendment No. D2
115	Part – E section - VI Tender drawing No. 4540-001-POC-A-010	-	-	-	 In tender drawing.No.4540-001-POC-A-010 at layout plan between TP-129,CH:24369.654 and TP-130,CH:24744.959 RCC drain crossing is indicated. - For crossing of RCC drain bidder understand that, hume pipe/pedestal can be considered. otherwise kindly provide typical cross sectional details of RCC drain and pipe crossing.	Bldder to refer Amendment No. D2
116	Part – E section - VI Tender drawing No. 4540-001-POC-A-013	-	-	-	 Pipe bridge is crossing the peripheral road of canal . - Bottom of pipe to maximum water level requirement on the bridge is also specified in the Tender. - Considering the above , it is inferred that pipe bridge will hinder the movement of men and material. - Bidder suggest that road could be diverted locally. Request owner to review and confirm the same. 	Bldder to refer Amendment No. D2

117	Part – E section - VI Tender drawing No. 4540-001-POC-A-013					For section A-A no walkway has shown. Bidder understand that for Nallah crossings no walkway is required along with the pipelines. Please confirm.	Bldder to refer Amendment No. D2

118	Part – E section - VI Tender drawing No. 4540-001-POC-A-012	-	-	-		In tender drawing No. 4540-001-POC-A-012 at the beginning of inlet channel , channel invert level is indicated as RL (+) 69.500 M. - However Top of channel elevation is not indicated, Kindly specify the elevation requirements.	
119	TECHNICAL SPECIFICATION SECTION – VI PART-B MECHANICAL PART – E SECTION - VI TENDER DRAWING NO. 4540-001-POC-A-	SUB SECTION A-15 Annexure 2 Vertical Pump 1.00 Scope Make up & Raw water Pump	28 OF 31	9.00.00	"Maximum Water Level in sump = As per system requirement (Min 0.2 m below FGL)" 	In tender document it is indicated that maximum water level from finished ground level shall be minimum 0.2 m. (Max water level = FGL -0.2= RL (+) 81 - 0.2 = RL (+)80.80 M) - In tender drawing maximum water level is indicated as RL (+) 76.20 M. - since different values are indicated , please confirm the maximum water level to be considered.	Bidder to refer Amendment No. D2
120	TECHNICAL SPECIFICATIONS FOR EPC PACKAGE SECTION VI –Part – A	SUB SECTION– IIA-09 SCOPE OF SUPPLY & SERVICES FOR MUW SYSTEM	2 OF 3	2.00.01	"Scope for services for underground as well as over ground piping also include all crossing like existing pipe line/ cable , utility lines, roads, nallah...."	In tender document ,It is indicated that make up water piping has to cross Existing pipe line and cables. - However in tender layout it is inferred that such an existing pipe lines/cables are not available - If existing pipes / cables needs to be crossed , kindly provide the locations and details.	Bidder to refer amendment A-WS-12
121	TECHNICAL SPECIFICATION SECTION – VI PART-B MECHANICAL	SUB SECTION-A-01 EQUIPMENT SIZING CRITERIA	68 OF 101	3.10.00	"Minimum Corrosion allowance of 2 mm."	It could be noted that make up water piping is envisaged with 3LPE coating as primary protection & followed by secondary cathodic protection system. Further 1.6 mm corrosion allowance is being followed for earlier executed NTPC projects such as NABINAGAR , TELANGNA projects. Considering the above we suggest 1.6mm corrosion allowance , request NTPC to kindly review and confirm.	Bidder to refer amendment A-WS-24
122	TECHNICAL SPECIFICATION SECTION – VI PART-B (BOOK 4 OF 5 – CIVIL WORKS) PART – E SECTION - VI TENDER DRAWING NO. 4540-001-POC-A-	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	68 OF 101	3.10.00	".....For other water body crossings, such as local Nallah / canal,local water bodies, local drains etc. suitable structural arrangement with 800 mm wide walkway shall be provided....." 8. BRIDGE AND IN THE SCOPE OF BRIDGE WHENEVER BRIDGE IS REQUIRED TO CROSS OVER THE EXISTING STRUCTURE, THE BRIDGE SHALL BE NOT IN THE SCOPE OF BRIDGE. 9. ANY ADDITIONAL PROTECTION SUBJECT TO THE EXISTING STRUCTURE FACILITY AS REQUIRED BY THE CONCERNED AUTHORITY SHALL BE CARRIED OUT BY BIDDER. FURTHER ANY DAMAGE/ MODIFICATION TO EXISTING STRUCTURE FACILITY SHALL BE RESTORED BY BIDDER TO THE FULL SATISFACTION OF CONCERNED AUTHORITY. 10. OBTAINING ALL NECESSARY APPROVALS FROM THE CONCERNED AUTHORITIES FOR EXECUTION OF STRUCTURAL STEEL BRIDGE INCLUDING PLANS AND WORKS IS IN SCOPE OF BIDDER. 11. CLEAR HEIGHT OF MINIMUM 2.0M AND WIDTH OF MINIMUM 0.8M SHALL BE PROVIDED ON BOTH SIDE.	for above ground trestle, In tender document it is indicated to provide 800mm one side walkway. - However in tender drawing it is indicated to provide 600 mm walkway at both side of pipes. - since different values are indicated , Kindly confirm walkway requirements for canal.	Bidder to refer Amendment No. D2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
123	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.00.00	Right of use (ROU) permission for make-up water corridor shall be available after 8 months from NOA.	a) Considering the overall project timelines, Bidder request Owner to provide Right of use (ROU) permission for make-up water corridor on or before the date of NOA. b) Bidder understands that make up water corridor includes only Intake pipeline route and Transmission line route, hence land for Make up water pump house & Channel, electrical control bldg etc. will be available on or before NOA. Please confirm.	Bidder to refer Amnendment No. D2
124	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.04.00	Railways siding land shall be available after 12 months form NOA.	Considering the overall project timelines, Bidder request Owner to provide Railway Siding Land on or before the date of NOA.	Bidder to refer Amnendment No. D2
125	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.05.00	The area will be handed over as is & where is basis.	a) Bidder understands that dismantling of any existing underground and overground facilities within the railway siding land are excluded from Bidder's scope of work. Please confirm. b) Also in case forest land is encountered, uprooting of trees including necessary permission from statutory authorities are excluded from Bidder's scope of work. Please confirm.	Bidder to refer Amnendment No. D2
126	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.00.00	Right of use (ROU) permission for make-up water corridor shall be available after 8 months from NOA.	a) Bidder understands that dismantling of any existing underground and overground facilities along the make up water pipeline route and intake pump house area are excluded from Bidder's scope of work. Please confirm. b) Also in case forest land is encountered, uprooting of trees including necessary permission from statutory authorities are excluded from Bidder's scope of work. Please confirm.	Bidder to refer Amnendment No. D2
127	Section VI, Part E, Tender drawing				General Layout of MUW System Drag No. 4540-001-POC-A-009	Bidder understands that the channel and other (forebay, pumphouse etc.) location furnished in the tender drawing are based on Owner's survey and relevant studies. Therefore Bidder do not envisage any change in the same. Please confirm Bidder's understanding.	Bidder to refer Amnendment No. D2
128	Section-VI/Part-A	SUB-SECTION-IID	9 of 13	1.00.00,34 a	The FSR (Feasibility Site Report) attached at Annexure D-1-12(N) is for bidding /reference purpose only. As it is in the process of approval from Indian Railways, the work shall be executed as per the Indian Railway Standards. Executing agency has to prepare the DPR, ESP,SIP & Other necessary drawings and get the approval from Indian Railways.	Bidder understands that approval of FSR from Indian Railways shall be included in Owner's scope of work. Please confirm.	Bidder to refer Amnendment No. D2
129	Section-VI/Part-A	SUB-SECTION-IID	9 of 13 10 of 13	1.00.00,34 b	Above scope of work is not limiting and any increase in the scope with respect to that mentioned in FSR will be compensated as below:-	Railway Siding work - Bidder understands that for compensation purpose during detail engineering, change in scope shall be measured with respect to the Bid stage Feasibility Site Report (FSR). Please confirm acceptance.	Bidder to refer Amnendment No. D2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
130	SECTION – VI/ PART-B/	SUB-SECTION-D- 1-5 CIVIL WORKS	84 OF 120	5.18.05	Structural Steel Bridges For Make-Up Water Pipes Crossing At Irrigation Canal/Nallah/ Samal Barrage Reservoir Submergence Area	In case of outdoor walkway for steel bridges, Kindly confirm whether chequered plates or gratings should be provided for walkways.	Bidder to refer Amnendment No. D2
131	SECTION – VI/ PART-B/	SUB-SECTION-D- 1-5 CIVIL WORKS	84 OF 120	5.18.05	Structural Steel Bridges For Make-Up Water Pipes Crossing At Irrigation Canal/ Nallah/ Samal Barrage Reservoir Submergence Area :- The entire deck shall be supported on piers. The piers shall be supported on piles and pile cap.	Kindly confirm whether this substructure arrangement i.e. pile cap supported on piles (if required) can be provided for the mentioned locations. 	Bidder to refer Amnendment No. D2
132	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.00.00	Right of use (ROU) permission for make-up water corridor shall be available after 8 months from NOA.	Bidder understands the soil investigation, topographic survey, bathymetry survey etc. shall be allowed from date of NOA. Please confirm.	Bidder to refer Amnendment No. D2
133	Section-VI/Part-A	SUB-SECTION-III	3 of 3	5.04.00	Railways siding land shall be available after 12 months form NOA.	Bidder understands the soil investigation, topographic survey etc. shall be allowed from date of NOA. Please confirm.	Bidder to refer Amnendment No. D2

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
134	SECTION – VI, PART-E	Dwg. No. 4540-001-POE-J-001, Rev.A	Note-4	1	One complete 400kV GIS dia (Line-III-tie-Line-IV) along with associated GIS duct, AIS equipment, termination cable, cabling, Control & Protection and metering, Civil works etc. complete in all respect as per SLD and technical specification shall be quoted separately in price schedule.	(1) Bidder understand that the complete 400kV GIS dia (Line-III-tie-Line-IV) to be offered as optional and not considered in base offer. (2) Bidder understand that, space for complete 400kV GIS dia (Line-III-tie-Line-IV) in GIS building and space for related control panels in Switchyard control building to be kept in line with clause 1.01.07, Subsection-B-17, Part-B, Sec-VI. Owner may please confirm.	1. Bidder's understanding is not correct. Bidder to consider price of complete 400KV GIS dia (Line -III- Tie-Line-IV) also in base offer. 2. Bidder's understanding is not correct. space for Future bay provision at one end shall be considered after Line #3 -tie- Line#4 bay in line with clause 1.01.07 of Chp B-17, Part-B, Sec-VI. Note-4 is deleted in amendment. Please refer amendmenrt no. B-31

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
135	Section VI/ Part-A	Section VI/ Part-A/ Sub section- IIA-16	13 of 18	1.03.01	Each Pontoon/Barge shall be capable to float & back upto a distance of 100 m from bank of the Quarry in a Mechanized way, controlled from the bank.	Pontoon / barge movement distance from bank of the quarry shall be inline with Pontoon / barge OEM requirement. Kindly confirm acceptance.	Shall not be under scope of the Package
136	Section VI/ Part-A	Sub section- IIA-16	14 of 18	1.03.01	Two numbers of Dewatering Pump header shall be provided all around the Mine Void Quarry.	Bidder proposes to consider 1 no Pontoon / barge mounted flow for sizing of each header all around the mine void quarry. Please confirm acceptance.	Shall not be under scope of the Package
137	Section VI/ Part-A	Sub section- IIA-16	14 of 18	1.03.01	Two numbers of Dewatering Pump header shall be provided all around the Mine Void Quarry.	Ash Slurry line garlanding is envisaged as indicated by NTPC in Tender drawings. However, Dewatering pump header to be provided all around the mine void quarry. Owner to please clarify scope of road all around mine void quarry.	Shall not be under scope of the Package
138	SECTION-VI / PART-A SECTION-VI / PART-B		2 of 18 32 of 40	1.01.04 6.00.00	(f) Ash water recirculation system for recycling ash water from Mine Void The proposed Ash Water Recovery system shall recycle the decanted water from overflow lagoon/Mine void to ash water pump house	Requests Owner to provide the collected Ash water quality of Ash pond water to decide further treatment.	Shall not be under scope of the Package
139	Section VI/ Part-A	Sub section- IID	2 of 13	1.00.00	In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline and external CHP corridor, dismantling of existing railway siding (both inside and outside plant boundary) is also in the scope of the bidder	1. Dismantling of Existing facility at mine end for external CHP is not considered in Bidder scope. 2. Only those facility will be dismantled which are fouling with Stage-III Ash slurry line corridor. 3. Dismantling of facility / area for Ash pipeline corridor inside plant boundary passing through existing Stage-I and Stage-II facility, is not in bidder scope. 4. Any existing Railway crossing, road crossing, UG facility can be reused by bidder after strengthening of the same.	Bidder to refer Amnedment No. D2
140	Section VI/ Part-A	Sub section- IID	2 of 13	1.00.00	In addition to above, dismantling of existing structures (both below ground and above ground) in ash pipeline and external CHP corridor, dismantling of existing railway siding (both inside and outside plant boundary) is also in the scope of the bidder	1. Owner to please provide mark up for dismantling scope of railway siding of inside and outside plant boundary.	Bidder to refer Amnedment No. D2

Sr. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
141	Section VI/ Part-A	Sub section- IID	2 of 13	1.00.00	Under-ground MUW Pipe Line inlet line from Plant Boundary upto Stage- II Raw water reservoir	1. Bidder understand that tap off point from Stage-II make up water line to stage-III raw water reservoir is to be taken during initial operation till ready ness of stage-III make up water line. Please confirm bidder understanding. 2. Further, owner is requested to please provide following information for tapping point from stage-II make up water line 1. Location 2. Flow & pressure 3. Terminal point pipe MOC details	1. Bidder to refer Amnedment No. D2 2. To be dealt during detailed engineering

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
142	Section VI- Part A	Sub-Section-III, Terminal points and exclusions and Owner's input	1 of 3	1.03.00	Ash handling system : Employers' cross-country conveyor shall be routed along the Ash slurry disposal corridor from plant end towards mine void where corridor space is limited. Bidder has to ensure that there shall not be any hindrance due to Ash slurry & AWRS corridor for supporting structures of Employers' pipe Conveyor. Employers' pipe conveyor may be taken-up in parallel or in near future.	Bidder requests Owner to provide clear space required for Owner's cross-country pipe conveyor along Ash slurry & AWRS corridor.	Ash slurry corridor outside plant boundary shall not be under scope of the Pkg.

Sl. No	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification								
143	VI/PART-B	SUB-SECTION-D-1-7	7.02.02 (h)	3 of 12	During design the Allowable Bearing Pressure shall be adopted after approval of geotechnical investigation report. However, the maximum allowable bearing pressure shall be lower of the two values i.e. as per approved geotechnical report and as per the values furnished in Table-1.	Bidder shall consider the safe bearing pressure & Pile capacity with respect to the approved geotechnical investigation report to be conducted during detailed engineering only. Please confirm	Bidder to refer Amendment No. D2								
144	VI/PART-B	SUB-SECTION-D-1-7	7.10.00 (a)- 11	10 & 11 of 12	<table><tr><td>11</td><td>Coal, Limestone and Gypsum Handling System</td><td>Minimum one borehole under each TP and one under each crusher and one borehole under each structure. Minimum 5 no of under each stockpile area, 12 nos in Limestone and Gypsum handling area, 8 nos in Track & Truck Hopper area and 8 Nos of ERT</td><td>20 to 30 m</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	11	Coal, Limestone and Gypsum Handling System	Minimum one borehole under each TP and one under each crusher and one borehole under each structure. Minimum 5 no of under each stockpile area, 12 nos in Limestone and Gypsum handling area, 8 nos in Track & Truck Hopper area and 8 Nos of ERT	20 to 30 m					Bidder requests to consider the following number of boreholes. 1) Coal handling system : One (01) borehole under each TP One (01) borehole under each crusher house One (01) borehole for every 50 m length of conveyor One (01) borehole for every 50 m length of Tunnel Minimum Three (03) boreholes in each stock pile area 2) Lime Stone handling area : One (01) borehole for Ramp One (01) borehole for BRU station One (01) borehole for BRU building One (01) boreholes for Crusher House One (01) borehole for Conveyor One (01) borehole for Ball Mill Building One (01) borehole for Limestone Storage Silo 3) Gypsum Handling area : One (01) borehole for Gypsum Dewatering Building One (01) borehole for Gypsum Storage Shed 4) Minimum Six (06) boreholes for track hopper and truck tippler area 5) Minimum eight (08) numbers ERT	Bidder to refer Amendment No. D2
11	Coal, Limestone and Gypsum Handling System	Minimum one borehole under each TP and one under each crusher and one borehole under each structure. Minimum 5 no of under each stockpile area, 12 nos in Limestone and Gypsum handling area, 8 nos in Track & Truck Hopper area and 8 Nos of ERT	20 to 30 m												

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
145	SECTION VI / PART E/ Tender Drawings				4540-001-POC-A-010 (sht-1 of 23)	Further to Query no. 312, vide Lot 2, Bidder requests Owner to review FGL (81 m) for Make up water pipeline as the NGLs are quite lower (78 m) and substantial quantity of borrowed earth will be required to match given FGL. Bidder requests Owner to review the FGL requirement.	Bidder to refer Amnedment D2
146	SECTION VI / PART E/ Tender Drawings				4540-001-POC-A-013, Rev A PIPE BRIDGE CROSSING AT IRRIGATION CANAL , NALLAH & RESERVOIR SUBMERGENCE AREA	Owner is requested to allow intermediate support inside the existing channel for the pipe bridge structure supporting make up water pipes. Please confirm.	Bidder to refer Amnedment D2
147	SECTION VI / PART E/ Tender Drawings				Drg No. 4540-001-POM-A-041 Cross Country Coal conveyor routing from NTPC plant to coal mine area	Ash pipe layout corridor shall be followed as per tender document. It is understood that remaining space, if available, shall be utilized by Owner for future Pipe conveyors. Bidder shall not undertake conceptual or detail design of foundation for future Pipe conveyors. Please confirm.	Bidder to refer Amendment No A-MH-1
148	SECTION VI / PART E/ Tender Drawings				Drg No. 4540-001-POM-A-030, Rev No. A Proposed routing of ash disposal & AWRS piping and associated facilities	a) Bidder understands that tree cutting (girth more than 30 cm) required for laying garlanding pipes around mine void is excluded from Bidder's scope of work. b) Bidder understands that alignment of proposed inspection road surrounding the mine void shall be constructed above the existing motorable road available along the mine void. Please confirm.	Bidder to refer Amnedment D2
149	SECTION VI / PART E/ Tender Drawings				Drg No. 4540-001-POM-A-030, Rev No. A Proposed routing of ash disposal & AWRS piping and associated facilities Existing rail crossing (tentative)	a) Bidder requests Owner to specify the coordinates of crossings (Railway/Road etc.) envisaged at MCL coal mine area. b) Also necessary shut down shall be taken by Owner for executing civil works in MCL crossing, if required. Please confirm. c) Permission for working within the MCL area shall be Owner's responsibility. Please confirm.	Bidder to refer Amnedment D2
150	SECTION VI / PART E/ Tender Drawings Section VI, Part B	D-1-5	36 of 120	5.05.07	Drg No. 4540-001-POM-A-030, Rev No. A Proposed routing of ash disposal & AWRS piping and associated facilities Single lane maintenance / Inspection road with 1.5m wide shoulders on both sides of the road shall be provided along the entire route of the ash slurry pipeline & recovery pipe line from plant boundary wall to the mine voids along ash pipelines including road for garlanding. Required levelling and grading for ash pipe corridor road shall be provided such that longitudinal slope of road shall not more than 1:30 at any stretch of the road.	a) During the site visit, it was observed that an existing road is already available along the ash pipeline corridor, hence new road will be constructed over the top surface of existing road. Dismantling of existing road is not envisaged. Please confirm. b) Due to limited space availability in majority of the stretch and in order to keep all bidders at par, construction of open drains on either side of the road is not possible and hence the same to be excluded from EPC scope of work. Please confirm.	Bidder to refer Amnedment D2
151	SECTION-VI, PART-B	D-1-5	74 of 120	5.18.02.02.02	The tender drawing provides a general idea about the work to be performed under the scope of this contract. These are preliminary drawings for bidding purposes only and are by no means the final drawing or show the full range of the work under the scope. Work has to be executed according to the drawings prepared by the Bidder and approved by Engineer	Owner is requested to share the document wherein the suitability for the type of intake system is mentioned.	Bidder to refer Amnedment D2
152	SECTION-VI, PART-B	D-1-5	84 of 120	5.18.05	In certain stretches of the pipeline corridor along the irrigation canal, pipes will have to be laid along the slope of the embankment due to space constraints. In such cases, suitable retaining wall shall be provided on the downstream side of canal embankment to retain the pipelines as well as overburden fill above pipelines. In no case, pipelines shall be laid by excavation/cutting the embankment slope	a) While undertaking excavation for retaining wall (including its foundation) and pipeline trench in slope portion, majority of the embankment fill will be disturbed which will require construction of entire embankment from scratch. Hence, alternatively EPC Contractor shall excavate the top part of embankment to the extent required for laying of pipes without disturbing the existing slope profile and subsequently the embankment top surface will be restored as per original. Please confirm. b) Owner is requested to share the layout profile drawing for existing channel and embankment.	Bidder to refer Amnedment D2

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
153	SECTION-VI, PART-B	D-1-5	73 of 120	5.18.02.01.02	The contractor is required to perform his construction activity within the width of acquired land set aside for erection of pipeline or within the Right-of-way area as decided by the Owner.	a) Bidder understands that Right of way for the additional land which will be required for construction activity i.e. for approaching pipeline corridor, temporary laydown area etc. shall be made available by Owner. Please confirm. b) Also forest clearance and tree cutting within the additional area which will be required for approaching pipeline corridor shall be Owner's responsibility. Please confirm.	Bidder to refer Amnedment D2
154	SECTION VI / PART E/ Tender Drawings				Drg No. 4540-001-POC-A-012, Rev No. A Make up water pump house Plan & Section Notes: Dimension of all buildings/facilities shown here are minimum dimension only. Exact details shall be finalized during detail engineering stage.	Bidder understands that the intake channel dimension and invert level mentioned in the tender drawing will remain unchanged as the same has been finalized by Owner based on site investigation and feasibility studies. Please confirm or else clarify Owner's requirement.	Bidder to refer Amnedment D2
155	SECTION-VI, PART-B	D-1-5	35 of 120	5.05.04	The finished floor level (FFL) of Ash Water Recirculation (AWR) pump house complex shall be 500 mm above FGL. However, in order to facilitate approach/connection to the road on top of mine void with AWR pump house complex, if required FGL may be fixed at higher level than 1.5 m above HFL.	Owner is requested to specify the FGL to be considered for Ash water recirculation pump house.	Bidder to refer Amnedment D2
156	General				compound wall along ash slurry corridor is existing.	During site visit, it was observed that there is an existing compound wall along the ash pipeline corridor. Bidder understands that Demolition, Refurbishment and/or reconstruction of this compound wall is not required and excluded from EPC scope of work. Please confirm bidder understanding.	Bidder to refer Amnedment D2
157	Part E Tender drawings					Owner is requested to provide HFL to be considered at canal location where Stage III ash slurry pipe line is crossing.	Bidder to refer Amnedment D2
158	Section VI/ Part-A	Sub section-III	3 of 3	5.04.00	Railways siding land shall be available after 12 months form NOA.	Owner is requested to please mark up on GLP which land for railway siding shall be available after 12 month.	The land outside the plant bounday is under the process of approval of ECR and shall be intimated in due course of time. The land inside the plant boundary is alreay shown in GLP.

Sr. No.	Section / Part / Chapter / Volume	Sub-section	Clause No.	Page no.	Bid Specification Stipulation	Statement of Prebid Queries & Clarification	Owner's Reply
159	SECTION-VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.15.00	7 of 17	Construction power supply network, within the plant , is a temporary arrangement which shall be used during the project construction phase.	Owner may please confirm that, Bidder is allowed to extend the construction power supply from plant area to proposed laydown area for providing electrical power in laydown area.	Please refer amendment no.B-32. in this regards. for locations outside the plant boundary Bidder shall make separate arrangement of suitable capacity as necessary for meeting construction power requirement.
160	SECTION-VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.15.00	7 of 17	To meet the construction power requirement of the project, the Employer shall provide Two (02) number 6.6 kV sources through two number 220/6.9kV transformers Supply, erection, testing and commissioning of overhead lines ring mains, single pole /double pole/ four pole structures with switches, fuse, lightening arrestors, LT transformers, 415V switchboards, power and control cables, DC Systems etc. as required for further distribution for meeting the construction power requirements, shall be in the bidder's scope.	(1) Owner is requested to provide preliminary route survey for laying Construction power line from plant boundary to proposed laydown area. (2) Bidder understands that, Owner will provide ROW for laying Construction power line from plant boundary to laydown area.	Please refer amendment no. B-32 in this regards. for locations outside the plant boundary Bidder shall make separate arrangement of suitable capacity as necessary for meeting construction power requirement.
161	SECTION – VI, PART-A	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	1.16.02 (IV) & 1.16.05 (v)	10 of 17	33 kV Transmission Line of 28 Km length (approx.) with (2nos) Single Circuit towers (narrow based lattice towers with fully galvanised structure) from TTPS plant boundary to Make Up water pump house . The route is along the Make up water pipe corridor. EPC vendor shall optimize the corridor of MUW pipe and 33kV Transmission line in the width of the corridor.	Bidder has visited site and observed that the proposed route for transmission line mostly falls along the embankment of adjacent canal. There are various encroachment along the route and at certain places the width of route is very narrow. It is not feasible to place two towers along with pipe line within the available route, hence bidder proposes to use double circuit towers for 33kV Transmission line. Owner may please confirm.	Please refer amendment no. B21 and B-22.

S. No.	Sec/Part	Sub Sec	Page No.	Clause No.	Specification Requirement	Bidder's Query	NTPC's Clarification
162	TECHNICAL SPECIFICATIONS SECTION-VI, Part-A	SUB-SECTION-IIA-16 ASH HANDLING SYSTEM	PAGE 11 of 18	1.01.08, 'ii.	Four (04) lengths of combined ash slurry disposal MS pipe lines from combined ash slurry pumps up to Mine Void including garlanding at mine end and extensions into the mine void at number of discharge points complete with basalt lined pipe bends,	Bidder understands that any work related to existing mine void are excluded from Bidder's scope of work. Please confirm Bidder's understanding.	Bidder to refer Amendment D2
163	General					Owner is requested to provide the quality of water available at Quarry 4.	Quality of water (as of now) at Quarry No 4 has been provided in Amendmnet No. 1 in A-MH (Page No. 20 Of 123).
164	Section VI/ Part-A/ Sub section-III	3 of 3	3 of 3	5.10.00	Stage-III Rreservoir and PT Plant to be made ready before dismantling of existing stage-II reservoir and PT Plant.	Owner is requested to please clarify the scope and source of Power supply for Stage-III Raw water pumps and PT plant during initial operation.	Please refer amendment no B-34.
165	Section VI/ Part-E /	4540-001-POC-A-013			PIPE BRIDGE CROSSING AT IRRIGATION CANAL, NALLAH & RESERVOIR SUBMERGENCE AREA	Owner is requested to please provide following details. 1. Maximum water level at canal crossing 2. Maximum water level at Nallah Crossing	Bidder to refer Amendment D2
166	Section VI/ Part-B/ Sub section- D-1-5		5.18.06	85 of 120	There are two railway crossings (TP 132 to TP133 and TP 24 to TP25), one no. road crossing (TP 35 to TP 36), and one no NH Crossing (TP 101 to 102), as mentioned in tender drawing no 4540-001-POC-A-010) for which culverts (Box culvert/pipe culvert) will be constructed bythe owner, However, pipe line laying along with associated RCC pedestal/thrust block and RCC pits at entry/ exit points shall be in bidder's scope	Bidder understand that at railway crossing culvert (which are in Owner scope), cable also shall be laid through culvert along with piping. Please confirm bidder under standing.	Bidder to refer Amendment D2
167	Section VI/ Part-E /	4540-001-POC-A-013			PIPE BRIDGE CROSSING AT IRRIGATION CANAL, NALLAH & RESERVOIR SUBMERGENCE AREA Note 11 : CLEAR HEIGHT OF MINIMUM 2.5M AND WALKWAY OF MINIMUM 0.6M SHALL BE PROVIDED ON BOTH SIDE.	Bidder understands that this shall be applicable for pipe bridge and steel bridge along reservoir submergence area.	Bidder to refer Amendment D2
168	Section VI/ Part-E /	4540-001-POC-A-014			MUW PIPELINE ROUTING BELOW NH,SH & RAILWAY CROSSING TYPICAL SECTION WHERE PIPE CROSSING THROUGH HUME PIPE	Bidder understands that two nos. 200 dia Hume pipe with RCC encasement indicated on both side of Hume pipe of MuW pipe is for Cable routine. Please confirm Bidder understanding. Further, no of hume pipe for cable routine shall be provided based on requirement by bidder. Please confirm bidder understanding.	Bidder to refer Amendment D2
169	Section VI/ Part-B	D-1-12 (I)	1 of 4	1.0.0	This section covers general guidelines and activities to be undertaken by the EPC contractor for using abandoned ash dyke as a Lay down area. An area of 70 acre (approx.) (16 Acres + 24 Acres +30 Acres) indicated in Annexure-J as Area 'A', 'B' & 'C' has been identified for this purpose.	Bidder requests Owner to allow alternative laydown area within 20 km radius from plant boundary with proper fencing & security to avail the payment linked with "receipt" of material/ equipment under Supply contracts. Please confirm	Bidder to refer Amendment no. D1-36 and D1-37. The MRC Payment can be done for alternate location of Laydown area, subject to endorsement of CISF and physical verification of materials by concerned department/EIC.



**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
WORKS FOR TALCHER THERMAL
POWER PROJECT STAGE-III: 2X660MW**

SPECIFICATION NO. PE-TS-497-600-C001

VOLUME - II B

SECTION - D | SUB-SECTION

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SHEET 1 OF 4

NTPC LIMITED

**TALCHER THERMAL POWER PROJECT STAGE -III:
2x660 MW PROJECT
TALCHER, ODISHA**

VOLUME: II B

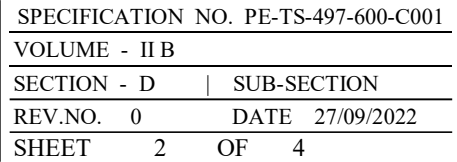
SECTION - D

STANDARD SPECIFICATION

SPECIFICATION NO. PE-TS-999-600-C001



**Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301**





**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
WORKS FOR TALCHER THERMAL
POWER PROJECT STAGE-III: 2X660MW**

SPECIFICATION NO. PE-TS-497-600-C001

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C O N T E N T

SUB-SECTION

DESCRIPTION

D1	Earthwork in excavation and backfilling
D2	Cement concrete (Plain and reinforced) and formwork
D3	Carpentry and joinery
D4	Roof and underground structures water proofing, insulation and allied works
D5	Metal doors, windows, ventilators, louvers etc.
D6	Glass and Glazing
D7	Rolling Steel Shutter and Grills
D8	Miscellaneous Metal
D9	Masonry and allied works
D10	Finish to masonry and concrete
D11	Painting, Whitewashing, polishing
D12	Floor finish and allied works
D13	Sheet work in roof and siding
D14	Suspended ceiling
D15	Water supply, drainage & sanitation
D16	Road & drainage
D17	Fabrication of structural steelwork
D18	Erection of structural steelwork
D19	Roof decking
D20	False flooring
D21	Bored cast-in-situ RCC piles
D22	Site levelling & grading works
D23	Anti-termite treatment



**TECHNICAL REQUIREMENT FOR CIVIL,
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GENERAL

Section C & Section D of this specification cover design, preparation of general arrangement drawings, construction and fabrication drawings, supply of materials and construction of all civil, structural and architectural works.

Section-C covers specific technical & functional requirements of contract and should be read in conjunction with BOQ, Section-D and other sections of the contract. In case of any conflict between the contents of BOQ and Section-C, BOQ will prevail over Section-C. In case of any conflict between Section-C and Section-D, Section-C will prevail over Section-D. Further contract document and clarifications given by BHEL to Bidder will prevail over Section C and D in case of any conflict. During the detailed engineering if there is some change in requirements, which is agreed by customer, consultant and BHEL, the same shall prevail over all.



TITLE:
**TECHNICAL SPECIFICATION FOR
EARTHWORK IN EXCAVATION AND
BACKFILLING**

SPECIFICATION NO. PE-TS-999-600-C001			
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VOLUME: II B

SECTION - D

SUB-SECTION – D1

EARTHWORK IN EXCAVATION AND BACKFILLING

SPECIFICATION NO. PE-TS-999-600-C001



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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C O N T E N T

CLAUSE NO.	DESCRIPTION	SHEET NO.
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2.00.00	GENERAL	3
3.00.00	EXECUTION	6
4.00.00	TESTING AND ACCEPTANCE CRITERIA	19
5.00.00	RATES AND MEASUREMENTS	19
6.00.00	INFORMATION TO BE SUBMITTED BY THE BIDDER	20



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**STANDARD TECHNICAL SPECIFICATION FOR EARTHWORK IN
EXCAVATION AND BACKFILLING**

1.0.0 SCOPE

This specification covers earth work excavation in all types of soil, soft rock and hard rock including setting out, clearing and grubbing, shoring, dewatering, back filling around foundations/pipelines to grade, watering, compaction of fills, testing, approaches, disposal of surplus earth, protective fencing, lighting etc relevant to the structures and locations covered under this contract.

2.0.0 GENERAL

2.1.0 Work to be provided for by the Contractor

The work to be provided for by the contractor unless specified otherwise shall include but not be limited to the following.

a) Supplying and providing all labour, supervision services, earth moving machineries, surveying instruments including facilities as required under statutory labour regulations, materials, scaffolds, equipment, tools and plants, transportation, etc. required for the work.

b) Preparation and submission of working drawings showing the approaches, slopes, berms, shoring, sumps for dewatering including drainage, space for temporary stacking of soils, disposal area, fencing etc and all other details as may be required by the engineer.

c) To carry tests and submit to the Engineer, test results of fill materials and degree of soil compaction of fill whenever required by the Engineer to assess the quality of fill.

d) Design, construction and maintenance of Magazine of proper capacity for storage of explosives for blasting work and removal of the same after completion of the work etc. including procurement of necessary licenses from proper authorities.

2.2.0 Work to be provided by others

No work under this specification will be provided by any agency other than the contractor unless specifically mentioned elsewhere in the contract.



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**TECHNICAL SPECIFICATION FOR
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2.3.0 Codes and Standards

All works shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes unless specified otherwise.

IS-1200	Method of measurement of building and civil engineering works, Part-I: Earthwork
IS-2720	Method of test for soils (Relevant parts)
IS-3764	Excavation work - Code of safety
IS-4081	Safety code for blasting and related drilling operations
IS-4701	Indian Standard Code of Practice for earthwork on Canals
IS:6922	Criteria for safety and design of structures subject to underground blasts
IS: 3764	Excavation work – code of safety

In case of conflict between this specification and those (IS Codes) referred to herein, the former shall prevail. In case any particular aspect of work is not covered specifically by this specification/IS Codes, any other standard practice as may be specified by the engineer shall be followed.

2.4.0 Conformity with Designs

The contractor shall carry out the work as per the approved drawings, specification and as directed by the engineer.

2.5.0 Materials

2.5.1 General

All materials required for the work shall be of the best commercial variety and approved by the engineer.

2.5.2 Material for Excavation

For the purpose of identifying the various strata encountered during the course of excavation, refer clause no. 3.4.0 for the classification of earth strata.

2.5.3 Material for Filling

Material to be used for back filling shall be free from vegetations, roots, salts, rubbish, lumps, organic matter and any other harmful chemicals etc and shall be got approved by the engineer. Normally excavated earth shall be used for back filling. In case such earth contains deleterious salts, the same shall not be used. All clods of earth shall be broken or removed. Where the excavated



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material is mostly rock and if filling with the same is permitted by the engineer in writing, then the filling with rock shall be done in the following manner. The boulders shall be broken into pieces not exceeding 150mm size in any direction and mixed with fine materials consisting of decomposed rock, moorum or any approved earth to fill the voids as far as possible and the mixture shall then be used for filling.

In case the earth required for backfilling is over and above the earth available from the compulsory excavations within the project area, then borrow areas for obtaining suitable fill material shall be arranged by the contractor himself from outside the plant boundary limits and all expenses including royalties, taxes, duties etc shall be borne by him. The selected earth from the borrow areas shall be got approved by the engineer. The borrowed material shall be free from roots, vegetations, decayed organic matter, harmful salts and chemicals, free from lumps and clods etc. The contractor shall obtain and submit necessary clearances/permissions from the concerned authorities for the borrow areas/materials acquired to the engineer.

If specified, the back filling shall be done with clean well graded sand from approved quarries free from harmful and deleterious materials.

2.6.0 Quality Control

All works shall confirm to the lines, levels, grades, cross sections and dimensions shown on the approved drawings and/or as directed by the engineer. The contractor shall establish and maintain quality control for the various aspects of the work, method of construction, materials and equipments used etc. The quality control operation shall include but not be limited to the following.

Sl. No.	Activity	Check
1	Lines, levels & grades	a) By periodic surveys b) By establishing markers, boards etc
2	Back filling	(a) On quality of fill material (b) On moisture content of back fill (c) On degree of compaction achieved

2.7.0 Information regarding site conditions

Surface and Sub-surface data regarding the nature of soil, rock, sub-soil water etc. shown on drawing or otherwise furnished to the Contractor shall be taken as a guidance only and variation therefrom shall not affect the terms of the contract. The Contractor must satisfy himself regarding the character and volume of all work under this contract and expected surface, sub-surface and /



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or sub-soil water to be encountered. He must also satisfy himself about the general conditions of site and ascertain the existing and future construction likely to come up during the execution of the contract so that he may evolve a realistic programme of execution.

3.0.0 EXECUTION

The contractor shall prepare and submit the detailed drawings/schemes for excavation and back filling works as proposed to be executed by him showing the dimensions as per the construction drawings and specification adding his proposal of slopes, shoring, approaches, dewatering, drainage, berms etc. for the approval of engineer.

3.1.0 Setting out

On receiving the approval from the engineer with modifications and corrections if any, the contractor shall set out the work from the control points furnished by the engineer and fix permanent points and markers for ease of periodic checking as the work proceeds. These permanent points and markers shall be fixed at the interval as prescribed by the engineer and shall be got checked and certified by the engineer after whom the contractor shall proceed with the work. It should be noted that this checking by the engineer prior to the start of the work will in no way relieve the contractor of his responsibility of carrying out the work to true lines, levels and grades as per the drawings and specification. If any errors are noticed in the contractor's work at any stage, the same shall be rectified by the contractor at his own risk and cost.

3.2.0 Initial Levels

Initial levels of the ground either in a definite grid pattern or as directed by the Engineer will be taken by the Contractor jointly with the Engineer over the original ground prior to starting actual excavation work and after setting out. These initial levels will be used for preparing cross-sections for volume measurement or for cross-checking the depths obtained from tape measurements. All records of levels, measurements etc. and also any drawing, cross-section etc. made therefrom, shall be jointly signed by the authorised representative of the contractor and the Engineer before the commencement of work and they shall form the basis of all payments in future.

3.3.0 Clearing and Grubbing

The area to be excavated shall be cleared out of fences, trees, logs, stumps, bushes, vegetation, rubbish, slush etc. Trees upto 300mm girth shall be uprooted. Trees above 300mm girth to be cut shall be approved by the engineer and marked. Cutting of trees shall include removing roots as well.



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After the tree is cut and roots taken out, the pot holes formed shall be filled with good earth in 250mm layers and compacted unless directed otherwise by the engineer. The trees shall be cut in to suitable pieces as instructed by the engineer. Before earthwork is started, all the spoils, unserviceable materials and rubbish shall be burnt or removed and disposed to the approved disposal area(s) as specified by the engineer. Useful materials, saleable timber, fire woods etc shall be the property of the owner and shall be stacked properly at the worksite in a manner as directed by the engineer.

3.4.0

Classification

All earthwork shall be classified under the following categories:

No distinction will be made whether the material is dry or wet.

a) **Ordinary Soil**

This shall comprise vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick and shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.

b) **Hard Soil**

This shall include :

- i) stiff heavy clay, hard shale, or compact moorum requiring grafting tool or pick or both and shovel, closely applied ;
- ii) gravel and cobble stone having maximum diameter in any one direction between 75 and 300 mm ;
- iii) soling of roads, paths, etc., and hard core ;
- iv) macadam surfaces such as water bound, and bitumen/tar bound;
- v) lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar, below ground level ;
- vi) soft conglomerate, where the stones may be detached from the matrix with picks ; and
- vii) generally any material which requires the close application of picks, or scarifiers to loosen and not affording resistance to digging greater than the hardest of any soil mentioned in (i) and (vi) above.

c) **Soft and Decomposed Rock**

This shall include :

- i) limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with crowbars ;



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- ii) unreinforced cement concrete which may be broken up with crowbars or picks and stone masonry in cement mortar below ground level ;
- iii) boulders which do not require blasting having maximum diameter in any direction of more than 300 mm, found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin ; and
- iv) any rock which in dry state may be hard, requiring blasting, but which when wet becomes soft and manageable by means other than blasting.

d) Hard Rock (requiring blasting)

This shall include :

- i) any rock or cement concrete for the excavation of which the use of mechanical plant or blasting is required ;
- ii) reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground level; and
- iii) boulders requiring blasting.

e) Hard Rock (blasting prohibited)

Hard rock requiring blasting as described under (d) but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

In case of any dispute regarding classification, the decision of the Engineer shall be final.

3.5.0 Excavation for Foundations and Trenches

3.5.1 General

All excavation shall be done to the minimum dimensions as required for the safety and working facility. In each individual case, the contractor shall obtain prior approval of the engineer for the method he proposes to adopt for the excavation including dimensions, side slopes, shoring, dewatering, drainage and disposal etc. This approval however shall not in any way make the engineer responsible for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. All excavation in open cuts shall be made true to the line, slopes and grades as shown on the drawings and/or as directed by the engineer. No material shall project within the dimension of minimum excavation lines marked. Boulders (if any) projecting out of the excavated surfaces shall be removed if they are likely to be a hindrance to the work/workers in the opinion of the engineer.

Method of excavation shall in every case be subject to the approval of the engineer. The contractor shall ensure the stability and safety of the excavation, adjacent structures, services and works etc including the safety of the



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workmen. If any slip occurs, the contractor shall remove all the slipped materials from the excavated pit without any extra cost to the engineer/owner. All loose boulders and semi detached rocks which are not inside but so close to the area to be excavated and may liable to fall or otherwise endanger the workmen, equipment of the work etc during excavation in the opinion of the engineer shall be stripped off and removed away from the area of excavation. The method to be used for removal shall be such that it should not shatter or render unstable or unsafe the portion which was originally sound and safe. In case any material not required to be removed initially but later to become loose or unstable in the opinion of the engineer shall also be promptly and satisfactorily removed.

The rough excavation may be carried out upto a maximum depth of 150 mm above the final level. The balance shall be excavated with special care. If directed by the engineer, soft and undesirable spots shall be removed even below the final level. The extra excavation shall be filled up as instructed by the engineer. If the excavation (in all types of soil and rock) is done to a depth greater than that shown on the drawing or as directed by the engineer, the excess depth up to the required level shall be filled with cement concrete not leaner than 1:4:8 or richer as directed by the engineer at the own risk and cost of the contractor. In case where excavation in soil, soft rock (including weathered rock) and hard rock are involved, the excavation in each stratum shall be carried out separately with the approved methodology and as per the instructions of the engineer.

All excavated materials such as rock, boulders, bricks, dismantled concrete blocks etc shall be the property of the owner and shall be stacked separately as directed by the engineer. All gold, silver, oil, minerals, archeological and other findings of importance, trees cut or other materials of any description and all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of the owner and the contractor shall duly preserve the same to the satisfaction of the engineer/owner. The contractor shall deliver the same to such person or persons as may be authorized or appointed from time to time by the owner to receive the same.

Prior to starting the excavation, the ground level at the location shall be checked jointly with the engineer.

3.5.2

Excavation in All Type of Soil and in Soft Rock

The excavation in all type of soil, soft rock including decomposed rock etc shall be carried out as per the approved proposal and as directed by the engineer. The work shall be carried out in a workmanlike manner without endangering the safety of nearby structures/services or works and without causing hindrance to any other activities in the area. Foundation pits shall not



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be excavated to the full depth unless construction is imminent. The last 150mm depth shall be excavated once concreting work is imminent. At the discretion of the engineer, the full depth may be excavated and the bed be covered with lean concrete as specified after watering and compacting the bed. As the excavation reaches the required dimensions, lines, levels and grades etc, the work shall be got checked and approved by the engineer. In cases where deterioration of the ground, upheaval, slips etc are expected, the engineer may order to suspend the work at any stage and instruct the contractor to carry out the protection works before the excavation will be restarted.

3.5.3 Excavation in Hard Rock

Hard rocks shall normally be excavated by means of blasting. In case where blasting is prohibited for any reasons, the excavation shall be carried out by chiselling or any other approved method as directed by the engineer. Personnel deployed for rock excavation shall be protected from all hazards such as loose rock/boulder rolling down and from general slips of excavated surfaces. Where the excavated surface is not stable against sliding, necessary supports such as props, bracings or bulkheads shall be provided and maintained during the period of construction. Where the danger of falling loose rock/boulder from the excavated surfaces deeper than 2m exist, steel mesh anchored to the lower edge of the excavation and extending over and above the rock face adequate to retain the dislodged material shall be provided and maintained.

3.5.4 Blasting

Storage, handing and use of explosives shall be governed by the current explosive rules/regulations laid down by the Central and the State Governments. The contractor shall ensure that these rules/regulations are strictly adhere to. The following instructions are also to be strictly followed and the instructions wherever found in variance with the above said rules/regulations, the former (instructions) shall be superseded with the later (above said rules/regulations).

No child under the age of 16 and no person who is in a state of intoxication shall be allowed to enter the premises where explosives are stored nor they shall be allowed to handle the explosives. The contractor shall obtain licence from the District Authorities for undertaking the blasting work as well as for obtaining and storing the explosives as per Explosives Rules, 1940 corrected upto date. The contractor shall purchase the explosives, fuses, detonators etc only from a licensed dealer and shall be responsible for the safe custody and proper accounting of the explosive materials. The engineer or his authorized representative shall have the access to check the contractor's store of explosives and his accounts at any time. It is the full responsibility of the contractor to transport the explosives as and when required for the work in a safe manner to the work spot.



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Further, the engineer may issue modifications, alterations and new instructions to the contractor from time to time. The contractor shall comply with the same without these being made a cause for any extra claim.

3.5.4.1 Materials

All materials such as explosives, detonators, fuses, tamping materials etc proposed to be used in the blasting operation shall have the prior approval of the engineer. Only explosives of approved make and strength are to be used. The fuses known as instantaneous fuse must not be used. The issue of fuse with only one protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and shall be not less than 4 seconds per inch of length with 10% tolerance on either side. Before use, the fuse shall be inspected. Moist, damaged or broken ones shall be discarded. When the fuses are in stock for long, the rate of burning of fuses shall be tested before use. The detonators shall be capable of giving an effective blasting of the explosives. Moist and damaged detonators shall be discarded.

3.5.4.2 Storage of Explosives

The current Explosive Rules shall govern the storage of explosives. Explosives shall be stored in a clean, dry and well ventilated magazine to be specially built for the purpose. Under no circumstances should a magazine be erected within 400m of the actual work site or any source of fire. The space surrounding the magazine shall be fenced and the ground inside shall be kept clear and free from trees, bushes etc. The admission to this fenced space shall be through a single gate only and no person shall be allowed without the permission of the officer-in-charge. The clear space between the fence and the magazine shall not be less than 90m. The magazine shall be well drained. Two lightning conductors, one at each end shall be provided to the magazine. The lightning conductors shall be tested once in every year.

Explosives, fuses and detonators shall each be separately stored. Cases of explosives must be kept clear of the walls and floors for free circulation of air on all sides. Special care shall be taken to keep the floor free from any grains of explosives. Cases containing explosives shall not be opened inside the magazine and the explosives in open cases shall not be received into a magazine. Explosives which appear to be in a damaged or dangerous condition are not to be kept in any magazine but must be removed without delay to a safe distance and be destroyed.

Artificial light, matches, inflammable materials, oily cotton, rag waste and articles liable to spontaneous ignition shall not be allowed inside the magazine. Illumination shall be obtained from an electric storage battery



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lantern. No smoking shall be allowed within 100m distance from any magazine.

Magazine shoes without nails shall be used while entering the magazine. The persons entering the magazine must put on the magazine shoes which shall be provided at the magazine for this purpose and should be careful

- * not to put their feet on the clean floor unless the magazine shoes on.
- * not to touch the magazine shoes on ground outside the clean floor.
- * not to allow any dirt or grit to fall on the clean floor.

Persons with bare feet shall dip their feet in water before entering the magazine and then step directly from the tub to the clean floor. No person having article of steel or iron with/on him shall be allowed to enter the magazine. Workmen shall be examined before entering the magazine to check none of the prohibited articles are with them. A brush broom shall be kept in the lobby of the magazine for cleaning the magazine. Cleaning shall be done immediately after each occasion whenever the magazine is opened for receipt, delivery or inspection of the explosives.

The mallets, levers, wedges etc for opening the barrels or cases shall be of wood. The cases of explosives are to be carried by hand and shall not be rolled or dragged inside the magazine. Explosives which have been issued and returned to the magazine are to be issued first; otherwise those which have been stored long in the store are to be issued first. Neither the magazine shall be opened nor any person shall be allowed in the vicinity of the magazine during any dust storm or thunderstorm. All magazines shall be officially inspected at definite intervals and a record of such inspections shall be kept.

3.5.4.3 Carriage of Explosives

Detonators and explosives shall be transported separately to the blast site. Explosives shall be kept dry and away from direct rays of the sun, artificial lights, steam pipes or heated metal and other sources of heat. Before explosives are removed, each case or package shall be carefully examined to ascertain that it is properly closed and shows no sign of leakage.

No person except the driver shall be allowed to travel on the vehicle conveying explosives. No explosive shall be transported in a carriage or vessel unless all iron or steel therein the carriage or vessel which are likely to contact the package containing explosives are effectually covered with lead, leather, wood, cloth or any other suitable material. No light shall be carried on the vehicle carrying explosives and no operation connected with the loading, unloading and handling of explosives shall be conducted after sunset.



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3.5.4.4 Use of Explosives

The contractor shall appoint an agent who shall personally superintend the firing and all operations connected therewith. The contractor shall satisfy himself that the person so appointed is fully acquainted with his responsibilities.

Holes for charging the explosives shall be drilled with pneumatic drills and the drilling pattern shall be so planned that the rock pieces after blasting will be suitable for handling. The hole diameter shall be of such a size that the cartridges can easily pass down through them and any undue force is not required during charging. Charging operation shall be carried out by or under the personal supervision of the shot firer. Wrappings shall never be removed from the explosive cartridges. Only one cartridge at a time shall be inserted in a hole and wooden rods shall only be used for loading and stemming the shot holes. Only such quantities of explosives as are required for a particular work shall be brought to the work site. Should any surplus remain when all the holes have been charged shall be carefully removed to a point at least 300m away from the firing point.

The authorized shot firer himself shall make all the connections. The shot firing cable shall not be dragged along the ground to avoid any damage to the insulation. The shot firing cable shall be tested each time for its continuity and possible short circuiting. The shot firer shall always carry the exploder handle with him until he is ready to fire shots. The number of shots fired at a time shall not exceed the permissible limits. Before any blasting is carried out it shall be ensured that all workmen, vehicles and equipment on the site are cleared from an area of minimum 300m radius from the firing point or as required by the statutory regulations at least 10 minutes before the time of firing by sounding a warning siren and the area shall be encircled by red flags.

The explosives shall be fired by means of an electric detonator placed inside the cartridge. For simultaneous firing of a number of charges, the electric detonators shall be connected with the exploder through the shot firing cable in a simple series circuit. Due precautions shall be taken to keep the firing circuit insulated from the ground, bare wires, rails, pipes or any other path of stray current etc and keep the lead wires short circuited until it is ready to fire. Any kink in the detonator leading wire shall be avoided. For simultaneous firing of a large number of shot holes, use of cordtex may be done. An electric detonator attached to its side with adhesive tape shall initiate cordtex connecting wire or string. Blasting shall only be carried out at certain specified times to be agreed jointly by the contractor and the engineer.

At least five minutes after the blast has been fired in case of electric firing or as stipulated in the regulations, the authorized shot firer shall return to the



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blast area and inspect carefully the work and satisfy himself that all the charged holes have exploded. Cases of misfired unexploded charges shall be exploded by drilling a parallel fresh hole at a distance of not less than 600mm from the misfired hole and by exploding a new charge. The authorized shot firer shall be present during the removal of debris as it may contain unexploded explosives near the misfired hole. The workmen shall not return to the site of firing until at least half an hour after firing.

Where blasting is to be carried out in proximity of other structures, controlled blasting by drilling shallow shot holes and proper muffling arrangements with steel plates loaded with sand bags etc shall be used on top of the blast holes to prevent the rock fragments from causing any damage to the adjacent structures and other properties. Adequate safety precautions as per building byelaws, safety codes, statutory regulations etc shall be taken during blasting operations.

3.5.4.5 Restrictions in Blasting

- a) Blasting which may disturb or endanger the stability, safety or quality of the adjacent structures/foundations shall not be permitted.
- b) Blasting within 200m of a permanent structure or construction work in progress shall not be permitted.
- c) Progressive blasting shall be limited to two third of the total remaining depth of excavation.
- d) No large scale blasting operations will be resorted to when the excavation reaches the last one metre and only small charge preferably black powder may be allowed so as not to shatter the parent rock.
- e) The last blast shall not be more than 0.50 m in depth.
- f) In rocky formations, at locations where specifically indicated or ordered in writing by the engineer, the use of explosives shall be discontinued and excavation shall be completed by chiselling or any other suitable method as approved by the engineer.

3.5.5 Disposal

The excavated spoils shall be disposed of in any (or all) of the following manner as directed by the engineer.

- a) By using it straightway for backfilling.
- b) By stacking it temporarily to use for backfilling at a later date during execution of the contract.
- c) i) By either spreading
or
ii) By spreading and compacting at designated disposal areas.



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a) By selecting the useful material and stacking it neatly in designated areas as indicated by the engineer for use in backfilling by some other agency.

3.5.6 Disposal of Surplus Materials

All surplus material from excavation shall be removed and disposed of from the excavation site to the designated disposal area indicated by the engineer. All good and sound rocks obtained from excavations and all assorted materials of dismantled structures are the property of the owner and if the contractor wants to use it, he shall have to obtain it from the engineer at a mutually agreed rate. All sound rocks and other assorted materials like excavated bricks etc shall be stacked separately.

3.5.7 Protection

The contractor shall notify the engineer as soon as the excavation is expected to be completed within a day so that he shall inspect it at the earliest. Immediately after approval of the engineer, the excavation must be covered up in a shortest possible time. But in no case the excavation shall be covered up or worked on before approval by the engineer. Excavated material shall be placed 1.5m or half the depth (of excavation) whichever is more from the edge of the excavation or further away if directed by the engineer. Excavation shall not be carried out below the foundation level of the structure close by until the required precautions are taken. Adequate fencing is to be made enclosing the excavation. The contractor shall protect all the underground services exposed during excavation. All existing surface drains in the work area shall be suitably diverted by the contractor before taking up excavation to maintain the working area neat and clean.

3.5.8 Dealing with Surface Water

All working areas shall be kept free of surface water as far as reasonably practicable. Works in the vicinity of cut areas shall be controlled to prevent the ingress of surface water.

No works shall commence until surface water streams have been properly intercepted , redirected or otherwise dealt with.

Where works are undertaken in the monsoon period, the Contractor may need to construct temporary drainage systems to drain surface water from working areas.

3.5.9 Dewatering

All excavation shall be kept free of water and slush. Grading in the vicinity shall be controlled to prevent the surface water running into the excavations.



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The contractor shall remove any water inclusive of rain water and subsoil water etc accumulated in the excavation by pumping or other means as approved by the engineer and keep the excavations dewatered and/or lower the subsoil water level to 300mm below the founding level until the construction of foundation and backfilling are completed in all respects.

Sumps made for dewatering must be kept clear of the foundations. The engineer's prior approval on the method of pumping to be adopted shall be taken; but in any case, the pumping arrangement shall be such that there shall be no movement or blowing in of subsoil due to the differential head of water during pumping.

3.5.10 Timber Shoring

Close or open type timber shoring as approved by the engineer depending on the nature of sub-soil, depth of pit or trench and the type of timbering shall be adopted. Timbers made out of approved quality shall only be used. It shall be the responsibility of the contractor to take all necessary steps to prevent the sides of trenches and pits from collapsing.

3.5.10.1 Close Timbering

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called "polling boards". These shall be of 250mm wide(min.) and 40mm thick(min.) sections as directed by the engineer. The boards shall generally be placed vertically in pairs, one on each side of the cut and shall be kept apart (maximum spacing is limited to 1.20m) by horizontal walers of strong wood cross strutted with wooden struts or as directed by the engineer. The length of wooden struts shall depend on the width of the trench or pit.

In case where the soil is very soft and loose, the boards shall be placed horizontally against the sides of excavation and supported by vertical walers which shall be strutted to similar timber pieces on the opposite face of the trench or pit. The lowest board supporting the sides shall be taken into the ground. No portion of the vertical side of the trench or pit shall remain exposed to avoid any slipping out of earth.

The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started from one end and proceeded systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.

3.5.10.2 Open Timbering



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In case of open timbering, vertical board of 250mm wide(min.) and 40mm thick(min.) shall be spaced sufficiently apart to leave unsupported strips of maximum 500mm average width. The detailed arrangement, size of timber and the spacing etc shall be subjected to the approval of the engineer. In all other respects, the specification for close timbering shall apply to open timbering as well.

3.6.0 Treatment of Slips

The contractor shall take all precautions to avoid high surcharges and provide proper surface drainage to prevent flow of water over the sides of the excavations. These precautions along with proper slopes, berms, shoring and control of ground water should cause no slips to occur. If however slips still occur, the same shall be removed by the contractor with his own risk and cost.

3.7.0 Backfilling

3.7.1 General

The material to be used for backfilling shall be approved by the engineer which shall be obtained directly from the excavation, from the nearby areas where excavation work by the same agency is in progress, from the temporary stacks of excavated spoils or from the borrow pits as directed by the engineer. The material shall be free from lumps and clods, roots and vegetations, harmful salts and chemicals, organic materials etc.

In locations where sand filling is required, the sand used should be clean, well graded and be of the quality normally acceptable for use in concrete.

3.7.2 Filling and Compaction in Pits and Trenches all Around the Structures

As soon as the work in foundation has been accepted, the spaces around the foundation in pits and trenches shall be cleared of all debris, brick bats, mortar droppings etc and filled with approved earth in layers not exceeding 250mm (in loose thickness). Each layer(loose) shall be watered, rammed and properly compacted to the required degree to the satisfaction of the engineer. Earth shall be compacted with approved mechanized compaction machine. Usually, no manual compaction shall be allowed unless specifically permitted by the engineer. The moisture content of the fill material during compaction shall be controlled near to its optimum moisture content so as to obtain the required degree of compaction. The final surface shall be trimmed and levelled to proper profile as desired by the engineer.

3.7.3 Plinth Filling



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The plinth shall be filled with earth in layers not exceeding 250mm (in loose thickness) and each layer shall be watered and compacted to the required degree with approved compaction machine or manually if specifically permitted by the engineer. When the filling reaches the finished level, the surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and compacted in order to avoid any settlement at a later stage. The finished surface of fill shall be trimmed to the slope intended to be provided for the floor.

3.7.4 Filling in Trenches for Water Pipes and Drains

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. Where the trenches are excavated in soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 150mm, watered, rammed and compacted taking care that no damage is caused to the pipe below.

In case of trenches excavated in rock, the filling upto a height of 300mm or the diameter of the pipe whichever is more above the crown of the pipe or barrel shall be done with fine material such as earth, moorum, disintegrated rock or ash as per the availability at site and shall be filled in compacted layers not exceeding 150mm. The remaining filling shall be done in layers with the mixture of boulders (of size not exceeding 150mm) and fine material as specified elsewhere in the specification. Each layer shall be watered, rammed and compacted to the required degree and to the satisfaction of the engineer.

3.7.5 Filling in Disposal Area

Surplus materials from excavation which are not required for backfilling shall be disposed of in the designated disposal areas. The spoils shall not be dumped haphazardly but should be spread in layers approximately 250mm thick when loose, watered and compacted with the help of a compacting equipment as per the directions of the engineer. In wide areas, rollers shall be employed and compaction shall be done to the satisfaction of the engineer at the optimum moisture content which shall be checked and controlled by the contractor. In certain cases the engineer may direct the contractor to dispose the surplus materials without compaction which can be done by tipping the spoils from a high bench neatly maintaining a proper level and grade of the bench.

3.8.0 Approaches and Fencing

The contractor should provide and maintain proper approaches for the workmen and inspection. The roads and approaches around the excavation



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should be kept clear at all times so that there is no hindrance to the movement of men, material and equipment of various agencies connected with the project. Sturdy and elegant fencing is to be provided around the top edge of the excavation as well as around the bottom of the fill at the surplus disposal area where dumping from a high bench is in progress.

3.9.0 Lighting

Full scale area lighting is to be provided if night work is permitted or directed by the engineer. If no night work is in progress, red warning lights should be provided at the corners of the excavated pit and the edges of the fill.

4.0.0 TESTING AND ACCEPTANCE CRITERIA

4.1.0 Excavation

On completion of excavation, the dimension of the pits will be checked as per the drawings after the pits are completely dewatered. The work will be accepted after all undercuts have been set right and all over excavations are filled back to the required lines, levels and grades by placing ordinary cement concrete of 1:4:8 proportion and/or richer and/or by compacted earth as directed by the engineer. The choice of the grade of concrete will be a matter of unfettered discretion of the engineer. Over excavation of the sides shall be made good by the contractor while carrying out the backfilling. The excavation work will be accepted after the above requirements are fulfilled and all the temporary approaches encroaching inside the excavation have been removed.

4.2.0 Backfilling

The degree of compaction required will be as per the stipulation laid down in IS: 4701 and the actual method of measuring the degree of compaction will be as decided by the engineer. The work of back filling will be accepted after the engineer is satisfied with the degree of compaction achieved.

5.0.0 RATES AND MEASUREMENTS

5.1.0 Rates

a) The item of work in the schedule of quantities describe the work very briefly. The various items of the schedule of quantities shall be read in conjunction with the corresponding section in the technical specification including amendments and additions if any. For each item in the schedule of quantities, the bidder's rate shall include all the activities covered in the description of the items as well as for all necessary operations in detail as described in the technical specification.



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b) No claims shall be entertained if the details shown on the released for construction drawings differ in any way from those shown on the tender drawings.

c) The unit rate quoted shall include minor details which are obviously and fairly intended and which may not have been included in these documents but are essential for the satisfactory completion of the work.

d) The bidder's quoted rate shall be inclusive of supplying and providing all labour, men, materials, equipments, tools and plants, supervision, services, approaches, schemes etc.

f) In case blasting in hard rock is envisaged, the unit rate quoted for earth work shall include the cost of storage and safety arrangements for the materials required for blasting. No separate payment will be made on this account.

5.2.0

Measurements

Method of measurements are specified as below:

a) The length, breadth and depth shall be measured correct to the nearest centimeter if measurements are taken by tape. Rounding of numerical shall be as per relevant IS Codes. If the measurements are taken with staff and level, the levels shall be recorded correct to 5mm. The area and volume shall be worked out in square meter and cubic meter respectively correct to the nearest of two decimal places.

b) For earth work in excavation, the ground levels shall be taken before and after completion of the work in the actually excavated area. The quantity of earth work in excavation shall be computed from these levels in cubic meter.

c) In case of open footings (rafts/ pilecaps/ drains/ cable trench/ pipe trench/ sub soil beams etc.) up to the depth of 2.0 metres from ground level, around excavation of 30 cm beyond the outer dimension of footing (not the PCC dimension below footing) shall be measured for payment to make allowances for centering and shuttering. Any additional/excess excavation beyond this limit shall be at the risk and cost of the contractor and shall not be measured for payment for item of work on excavation, backfilling, carriage, dewatering etc. Required shoring & strutting, side slopes, benching, dewatering sump pits, approaches to the excavated pit etc. are deemed to be included in the quoted rates in the schedule of quantities.

d) In case of open footings (Rafts/ pilecaps / drains/ cable trench/ pipe trench/ sub soil beams etc.) at a depth of more than 2.0 metre from ground level,



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around excavation of 75 cm beyond the outer dimension of footing (not the PCC dimension below footing) shall be measured for payment to make allowances for centering and shuttering. Any additional/excess excavation beyond this limit shall be at the risk and cost of the contractor and shall not be measured for payment for item of work on excavation, backfilling, carriage, dewatering etc. Required shoring & strutting, side slopes, benching, dewatering sump pits, approaches to the excavated pit etc. are deemed to be included in the quoted rates in the schedule of quantities.

e) Where soft rock and hard rock are mixed, the measurement shall be done as follows. The two types of rock shall be stacked separately and measured in stacks. The net quantity of each type of rock shall be so arrived by applying a deduction of 50% for looseness/voids in the stacks. If the sum of net quantity of the two types of rock so arrived exceeds the total quantity of excavation, then the quantity of each type of rock shall be worked out from the total quantity (from excavation) in the ratio of net quantities in stack measurements of the two types of rock. If stacking is not feasible, the method as suggested by the engineer shall be followed.

f) Where soil, soft rock and hard rock are mixed, the measurement shall be done as follows. The soft and hard rock shall be removed from the excavated material and stacked separately and measured in stacks. The net quantity of each type of rock shall be so arrived by applying a deduction of 50% for looseness/voids in stacks. The difference between the entire excavation and the sum of the quantities of soft and hard rock so arrived shall be taken as soil.

g) The authorized quantity (calculated on the basis of authorized width/working space under clause no. 5.2.0 c & 5.2.0 d) or those actually excavated, whichever, are less, shall be measured for payment.

h) Tree cutting having girth more than 300mm shall be measured in number and are separately payable as deemed not covered in excavation items of work in the schedule of quantities.

6.0.0 INFORMATION TO BE SUBMITTED BY THE BIDDER

6.1.0 With Tender

Detail of equipments and machineries proposed to be used for excavation, backfilling and compaction shall be submitted along with the tender.



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6.2.0

After Award

After award of the contract the successful bidder shall submit the following for approval.

a) Within 30 days of the award of contract, the contractor shall submit a detailed programme of the work as proposed to be executed giving completion dates of excavation for the various foundations and the time required for backfilling and compaction after completion of foundation for the structures. The earthwork programme shall be planned in accordance with the foundation programme. The programme should also show how the excavation and backfilling quantities will be balanced minimizing the temporary stacking of spoils. It is to be noted that the engineer even after initial approval of the programme may instruct the contractor to enhance or to retard the progress of work during the actual execution in order to match with the progress of foundations. The initial programme being submitted by the contractor should have sufficient flexibility to take care of such reasonable variations.

b) Within 15 days of the award of contract, the contractor shall submit the drawings for earth work in excavation and backfilling showing detail of slopes, shoring, approaches, sump pits, dewatering lines, fencing etc for the approval of the engineer.



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GENERAL TECHNICAL SPECIFICATION

CEMENT CONCRETE (PLAIN & REINFORCED)



**Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301**



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SUB-SECTION – D2

CEMENT CONCRETE (PLAIN & REINFORCED)

1.00.00 SCOPE

1.01.00 General

This specification covers all the requirements, described hereinafter for general use of Plain and Reinforced Cement Concrete work in Structures and locations, cast-in-situ or precast, and shall include all incidental items of work not shown or specified but reasonably implied or necessary for the completion of the work. Special requirements for structures such as reinforced concrete chimney, cooling towers, etc. have been covered under the respective specifications. Those specifications shall be used in conjunction with this specification.

1.02.00 IS: 456 shall form a part of this specification and shall be complied with unless permitted otherwise. For any particular aspect not covered by this Code, appropriate Code, specifications and/or replacement by any International code of practice as may be specified by the Engineer shall be followed. All codes and Standards shall conform to its latest revisions. A list of IS codes and Standards is enclosed hereinafter for reference. However, should the list be not exhaustive and does not cover any aspect of the work, then relevant Indian and, in its absence, relevant International code shall apply.

2.00.00 General

2.01.00 Work to be provided for by the Contractor

The work to be provided for by the Contractor, unless otherwise specified shall include but not be limited to the following

- a) Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the work.
- b) Prepare Bar bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.
- c) Prepare working drawings of formworks, scaffolds, supports, etc.
- d) Prepare shop drawings for various inserts, anchors, anchor bolts, pipe sleeves, embedments, hangers, openings, frames etc.
- e) Prepare detailed drawings of supports, templates, hangers, etc. required for

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installation of various embedments like inserts, anchor bolts, pipe sleeves, frames, joint seals, frames, openings etc.

As decided by the Engineer some or all of the drawings & schedules prepared under item (b) to (e) above will have to be submitted for approval.

- f) Submit for approval detailed schemes of all operations required for executing the work, e.g. material handling, Concrete mixing, Placement of concrete, Compaction, curing, services, Approaches, etc.
- g) Design and submit for approval concrete mix designs required to be adopted on the job.

Furnish samples and submit for approval results of tests of various properties of the following:

- i) The various ingredients of concrete
- ii) Concrete
- iii) Embedments
- iv) Joint seals
- i) Provide all incidental items not shown or specified in particular but reasonably implied or necessary for successful completion of the work in accordance with the drawings and specifications.
- j) For supply of certain materials normally manufactured by specialist firms, the Contractor may have to produce, if directed by the Engineer, a guarantee in approved Performa for satisfactory performance for a reasonable period as may be specified, binding both the manufacturers and the Contractor, jointly and severally.

2.02.00 Work by others

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the contract.

2.03.00 Information to be submitted by the Tenderer

2.03.01 With Tender

The following technical information's are required with the tender:

- a) Source and arrangement of processing of aggregates proposed to be

adopted.

- b) Type of plant and equipment proposed to be used.
- c) Names of firms with which association is sought for to execute the special items of work in the contract.
- d) Types of formwork proposed to be used.

2.03.02

After Award

The Contractor shall submit the following information and data including samples where necessary, progressively during the execution of the contract.

a) Programme of Execution

Within 30 days of the award of contract, the Contractor will submit a Master Programme for completion of the work.

This Master Programme may have to be reviewed and updated by the Contractor, quarterly or at more frequent intervals as may be directed by the Engineer depending on the exigencies of the work.

Detailed day-to-day Programme of every month is to be submitted by the Contractor before the end of the previous month.

b) Samples

Samples of the following materials and any other materials proposed to be used shall be submitted as directed by the Engineer, in sufficient quantities free of cost, for approval. The Engineer for future reference will preserve approved samples. The approval of the Engineer shall not, in any way, relieve the Contractor of his responsibility of supplying materials of specified qualities:

- i) Coarse and fine aggregates.
- ii) Admixtures.
- iii) Plywood for Formwork.
- iv) Embedded and anchorage materials as may be desired by the Engineer.
- v) Joint sealing strips and other*waterproofing materials.
- vi) Joint filling compounds.

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vii) Foundation quality Rubber Pads.

c) Design Mix

Design mix as per specification giving proportions of the ingredients, sources of aggregates and cement, along with test results of trial mixes as per relevant I.S., is to be submitted to the Engineer for his approval before it can be used on the works.

d) Bar Bending Schedules

Bar Bending Schedules in accordance with Clause 2.01.00 (b) and 3.16.01 of this specification.

e) Detailed Drawings and Designs of Formworks to be used

Detailed design data and drawings of standard formworks to be used as per clause 2.01.00 (c).

f) Detailed Drawings for Templates & Temporary Supports for embedment
As per Clause 2.01.00 (e).

g) Mill Test Reports for Cement & Reinforcing Steel.

h) Inspection Reports

The Engineer in accordance with Clause 2.04.00 of this specification may desire inspection Reports in respect of Formwork and Reinforcement and any other item of work as.

i) Test Reports

Reports of tests of various materials and concrete as required under Clause 4.0: SAMPLING & TESTING of this specification or as directed by the Engineer.

j) Any other data, which may be required as per this specification or as directed by the Engineer.

2.04.00 Conformity with Design

The Contractor will prepare checklists in approved Performa, which will be called "Pour Cards". These Pour Cards will list out all items of work involved. The Contractor will inform the Engineer, sufficiently in advance, whenever any particular pour is ready for concreting. He shall accord all

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necessary help and assistance to the Engineer for all checking required in the pour. On satisfying himself that all details are in accordance to the drawings and specifications, the engineer will give written permission on the same Pour Cards allowing the contractor to commence placement of concrete. Details of all instructions issued by the Engineer and the records of compliance by the Contractor, deviations allowed by the Engineer and any other relevant information will be written on accompanying sheets attached to the Pour Cards. The Pour Cards along with accompaniments will be handed over to the Engineer before starting placement of concrete. One of the mix designs developed by the Contractor as per the I.S. Specifications and established to the satisfaction of the Engineer by trial mixes shall be permitted to be used by the Engineer, the choice being dictated by the requirements of designs and workability. The methods of mixing, conveyance, placement, vibration, finishing, curing, protection and testing of concrete will be as approved or directed by the Engineer.

2.05.00 Materials to be used

2.05.01 General Requirement

All materials whether to be incorporated in the work or used temporarily for the construction shall conform to the relevant IS Specifications unless-stated otherwise and be of best approved quality.

2.05.02 Cement

Ordinary Portland cement of grade-43 as per IS:8112/fly ash based Portland puzzolona cement conforming to IS:1489 (Part-1) shall preferably be used in reinforced/plain cement concrete works for all areas other than for the critical structures identified below. However, other types of cement such as ordinary Portland cement conforming to IS:269, Portland slag cement conforming to IS:455 respectively can be used under special circumstances. Cement used in all concrete mixes shall be in general of grade 33/43 unless design requires a higher grade. Ordinary Portland cement shall be used for following structure.

- a) TG foundation top deck and sub structures including raft.
- b) Spring Supporting decks of all machine foundations.
- c) Structures requiring grade of concrete of M30 and above.

In special cases, Rapid Hardening Portland Cement, Low Heat Cement, Sulphate resistant cement, high strength Ordinary Portland Cement etc. may be permitted or directed to be used by the Engineer.

For Brickwork, plaster, flooring and other finishing works, ordinary Portland cement of 33/43 grade shall be used.

2.05.03 Coarse Aggregate

Aggregate of sizes ranging between 4.75 mm and 150 mm will be termed as Coarse Aggregate. Coarse aggregate for concrete shall be chemically inert, hard, strong durable against weathering, of limited porosity, and free from deleterious materials. It shall be properly graded. Coarse aggregates shall be either crushed gravel or stone. All aggregates shall meet the requirement of IS:383:1970. Only Coarse Aggregate from, approved quarries and conforming to IS-383 will be allowed to be used on the works. Petrographic test shall be carried out by the contractor free of cost for checking the quality of rock from quarry. This test shall be repeated by the Contractor free of cost for change in quarry or as directed by the Engineer. The results shall be checked for reactivity of silica in aggregate with alkalis of cement.

2.05.04 Fine Aggregate

Aggregate smaller than 4.75 mm and within the grading limits and other requirements set in IS: 383 are termed as Fine Aggregate or Sand. Only Fine Aggregate from approved sources and conforming to the above IS Specification will be allowed to be used in works. Sand shall be hard, durable, clean and free from adherent coatings or organic matter and clay balls or pellets. Sand when used as fine aggregate in concrete shall conform to IS:383. For plaster, it shall conform to IS:1542 and for masonry work to IS:2116.

2.05.05 Water

Water for use in Concrete shall be clear and free from injurious oils, acids, alkalis, organic matter, salt, silts, or other impurities. Generally, IS: 3550 will be followed for routine tests. Acceptance of water shall be as per IS: 456.

2.05.06 Admixture

Only admixtures of approved quality will be used when directed or permitted by the Engineer. The different types of admixtures, which may be necessary to satisfy the concrete mix and the design requirement, shall be as per IS-9103 and may be one of the followings:

- a) Accelerating admixture
- b) Retarding admixture
- c) Water reducing admixture
- d) Air entraining admixture

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e) Water proofing admixture

The contractor shall inform the Engineer about the type of admixture which he is planning to use in different areas within the scope of work for the approval of the Engineer. The admixture shall be of proven make and from a reputed manufacturer. It should not have any adverse effect on strength, durability of concrete and reinforcement. Super plasticizers conforming to IS: 9103 or ASTM-C494 shall only be used as admixture having the above properties either individually or in a combination as per the direction of the Engineer.

2.05.07 Reinforcement

Reinforcement shall be as per relevant IS Specification as mentioned in the Contract/Drawing/Instructions. All bars shall be of tested quality.

2.06.00 Storage of Materials

2.06.01 General

All materials shall be stored so as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged or is otherwise considered defective by the Engineer, shall not be used for concrete and shall be removed from site immediately, failing which, the Engineer shall be at liberty to get the materials removed and the cost incurred thereof shall be realised from the Contractor's dues. The Contractor shall maintain upto-date accounts of receipt, issue and balance (stack wise) of all materials. Storage of materials shall conform to IS: 4082.

2.06.02 Cement

Sufficient space for storage, with open passages between stacks, shall be arranged by the Contractor to the satisfaction of the Engineer.

Cement shall be stored off the ground in dry, leak proof, well-ventilated warehouses at the works in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.

Cement shall be stored in easily countable stacks with consignment identification marks. Consignments shall be used in the order of their receipts at site. Sub-standard or partly set cement shall not be used and shall be removed from the site, with the knowledge of the Engineer, as soon as it is detected.

2.06.03 Aggregates

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Aggregates shall be stored on raised surface constructed by providing planks or steel plates or on concrete or brick masonry pavement. Each size shall be kept separated with wooden or steel or concrete or masonry bulkheads or in separate stacks and sufficient care shall be taken to prevent the material at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart with proper arrangement of drainage. The aggregates shall be stored in easily measurable stacks of suitable depths as may be directed by the Engineer.

2.06.04 Reinforcement

Reinforcing steel shall be stored consignment-wise and size-wise off the ground and under cover, if desired by the Engineer. It shall be protected from rusting, oil, grease, and distortions.

If necessary, the reinforcing steel may be coated with cement wash before stacking to prevent scale and rust at no extra cost to the Owner. The stacks shall be easily measurable. Steel needed for immediate use shall only be removed from storage.

2.07.00 Quality Control

Contractor shall establish and maintain quality control for different items of work and materials as may be directed by the Engineer to assure compliance with contract requirements and maintain and submit to the Engineer records of the same. The quality control operation shall include but not be limited to the following items of work:

a) Admixture:	Type, quantity, physical, and chemical properties that affects strength, workability, and durability of concrete. For air entraining admixtures, dosage to be adjusted to maintain air contents within desirable limits.
b) Aggregate:	Physical, chemical and mineralogical qualities. Grading, moisture content and impurities.
c) Water:	Impurities tests.
d) Cement:	Tests to satisfy relevant IS Specifications.
e) Formwork:	Material, shapes, dimensions, lines, elevations, surface finish, adequacy of form, ties, bracing

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and shoring and coating.

f) Reinforcement:	Shapes, dimensions, length of splices, clearances, ties and supports. Quality and requirement of welded splices.
	Material tests or Certificates to satisfy relevant IS Specification.
g) Grades of Concrete:	Usage and mix design, testing of all properties.
h) Batching & Mixing:	Types and capacity of plant, concrete mixers and transportation equipment.
i) Joints:	Locations of joints, water stops and filler materials. Dimension of joints, quality, and shape of joint material and splices.
j) Embedded and Anchorage Items:	Material, shape, location, setting.
k) Placing:	Preparation, rate of pouring, weather limitations, time intervals between mixing and placing and between two successive lifts, covering over dry or wet surfaces, cleaning and preparation of surfaces on which concrete is to be placed, application of mortar/slurry for proper bond, prevention of cold joint, types of chutes or conveyors.
l) Compaction:	Number of vibrators, their prime mover, frequency and amplitude of vibration, diameter and weight of vibrators, duration of vibration, hand-spreading, rodding and tamping.
m) Setting of base & Bearing plates:	Lines, elevations, and bedding mortar.
n) Concrete Finishes:	Repairs of surface defects, screening, floating, steel trowelling and brooming, special finishes.
o) Curing:	Methods and length of time.

Copies of records and tests for the items noted above, as well as, records of corrective action taken shall be submitted to the Engineer for approval as may be desired.

3.00.00 INSTALLATION

All installation requirements shall be in accordance with IS: 456 and as supplemented or modified herein or by other best possible standards where the specific requirements mentioned in this section of the specification do not cover all the aspects to the full satisfaction of the Engineer.

3.01.00 Washing and Screening of Aggregates

Washing and screening of coarse and fine aggregates to remove fines, dirt, or other deleterious materials shall be carried out by approved means as desired by the Engineer.

3.02.00 Admixture

All concrete shall be designed for normal rate of setting and hardening at normal temperature. Variations in temperature and humidity under different climatic conditions will affect the rate of setting and hardening, which will, in turn, affect the workability and quality of the concrete. Admixtures including plasticisers of approved make may be used with the Engineer's approval in accordance with IS-456 to modify the rate of hardening, to improve workability or as an aid to control concrete quality. The Engineer reserves the right to require laboratory test or use test data, or owner satisfactory reference before granting approval. The admixture shall be used strictly in accordance with the manufacturer's directions and/or as directed by the Engineer.

3.03.00 Grades of Concrete

Concrete shall be in one of the grades designated in IS: 456. Grade of concrete to be used in different parts of work shall be as shown on the drawing. In case of liquid retaining structures, IS: 3370 will be followed. Minimum cement content shall be as per IS: 456.

3.04.00 Proportioning and Works Control

3.04.01 General

“Design Mix Concrete” and “Nominal Mix Design” is defined as follows for use in this specification:

- a) Proportioning of ingredients of concrete made with preliminary tests by designing the concrete mix. Such concrete shall be called "Design Mix Concrete".
- b) Proportioning of ingredients of concrete made without preliminary tests

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adopting nominal concrete mix. Such concrete shall be called "Nominal Mix Concrete".

As far as possible, design mix concrete shall be used on all concrete works. Nominal mix concrete, in grades M-15 or lower only may be used if shown on drawings or approved by the Engineer. In all cases the Proportioning of ingredients and works control shall be in accordance with IS: 456 and shall be adopted for use after the Engineer is satisfied regarding its adequacy and after obtaining his approval in writing.

3.04.02 Mix Design Criteria

Concrete mixes will be designed by the Contractor to achieve the strength, durability, and workability necessary for the job, by the most economical use of the various ingredients. In general, the design will keep in view the following considerations

- a) Consistent with the various other requirements of the mix, the quantity of water should be kept at the lowest possible level.
- b) The nominal maximum size of coarse aggregate shall be as large as possible within the limits specified.
- c) The various fractions of coarse and fine aggregates should be mixed in such a proportion as to produce the best possible combined internal grading giving the densest and most workable mix.
- d) The finished concrete should have adequate durability in all condition, to withstand satisfactorily the weather and other destruction agencies, which it is expected to be subjected to in actual service.
- e) The mix design shall have required workability and characteristic strength as per IS: 456. The quantity of cement, aggregates, and admixtures shall be determined by mass.

The requirement of adequate structural strength is catered for by the choice of proper grade of concrete in structural design. The Contractor will strictly abide by the same in his design of concrete mix installation. Various trials shall be given by the contractor with specific cement content on each trial. In some cases, plasticizers and other admixtures may be necessary to achieve the desired results.

3.05.00 Strength Requirements

The strength requirements of both design mix and nominal mix concrete where ordinary Portland Cement or Portland Blast furnace slag cement is used, shall

be as per IS:456. All other relevant clauses of IS:456 shall also apply.

3.06.00 Minimum Cement Content

The minimum cement content for each grade of concrete shall be as per IS: 456. Contractor has to consider actual environmental exposure condition at site. Based on various tests results and as per Engineer, the environment condition shall be adopted for which minimum cement content shall be considered. No extra payment shall be made on account of any variation in environment condition.

- a) Sufficient number of trial mixes (to be decided by the Engineer) will be taken at the laboratory for the various designs and graphs of w/c ratio Vs crushing strengths at various ages will be plotted.
- b) All tests will be done in presence of the Engineer who shall be the final authority to decide upon the adoption of any revised minimum cement content. The Contractor will always be responsible to produce quality concrete of the required grade as per the acceptance criteria of IS: 456.
- c) The Engineer will always have the unquestionable right to revise the minimum cement content as decided above, if, in his opinion, there is any chance of deterioration of quality on account of use of lower cement content or any other reason.

3.07.00 Water-Cement Ratio

The choice of water-cement ratio in designing a concrete mix will depend on:-

- a) The requirement of strength.
- b) The requirement of durability.

3.07.01 Strength Requirement

In case of "Design Mix Concrete" the water-cement ratio of such value as to give acceptable test results as per IS: 456, will be selected by trial and error. The values of water-cement ratios for different grade and mix designs will have to be established after conducting sufficiently large number of preliminary tests in the laboratory to the satisfaction of the Engineer. Frequent checks on test will have to be carried out and the water-cement ratios will be revised if the tests produce unsatisfactory results. Notwithstanding anything stated above the Contractor's responsibility to produce satisfactory test results and to bear all the consequences in case of default remains unaltered.

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In case of nominal mix concrete, the maximum water-cement ratio for different grades of concrete is specified in Table-5 of IS: 456 and no tests are necessary. The acceptance test criterion for nominal mix concrete shall be as per IS: 456.

3.07.02 Durability Requirement

Tables 4 & 5 of IS: 456 give the maximum water-cement ratio permissible from the point of view of durability of concrete subjected to adverse exposure to weather, sulphate attacks, and contact with harmful chemicals. Impermeability may also be an important consideration.

Whenever the water-cement ratio dictated by Durability consideration is lower than that required from strength criteria, the former should be adopted.

In general the water cement ratio between 0.4 and 0.45 will be desirable to satisfy the durability requirement and from the consideration of impermeability of concrete. The contractor may propose lower water cement ratio as mentioned above by addition of a suitable plasticizer/super-plasticizer. Trial mix shall be carried out accordingly. However, the contractor has to propose specifically along with field trials in the event of lower cement content if found suitable along with a plasticizer.

3.08.00 Workability

The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and around the reinforcement and embedments and to give the required surface finish shall depend*on the type and nature of structure and shall be based on experience and tests. The usual limits of consistency for various types of structures are given below:

TABLE-V

LIMITS OF CONSISTENCY

Degree of workability	Slump in mm with Standard Cone as per IS: 1199		Use for which concrete is suitable
	Min.	Max.	
Very low	0	25	Large Mass concrete structure with heavy compaction equipments, roads
Low	25	50	Uncongested wide and shallow R.C.C. structures
Medium	50	100	Deep but wide R.C.C. structures with congestion of reinforcement and inserts
High	100	150	Very narrow and deep R.C.C. structures with congestion due to reinforcement and inserts.

Note: Notwithstanding anything mentioned above, the slump to be obtained for work in progress shall be as per direction of the Engineer.

With the permission of the Engineer, for any grade of concrete, if the water has to be increased in special cases, cement shall also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment will be made for this additional cement.

The workability of concrete shall be checked at frequent intervals by slump tests.

3.09.00 Size of coarse Aggregates

The maximum size of coarse aggregates for different locations shall be as follows unless otherwise directed by the Engineer

Very narrow space

- 12 mm

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Reinforced concrete
Except foundation - 20 mm

Ordinary Plain concrete and Reinforced
concrete foundations - 40 mm

Mass concrete - 80 mm

Lean concrete - 40 mm

Grading of coarse aggregates for a particular size shall conform to relevant I.S. Codes and shall also be such as to produce a dense concrete of the specified proportions, strength and consistency that will work readily into position without segregation.

Coarse aggregate will normally be separated into the following sizes and stacked separately in properly designed stockpiles

80 mm to 40 mm, 40 mm to 20 mm and 20 mm to 5 mm. In certain cases it may be necessary to further split the 20 mm to 5 mm fraction into 20 mm to 10 mm and 10 mm to 5 mm fractions.

This separation of aggregates in different size fractions is necessary so that they may be remixed in the desired proportion to arrive at a correct internal grading to produce the best mix.

3.09.01 Temperature control of concrete in top decks of machine foundations (i.e. of TGs, BFPs, Fans and Mills) as extra payable over RCC item of BOQ:

The temperature of fresh concrete shall not exceed 23°C when placed. A suitable measuring device for measuring the temperature of concrete as approved by the Engineer shall be used. For maintaining the limiting temperature of the 23°C, crushed ice shall be used as mixing water. The ice shall be formed of water conforming IS: 456. The Contractor shall establish the quantity of crushed ice to be mixed in order to achieve the limiting temperature of 23°C.

3.09.02 Base raft of Turbo Generator foundations and top decks of all machine foundations shall be cast in a continuous operation without any construction joint.

3.10.00 **Mixing of Concrete**

Ingredients of the concrete mix shall be measured by weight. Concrete shall always be mixed in mechanical mixer. Water shall not normally be charged

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into the drum of the mixer until all the cement and aggregates constituting the batch are already in the drum and mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall mixing be done for less than 2 (two) minutes and at least 40 (forty) revolutions after all the materials and water are in the drum. When absorbent Aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer. Mixers shall not be loaded above their rated capacity as this prevents thorough mixing.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used. Such concrete shall be immediately removed from site. Each time the work stops, the mixer shall be thoroughly cleaned & when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the Owner to allow for loss in the drum.

Regular checks on mixer efficiency shall be carried out as directed by the Engineer as per IS: 4634 on all mixers employed at site only those mixers whose efficiencies are within the tolerances specified in IS: 1791 will be allowed to be employed.

Batching Plant shall conform to IS: 4925. The measuring gauges of batching plant shall be periodically calibrated for which the contractor shall provide standard weights. The accuracy of all gauges shall be within limits prescribed by the Engineer.

When hand mixing is permitted by the Engineer, for unimportant out of the way locations in small quantities, it shall be carried out on a water-tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. In case of hand-mixing, 10% extra cement shall be added to each batch at no extra cost to the owner.

3.11.00

Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of laying as rapidly as practicable by approved means and placed and compacted in the final position before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the ingredients. For long distance haulage, agitator cars of approved design will be used. If, in spite of all precautions, segregations does occur during transport, the concrete shall be properly re-mixed before placement. During very hot or cold weather, if directed by the Engineer, concrete shall be transported in deep containers, which will reduce the rate of loss of water, by evaporation or loss of heat. If necessary, the container may have to be covered and insulated. Conveying equipments for concrete shall be well maintained

and thoroughly cleaned before, commencement of concrete mixing. Such equipments shall be kept free from set concrete.

3.12.00 Placing and Compacting Concrete

Where specifically covered, the relevant I.S. Code will be followed for the procedure of surface preparation, placement, consolidation, curing, finishes, repairs and maintenance of concrete. If, however, there is no specific provision in relevant I.S. code for any particular aspect of work, any other standard code of practice, as may be specified by the Engineer, will be adopted. Concrete may have to be placed against the following types of surfaces:

- a) Earth foundation
- b) Rock foundation
- c) Formwork
- d) Construction joint in concrete or masonry

The surface on or against which concrete is to be placed has to be cleaned thoroughly. Rock or old construction joint has to be roughened by wire brushing, chipping, sand blasting or any other approved means for proper bond. All cuttings, dirt, oil, foreign and deleterious material, laitance, etc. are to be removed by air water jetting or water at high pressure. Earth foundation on which direct placement of concrete is allowed, will be consolidated as directed by the Engineer such that it does not crumble and get mixed up with the concrete during or after placement, before it has sufficiently set and hardened.

Formwork, reinforcement, preparation of surface, embedments, joint seals etc., shall be approved in writing by the Engineer before concrete is placed. As far as possible, concrete shall be placed in the formwork by means approved by the Engineer and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1500 mm shall have to be approved by the Engineer.

Rock foundation or construction joint will be kept moist for at least 72 hours prior to placement. Concrete will be placed always against moist surface but never on pools of water. In case the foundation cannot be dewatered completely, special procedure and precaution, as directed by the Engineer will have to be adopted.

Formwork will be cleaned thoroughly and smeared lightly with form oil or grease of approved quality just prior to placement.

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A layer of mortar of thickness 12 mm of the same or less w/c ratio and the same proportion as that of the concrete being placed or cement slurry will be spread thoroughly on the rock Foundation or construction joint just prior to placement of concrete.

After concrete has been placed, it shall be spread, if necessary & thoroughly compacted by approved mechanical vibration to maximum, subsidence without segregation and thoroughly worked around shape. Vibrators shall not be used for pushing concrete into adjoining areas. Vibrators must be operated by experienced workmen and the work carried out as per relevant IS Code of Practice: In thin members with heavy congestion of reinforcement or other embedments, where effective use of internal vibrator is, in the opinion of the Engineer, doubtful, in addition to immersion vibrators the contractor may have to employ form vibrators conforming to IS: 4656. For slabs and other similar structures, the contractor will additionally employ screed vibrator as per IS: 2506. Hand tamping may be allowed in rare cases, subject to the approval of the Engineer. Care must be taken to ensure that the inserts, fixtures, reinforcement, and formwork are not displaced or distorted during placing & consolidation of concrete.

The rate of placement of concrete shall be such that no cold joint is formed and fresh concrete is placed always against green Concrete, which is still plastic and workable. No concrete shall be placed in open, during rains. During rainy season, no placement in the open is to be attempted unless sufficient tarpaulins or other similar protective arrangement for completely covering the still green concrete from rain is kept at the site of placement. If there has been any sign of washing of cement and sand, the entire affected concrete shall be removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete.

Slabs, beams, and similar members shall be poured in one operation, unless otherwise instructed by the Engineer. Mouldings, throating, drip course, etc., shall be poured as shown on the drawings or as directed by the Engineer. Holes shall be provided and bolts, sleeves, anchors, fastenings, or other fixtures shall be embedded in concrete as shown on the drawings or as directed by the Engineer. Any deviation there from shall be set right by the Contractor at his own expense as instructed by the Engineer.

In case the forms or supports get displaced during or immediately after the placement and bring the concrete surface out of alignment beyond tolerance limits, the Engineer may direct to remove the portion and reconstruct or repair the same -at the Contractor's expense.

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The Engineer shall decide upon the time interval between two placements of concrete of different ages coming in contact with each other, taking in consideration the degree of maturity of the older concrete, shrinkage, heat dissipation and the ability of the older concrete to withstand the load imposed upon it by the fresh placement.

Once the concrete is deposited, consolidated and finished in its final position, it shall not be distributed.

3.13.00 Construction Joints and Cold Joints

3.13.01 Construction Joints

It is always desirable to complete any concrete structure by continuous pouring in one operation. However, due to practical limitation of methods and equipment and certain design considerations, construction joints are formed by discontinuing concrete certain predetermined stages. These joints will be formed in a manner specified in the drawings/Instruction.

Vertical construction joints will be made with rigid stop-board forms having slots for allowing passage of reinforcement rods and any other embedments and fixtures that may be shown. Next stage concrete shall be placed against construction joint as per clause 3.12.

Where the location of the joints are not specified, it will be in accordance with the following:

- a) In a column, the joint shall be formed 75 mm below the lowest soffit of the beam framing into it.
- b) Concrete in a beam shall preferably be placed without a joint, but if Provision of a joint is unavoidable, the joint shall be vertical and at the middle of the span.
- c) A joint in a suspended floor slab shall be vertical and at the middle of the span and at right angles to the principal reinforcement.
- d) Feather-edges in concrete shall be avoided while forming a joint.
- e) A construction joint should preferably be placed in a low-stress zone and at right angles to the direction of the principal stress.
- f) In case the Contractor proposes to have a construction joint anywhere to facilitate his work, the proposal should be submitted well in advance to the Engineer for study and approval without which no construction joint will be allowed.

3.13.02 Cold Joint

An advancing face of a concrete pour, which could not be covered by fresh concrete before expiry of initial setting time (due to an unscheduled stoppage or delay on account of breakdown in plant, inclement weather, low rate of placement or any other reason), is called a cold joint. The Contractor should always remain vigilant to avoid cold joints.

If, however, a cold joint is formed due to unavoidable reasons, the following procedure shall be adopted for treating it:

- a) If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly against the old surface. The old concrete should be covered by fresh concrete as quickly as possible and the joint thoroughly and systematically vibrated.
- b) In case concrete has hardened a bit more than (a) but can still be easily removed by a light hand pick, the surface will be raked thoroughly and the loose concrete removed completely without disturbing the rest of the concrete in depth. A rich mortar layer 12 mm in thickness, will be placed on the cold joint fresh concrete shall be placed on the mortar layer and the joint will be thoroughly and systematically vibrated penetrating the vibrator deep into the old layer of concrete.
- c) In case the concrete at the joint has become so stiff that it cannot be remoulded and mortar or slurry does not raise inspite of extensive vibration, the joint, will be left to harden for at least 12 - 24 hrs. It Will then be treated as a regular construction joint, after cutting the concrete to required shape and preparing the surface as described under clause 3.12.

3.14.00 Repairs, Finishes, and Treatment of Concrete surfaces

3.14.01 Adequate and sound concrete surfaces, whether formed or unformed, can be obtained by employing a concrete mix of proper design, competent formwork, appropriate methods of handling, placing, and consolidation by experienced workmen.

Unsound concrete resulting from improper mix design, incompetent methods, equipment and formwork, poor workmanship and protection will not be accepted and will have to be dismantled, removed and replaced by sound concrete at the Contractor's cost. The Engineer may, at his sole discretion, allow to retain concrete with minor defects provided the Contractor is able to repair it by approved methods at no extra cost to the Owner, All concrete work shall be inspected by the Contractor immediately after the forms are removed

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& he will promptly report occurrence of any defects to the Engineer. All repair works will be carried out as per the instructions and in the presence of the Engineer or his representative. Generally, repair work will consist of any or all of the following operations:

- a) Sack rubbing with mortar and stoning with carborundum stone.
- b) Cutting away the defective concrete to the required depth shape.
- c) Cleaning of reinforcement & embedments. It may be necessary to provide an anti-corrosive coating on the reinforcement.
- d) Roughening by sand blasting or chipping.
- e) Installing additional reinforcement/welded mesh fabric.
- f) Dry packing with stiff mortar.
- g) Plastering, guniting, shotcreting etc.
- h) Placing and compacting concrete in the void left by cutting out defective concrete.
- i) Grouting with cement sand slurry of 1:1 mix.
- j) Repairing with a suitable mortar either cement or resin modified mortars.
- k) Polymer modified patching and adhesive repair& mortar for beams & columns.

3.14.02 Finishing unformed Surface

The contractor shall provide normal finishes in unformed surfaces which can be achieved by screeding, floating, trowelling etc. A few typical and common cases of treatment of concrete surface are cited below

a) Floor

Whenever a non-integral floor finish is indicated, the surface of reinforced concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No over trowelling, to obtain a very smooth surface, shall be done, as it will prevent adequate bond with the subsequent finish. If desired by the Engineer, the surface shall be scored and marked to provide better bond.

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Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel trowelling is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel trowelling properly done will flatten and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes, ripples, and trowel marks.

A fine textured surface that is not slick and can be used where there is likelihood of spillage of oil or water can be obtained by trowelling the surface lightly with a circular motion after initial trowelling keeping the steel trowel flat on the surface.

To provide a better grip the Engineer may instruct marking the floor in a regular geometric pattern after initial trowelling.

b) Beans, Columns & Walls

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the Contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy, and details of such hacking shall meet with the approval of the Engineer, who shall be informed to inspect such surfaces before they are covered up.

3.15.00 Protection and Curing of concrete

Newly placed concrete shall be protected by approved means from rain, sun, and wind. Concrete placed below the ground level shall be protected against contamination from falling earth during and after placing. Concrete placed in ground containing deleterious substances, shall be protected from contact with such ground, or with water draining from such ground, during placing of concrete and for a period of at least three days, or as otherwise instructed by the Engineer. The ground water around newly poured concrete shall be kept to an approved level by pumping out or other adequate means of drainage to prevent floatation or flooding. Steps, as approved by the Engineer, shall be taken to protect immature concrete from damage by debris, excessive 'Loadings, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently, it shall be covered either with sand, hessian, canvas, or similar materials and kept continuously wet for at least 14 (fourteen) days after final setting. Curing by continuous sprinkling of water will be allowed if the Engineer is satisfied with the adequacy of the

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arrangements made by the Contractor. Quality of water for curing shall be as per IS: 456.

If permitted by the Engineer, liquid curing compound may be used for prevention of premature water loss in concrete and thereby effecting curing of concrete. This type of curing compound shall be sprayed on newly laid concrete surfaces to form a thin film barrier against premature water loss without disturbances to normal setting action. The curing compound shall be emulsified paraffin based and shall comply with ASTM requirements for acceptance.

The curing compound shall be applied following the final finishing operation and immediately after disappearance of water from concrete surface. It is important not to apply the curing compound when standing water is still present on concrete.

The contractor shall arrange for the manufacturer's supervision at no extra cost.

The Contractor shall remain extremely vigilant and employ proper equipment and workmen under able supervision for curing. The Engineer's decision regarding the adequacy of curing is final. In case the Engineer notices any lapse on the part of the Contractor, he will inform the Contractor or his supervisor verbally or in writing to correct the deficiency in curing. If no satisfactory action is taken by the Contractor within 3 (three) hours of issuance of such instruction, the Engineer will be at liberty either to employ sufficient means through any agency to make good the deficiency and recover the cost thereof from the Contractor, or deduct certain amount from contractor's payment for the part where inadequate curing was noticed entirely at the discretion of the Engineer.

3.16.00 Reinforcement

Mild steel round bars, TMT bars, Hot rolled deformed bars or cold twisted deformed bars as medium tensile or high yield strength steel, plain hard drawn steel wire fabric etc, will be used as reinforcement as per drawings and directions. In an aggressive environment an anti-corrosive coating on the reinforcement may be provided as per IS: 9077, as shown on the drawing or as directed by the Engineer.

3.16.01 Bar Bending Schedules

The Contractor shall prepare Bar Bending Schedules showing clearly the arrangements proposed by the Contractor to match available stock of reinforcing steel, progressively, starting within one week of receipt of approval on corresponding design of RCC structure. As decided by the Engineer, some

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or all the detailed drawings and schedules will have to be submitted for approval. Approval of such detailed drawings by the Engineer shall not relieve the Contractor of his responsibility for correctness nor of any of his obligations to meet the other requirements of the contract. The contractor for record and distribution shall submit six prints of the final drawings & schedules with one reproducible print.

3.16.02 Cleaning

All steel for reinforcement shall be free from loose scales, oil, grease, paint or other harmful matters immediately before placing the concrete.

3.16.03 Bending

Unless otherwise specified, reinforcing steel shall be bent in accordance with the procedure specified in IS: 2502 or as approved by the Engineer. Bends and shapes shall comply strictly with the dimensions corresponding with the final Bar Bending Schedules. Bar Bending Schedules shall be rechecked by the Contractor before any cutting, bending is done.

No reinforcement shall be bent when already in position in the work, without approval of the Engineer, whether or not it is partially embedded in concrete. Bars shall not be straightened in a manner that will injure the material. Rebending can be done only if approved by the Engineer. Reinforcing bars shall be bent by machine or other approved means producing a gradual and even motion. All the bars shall be cold bent unless otherwise approved. Bending hot at a cherry-red heat (not exceeding 845°C) may be allowed under very exceptional circumstances except for bars whose strength depends on cold working. Bars bent hot shall not be cooled by quenching.

3.16.04 Placing in Position

All reinforcements shall be accurately fixed and maintained in position as shown on the drawings by such approved and adequate means like mild steel chairs and/or concrete spacer blocks. Bars intended to be in contact at crossing points, shall be securely tied together at all such points by No. 20 G annealed soft iron wire or by tack welding in case of Bar larger than 25 mm dia., as may be directed by the Engineer. Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of mild steel spacer bars. They should be spaced such that the main bars do not sag perceptibly between adjacent spacers. Before actual placing, the Contractor shall study the drawings thoroughly and inform the Engineer in case he feels that placement of certain bars is not possible due to congestion. In such cases he should not start placing any bar before obtaining clearance from the Engineer.

3.16.05 Welding / Coupler for Splicing

Lapping shall normally do splicing of reinforcement. For M.S. reinforcement bars, butt-welding may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards for welding of mild steel bars used in reinforced concrete construction as per IS: 2751 and IS: 456. For High yield strength deformed bars, lap welding may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards as per IS: 9417. Welding of High yield strength deformed bar shall not be allowed.

Splicing of reinforcement using mechanical coupler may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian standards for "Reinforcement couplers for mechanical splices of bars in concrete" as per IS: 16172. Corrosion test in the coupler-bar connections exposed to marine or severe environmental conditions to rule out any risk of galvanic corrosion will be done by the contractor at no extra cost. Proper fitting & fixing of mechanical coupler to rebar shall be ensured at site for each coupled joint as per inspection testing plan developed at site in consultation with manufacturer of coupler. If so required at site, coupler/ threading on rebar shall be such that two bars can be coupled by moving couplers not rebar (as being heavy reinforcement weight and L shaped, it is not feasible to rotate the rebar for fixing up the coupler) at no extra cost.

3.16.06 Control

The placing of reinforcements shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement shall be examined by the Engineer for accuracy of placement and cleanliness. Necessary corrections as directed by him shall be carried out. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS: 456, unless otherwise specified. The laps shall be staggered as far as practicable and as directed by the Engineer. Arrangements for placing concrete shall be such that reinforcement in position does not have to bear extra load and get disturbed. The cover for concrete over the reinforcements shall be as shown on the approved drawings unless otherwise directed by the Engineer. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar not leaner than 1 (one) part cement to 2 (two) parts sand by –volume and cured in a pond for at least 14 (fourteen) days. The type, shape, size and location of the concrete blocks shall be as approved by the Engineer.

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3.17.00 Cold Weather Concreting

When conditions are such that the ambient temperature may be expected to be 5°C or below during the placing and curing period, the work shall conform to the requirement of IS: 456 and IS: 7861.

3.18.00 Hot Weather Concreting

When depositing concrete in very hot weather, the Contractor shall take all precautions as per IS: 7861 and stagger the work to the cooler parts of the day to ensure that the temperature of wet concrete used in massive structures does not exceed 38°C while placing. Positive temperature control by precooling, post cooling or any other method, if required, will have to be done by the contractor at no extra cost.

3.19.00 Concreting under water

When it is necessary to deposit concrete under water it shall be done in accordance with the requirements of IS: 456.

3.20.00 Form Work

3.20.01 General

If it is so desired by the Engineer, the contractor shall prepare, before commencement of actual work, designs and working drawings for formwork and centring and get them approved by the Engineer. The formwork shall conform to the shape, grade, lines, levels and dimensions as shown on the drawings.

Materials used for the formwork inclusive of the supports and centring shall be capable of withstanding the working load and remain undistorted throughout the period it is left in service. All supports and scaffolds should be manufactured from structural or tubular steel except when specifically permitted otherwise by the Engineer.

The centring shall be true to vertical, rigid and thoroughly braced both horizontally and diagonally. Rakers are to be used where forms are to support inclined members. The forms shall be sufficiently strong to carry without undue deformation, the dead weight and horizontal pressure of the concrete as a liquid as well as the working load. In case the contractor wishes to adopt any other design criteria, he has to convince the Engineer about its acceptability before adopting it. Where the concrete is vibrated, the formwork shall be strong enough to withstand the effects of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the formwork shall be sufficiently tight to prevent any leakage of slurry or

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mortar.

To achieve the desired rigidity, tie bolts, spacer blocks, tie wires and clamps as approved by the Engineer shall be used but they must in no way impair the strength of concrete or cause stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel and concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of securing and aligning the formwork shall not be used.

The formwork shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the surface of the concrete must be brought to the notice of the Engineer immediately and rectified as directed by him.

For exposed interior and exterior concrete surfaces of beams, columns and wall, plywood or other approved form shall be thoroughly cleaned and tied together with approved corrosion-resistant devices. Rigid care shall be exercised in ensuring that all column forms are in true plumb and thoroughly cross-braced to keep them so. All floor and beam centring shall be crowned not less than 8 mm in all directions for every 5 metres span. The formwork should lap and be secured sufficiently at the lift joints to prevent bulges and offsets.

Temporary openings for cleaning, inspection and for pouring concrete shall be provided at the base vertical forms and at other places, where they are necessary and as may be directed by the Engineer. The temporary openings shall be so formed that they can be conveniently closed when required, during pouring operations without leaving any mark on the concrete.

3.20.02 Cleaning and Treatment of Forms

All parts of the forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish, loose concrete, chippings, shavings, sawdust etc. shall be scrupulously removed from the interior of the forms before concrete is poured. Compressed air jet and/or water jet along with wire brushes brooms etc. shall be used for cleaning. The inside surface of the formwork shall be treated with approved non-staining oil or other compound before it is placed in position. Care shall be taken that oil or other compound does not come in contact with reinforcing steel or construction joint surfaces. They shall not be allowed to accumulate at the bottom of the formwork. The oiling of the formwork will be inspected just prior to placement of concrete and redone wherever necessary.

3.20.03 Design

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The formwork shall be so designed and erected that the forms for slabs and the sides of beams, columns, and walls are independent of the soffits of beams and can be removed without any strain to the concrete already placed or affecting the remaining formwork.

Removing any props or repropping shall not be done except with the specific approval of the Engineer. If formwork for column is erected for the full height of the column, one side shall be left open and built up in sections, as placing of concrete progress. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment and alignment of the formwork and to allow it to be removed gradually without jarring the concrete.

3.20.04 Inspection of Forms

Casting of Concrete shall start only after the formwork has been inspected and approved by the Engineer. The concreting shall start as early as possible within 3 (three) days after the approval of the formwork and during this period the formwork shall be kept under constant vigilance against any interference. In case of delay beyond three days, a fresh approval from the Engineer shall be obtained.

3.20.05 Removal of Forms

Formwork shall be kept in position after casting of concrete for a minimum period as mentioned in IS: 456, however the period of retaining form in position can be extended as per drawing, instruction of Engineer or as required for satisfactory completion of work without any extra cost. Before removing any formwork, the Contractor must notify the Engineer well in advance to enable him to inspect the concrete if the Engineer so desires.

The Contractor shall record on the drawing or in any other approved manner, the date on which concrete is placed in each part of the work and the date on which the formwork is removed there from and have this record checked and countersigned by the Engineer regularly. The Contractor shall be responsible for the safe removal of the formwork and any work showing signs of damage through premature removal of formwork or loading shall be rejected and entirely reconstructed by him without any extra cost to the Owner, The Engineer may, however, instruct to postpone the removal of formwork if he considers it necessary.

If any other type of cement other than ordinary Portland cement and Rapid hardening cement is used, the time of removal of forms shall be revised such that the strength of this cement at the time of removal of forms match with strength of Portland cement at the time of removal of form.

3.20.06 Tolerance

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The formwork shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerances unless otherwise specified in this specification or drawings or directed by the Engineer:-

- For -
- a) Sectional dimension - ± 5 mm
 - b) Plumb - 1 in 1000 of height
 - c) Levels - ± 3 mm before any deflection has taken place

The tolerance given above are specified for local aberrations in the finished concrete surface & should not be taken as tolerances for the entire structure taken as a whole or for the setting and alignment of formwork, which should be as accurate as possible to the entire satisfaction of the Engineer. Any error, within the above tolerance limits or any other as may be specially set up by the Engineer, if noticed in any lift of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment.

3.20.07 Re-use of Forms

Before re-use, all forms shall be thoroughly scraped, cleaned, joints and planes examined and when necessary repaired, and inside surface treated as specified hereinbefore. Formwork shall not be used/re-used if declared unfit or unserviceable by the Engineer.

3.20.08 Classification

Generally, the "ordinary" class formwork shall be used unless otherwise specified.

- a) **Ordinary:** These shall be used in places where ordinary surface finish is required and shall be composed of steel and/or approved good quality partially seasoned timber.
- b) **Plywood:** These shall be used in exposed surfaces, where specially good finish is required and shall be made of approved brand of heavy quality plywood to produce a perfectly uniform and smooth surface conforming to the shape described in the drawing with required grain texture on the concrete. Re-use may only be permitted after special inspection and approval by the Engineer. He may also permit utilization of used plywood for the "ordinary" class, if it is still in good condition.
- c) **Ornamental:** These shall be used where ornamental and curved surface are required and shall be made of selected best quality well seasoned

timbers or of plywood, which can be shaped correctly.

3.21.00 Opening, Chases, Grooves, Rebates, Blockouts etc.

The Contractor shall leave all openings, grooves, chases, etc. in concrete work as shown on the drawings or as specified by the Engineer.

3.22.00 Anchor Bolts, Anchors, Sleeves, Inserts, Hangers/Conduits/Pipe and other misc. Embedded Fixtures

The Contractor shall build into concrete work all the items noted below and shall embed them partly or fully as shown on drawings and secure the same as may be required. The materials shall be as specified and be of best quality available according to relevant Indian Standards of approved manufacture and to the satisfaction of the Engineer. Exposed surfaces of embedded materials are to paint with one coat of approved anti- corrosive paint and/or bituminous paint without any extra cost to the Owner. If welding is to be done subsequently on the exposed surface of embedded material, the paint shall be cleaned off the member to a minimum length of 50 mm beyond each side of the weld line.

Necessary templates, jigs, fixtures, supports etc. shall be used as may be required or directed by the Engineer.

Items to be embedded

- a) Inserts, hangers, anchors, frame around openings, manhole covers, frames, floor clips, sleeves conduits and pipes.
- b) Anchor bolts and plates for machinery, equipment and for structural steel work.
- c) Steel structurals to be left embedded for future extension, special connection etc.
- d) Dowel bars, etc. for concrete work falling under the scope of other contractors.
- e) Lugs or plugs for door and window frames occurring in concrete work.
- f) Flashing and jointing in concrete work.
- g) Any misc. embedments and fixture as may be required.

Correct location and alignment, as per drawings/instruction of all these

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embedded items shall be entirely the responsibility of the Contractor.

3.23.00 Expansion and Isolation Joints

3.23.01 General

Expansion and isolation joints in concrete structures shall be provided at specific places as per details indicated on the drawings. The materials and types of joints shall be as specified hereinafter. In case of liquid retaining structures, additional precautions shall be taken to prevent leakage of liquids as may be specified on the drawings or as directed by the Engineer. All materials are to be procured from reliable manufacturers and must have the approval of the Engineer. Where it is the responsibility of the Contractor to supply the material, the Engineer may demand test certificates for the materials and/or instruct the Contractor to get them tested in an approved laboratory free of cost to the Owner. Joints shall be formed true to line, level, shape, dimension, and quality as per drawings and specifications. Prior approval of the method of forming the joints should be obtained from the Engineer before starting the work.

3.23.02 Bitumen Board/ Expanded Polystyrene Board

a) Bitumen Board

Bitumen impregnated fibreboard of approved manufacturer as per IS: 1838 may be used as fillers for expansion joints. It must be durable and waterproof. It shall be compressible and possess a high degree of rebound. The dimensions of the board should be equal to that of the joint being formed. It should, preferably be manufactured in one piece, matching the dimension of the joint and not prepared by cutting to size smaller pieces from larger boards at site. At the exposed end, the joint shall be sealed with approved sealing compound to a depth of at least 25 mm after application of an approved primer. The sealing compound and the primer shall be applied as specified by the manufacturer.

b) Expanded Polystyrene Boards

If required, commercial quality of expanded polystyrene products commonly used for thermal insulations may also be used as filler material in expansion joints. The thickness may vary from 12 mm to 50 mm. The material will have to be procured from reliable manufacturers as approved by the Engineer. The method of installations will be similar to that recommended by the manufacturers for fixing on cold storage walls. A coat of Bitumen paint may have to be applied on the board against which concrete will be placed.

3.23.03

Joint sealing strips

Joint sealing strips may be provided at the construction, expansion, and isolation joints as a continuous diaphragm to contain the filler material and/or to exclude passage of water or any other material into or out of the structure. The sealing strips will be either metallic like G.I., Aluminums, or Copper, or non-metallic like rubber or P.V.C.

Sealing strips will not have any longitudinal joint and will be procured and installed in largest practicable lengths having a minimum number of transverse joints. The material is to be procured from reputed manufacturers having proven records of satisfactory supply of joint strips of similar make and shape for other jobs. The jointing procedure shall be as per the manufacturer's recommendations, revised if necessary, by the Engineer. The Contractor is to supply all labour and material for installation -including the material and tools required for jointing, testing, protection, etc. If desired by the Engineer, joints in rubber seals may have to be vulcanized.

a) Metal Sealing Strips

Metal sealing strips shall be either G.I., Aluminium or Copper and formed straight, U shaped, Z shaped or any other shape and of thickness as indicated in the drawing. The transverse joints will be gas welded using brass rods and approved flux and will be tested by an approved method to establish that it is leak proof. If required, longer lap lengths and different method of brazing which will render it leak proof, will be adopted by the Contractor. The edges shall be neatly crimped and bent to ensure proper bond with the concrete.

i) G.I. Strips

G.I. strips shall be minimum 1.5 mm thick and 150 mm in width unless specified otherwise. The standard of Galvanizing shall be as per relevant Indian Standards for heavy-duty work. At the joints, the overlapping should be for a minimum length of 50 mm.

ii) Aluminium Strips

Aluminium strips shall be minimum 18 SWG thick and 300 mm wide unless specified otherwise and shall conform to IS: 737 of 19000 grades or 31000 grade (Designation as per IS: 6051). A minimum lap of 50 mm length is required at the joints.

iii) Copper Strips

The Copper strips shall be minimum 18 SWC in thickness and 300 mm

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width unless specified otherwise and shall conform to the relevant Indian Standards. It should be cleaned thoroughly before use to expose fresh surface, without any reduction in gauge. A minimum lap of 50 mm in length is required at the joints.

b) Non-metallic Sealing Strips

These will be normally in Rubber or P.V.C. Rubber or P.V.C. joint seals can be of shape having any combination of the following features:

- i) Plain
- ii) Central bulb
- iii) Dumb-bell or flattened ends
- iv) Ribbed and Corrugated Wings
- v) V shaped

As these types of seals can be easily handled in very large lengths unlike metal strips, transverse joints will be allowed only under unavoidable circumstances and with the specific approval of the Engineer. The method of forming these joints, laps etc. shall be as specified by the Manufacturer and/or as approved by the Engineer taking particular care to match the central bulbs & the edges accurately.

c) Rubber Sealing Strips

The minimum thickness of Rubber sealing strips shall be 3 mm and the minimum width 100 mm. The actual size and shape will be as shown in drawings or as directed by the Engineer. The material will be natural rubber and be resistant to corrosion, abrasion, and tear and also to attacks from the acids, alkalis and chemicals normally encountered in service. The physical properties will be generally as follows. The actual requirements may be slightly different as decided by the Engineer:

Specific Gravity	:	1.1 to 1.15
Shore Hardness	:	65A to 75A
Tensile Strength	:	25 - 30 N/Sq.mm
Maximum Safe Continuous Temperature	:	75°C



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Ultimate Elongation : Not less than 350%

b) P.V.C., Sealing Strips

The minimum thickness of P.V.C. sealing strips will be 3 mm and the minimum width 100 mm. The actual size and shape will be as shown in drawings or as directed by the Engineer. The material should be of good quality Polyvinyl Chloride highly resistant to tearing, abrasion, and corrosion as well as to chemicals likely to come in contact with during use. The physical properties will generally be as follows. The actual requirements, which will be directed by the Engineer, may vary slightly

Specific Gravity : 1.3 to 1.35

Shore Hardness : 60A to SOA

Tensile Strength : 10 - 15 N/Sq.mm

Maximum Safe Continuous
Temperature : 70 Deg.C

Ultimate Elongation : Not less than 275%

3.23.04 Bitumen Compound

When shown in drawing or directed, the gap in expansion joints shall be thoroughly cleaned and bitumen compound laid as per manufacturer's specifications. The compound to be used shall be of approved manufacture and shall conform to the requirements of IS: 1834.

3.23.05 Isolation Joints

Strong and tough alkathene sheet or equivalent, about 1 mm in thickness and as approved by the Engineer shall be used in isolation joints. It shall be fixed by an approved adhesive compound on the cleaned surface of the already set concrete to cover it fully. Fresh concrete shall be laid against the sheet, care being taken not to damage the sheet in any way.

3.23.06 Pad

Hard foundation quality rubber pads of required thickness and shapes shall be put below machine or other foundations as shown on the drawings. The rubber shall have a unit weight of 1500 Kg/Cu.m, a shore hardness - 65A to 70A and be of best quality of approved manufacture, durable, capable of absorbing vibration and must be chemically inert in contact with moist or dry earth or any other deleterious material expected under normal conditions.

3.24.00 Grouting under Machinery or Structural Steel Bases

If required, grouting under base plates of machines or structural steel etc. shall be carried out by the Contractor. In general, the mix shall be 1 (one) part cement and 1 (one) part sand and just enough water to make it flow as required. The areas to be grouted shall be cleaned thoroughly with compressed air jet and/or with water in locations where accumulated surplus water can be removed. Where directed by the Engineer, 6 mm down stone chips may have to be used in the mix. Surface to be grouted shall be kept moist for at least 24 hours in advance. The grout shall be placed under expert supervision, so that there is no locked up air. Edges shall be finished properly. If specified on drawings, admixtures like Aluminium powder, "Ironite" etc. may have to be added with the grout in required proportions. Premixed non-shrink grout of approved manufacture having proper strength shall be used with Engineer's approval for important machineries.

3.25.00 Precast Concrete

The Specification for precast concrete will be similar as for the cast-in-place concrete described herein and as supplemented in this section. All precast work shall be carried out in a yard made for the purpose. This yard shall be dry, properly levelled and having a hard and even surface. If the ground is to be used as a soffit former of the units, it shall be paved with concrete or masonry and provided with a layer of plaster (1:2 proportion) with smooth neat cement finish or a layer of M.S. sheeting. Where directed by the Engineer, casting will have to be done on suitable vibrating table. The yard, lifting equipment, curing tank, finished material storage space etc. shall be designed such that the units are not lifted from the mould before 7 (seven) days of curing and can be removed for erection after 28 (twenty-eight) days of curing. The moulds shall preferably be of steel or of timber lined with G.I. sheet metal. The yard shall preferably be fenced.

Lifting hooks, where necessary or as directed by the Engineer, shall be embedded in correct position of the units to facilitate erection, even though they may not be shown on the drawings, and shall be burnt off and finished after erection.

Precast concrete units, when ready, shall be transported to site by suitable means approved by the Engineer. Care shall be taken to ensure that no damage occurs during transportation. All adjustments, levelling, and plumbing shall be done as per instructions of the Engineer. The Contractor shall render all help with instruments, materials, and men to the Engineer for checking the proper erection of the precast units.

After erection and alignment, the joints shall be filled with grout or concrete as

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per drawings. If centrings have to be used for supporting the precast units, they shall not be removed until the joints have attained sufficient strength and in no case before 14 (fourteen) days. The joint between precast roof planks shall be pointed with 1:2 cement: sand mortar where called for in the drawings.

3.26.00 Waterproofing of Concrete Structure

3.26.01 General

Where required, waterproofing of concrete structures shall be ensured internally by suitable design of the concrete mix, addition of suitable admixtures in the concrete or mortar at the time of mixing and/or installing water bars at the joints. In addition to the above measures, the structures shall be made watertight by adopting "structural waterproofing" as per specification. The design, material, and workmanship shall conform to the relevant I.S. Codes where applicable. The Engineer's approval of the materials shall be obtained by the Contractor before procurement. If desired by the Engineer, test certificates for the materials and samples shall be submitted by the Contractor free of charge. The materials shall be of best quality available indigenously, fresh clean and suitable for the duties called upon.

3.26.02 Water Bar/Seal/Special Treatment of Construction Joint

Water bearing structures and underground structures may have water bar/seals installed at the joints. They may be metallic, rubber, or P.V.C. The materials and installation will be as described under Clause 3.23.3. Construction joint shall be provided as per clause 3.13.1 with or without water bar/seal as shown on the drawing. In case of water bars being used at the construction joint, fixing of the same has to be done carefully, so that the water bar is not disturbed during concreting. The construction joint shall also be treated by any one of the following methods.

Method 1: A surface retarder in the form of a thixotropic gel shall be applied on the joint surface of the previous pour in case of joint on the wall and in case of floor the same shall be applied on the formwork against which previous pour of concreting shall be done. The retarder may be liquid or paste form depending on the type of formwork. The formwork shall be removed within 24 hours after concreting. Within 2 hours of striking of the formwork the retarder shall be washed off with strong water jet to make surface rough and clean. Then a rich cement mortar using cement, sand and aggregates (maximum size 8 mm) along with synthetic rubber emulsion type water resistant bonding agent shall be applied for a depth of 50 mm just before pouring the next stage of concreting. In case of walls, the above bonding agent will be mixed with water, which will be used for making the cement mortar. The proportion of mixing of this bonding agent with water shall be as per manufacturer's specification. In case of floor joint, however, after washing of retarder a

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solvent free two-component epoxy resin-bonding agent will be used at the joint before the next pour of concrete. The above bonding agent shall have the following properties after 28 days

Compressive strength	-	55 to 60 N/Sq.mm
Flexural strength	-	5 to 30 N/sq.mm
Tensile strength	-	15 N/Sq.mm (approx.)
Bonding strength to concrete	-	3 N/Sq.mm (approx.)
Bonding strength to steel	-	20 N/Sq.m (approx.)

The whole operation shall be done as per manufacturers specification. The contractor shall provide manufacturer's supervision at no extra cost to the owner.

Method 2: One row of threaded nozzles at regular intervals not exceeding 1.5 m centre to centre shall be placed in concrete along the construction joint during casting. Injection of cement water together with a suitable waterproof expanding grouting admixture of approved quality shall be done through the nozzles after the concrete has set to seal the voids in concrete near the construction joint in walls and slabs. The injection shall be done under pressure of approximately 2 to 4 kg/sq.cm. The nozzles shall be sealed off with suitable admixture after the injection is over. The whole operation shall be carried out as per manufacturer's specification and supervision. The cost of such manufacturer's supervision shall be borne by the contractor.

3.26.03 Waterproofing Admixtures

The waterproofing admixture for concrete and cement mortar/plaster shall conform to IS: 2645. The admixture shall not cause decrease of strength of concrete/plaster at any stage and it shall be free from chlorides and sulphates. The admixture shall not affect the setting time by more than 5%. The maximum permissible dosage of admixture will be 3% (three percent) by weight of cement, but a lower dosage will always be preferred. The product shall be stored in strong moisture proof packings. However, in case of important structures where M25 or higher grade concrete is specified, the use of melamine based, high range water reducing concrete admixture shall be used to provide a waterproof concrete, For achieving high strength concrete having cement content around 400 kg/cu.m. a melamine based super plasticizer will be preferable.

- In concrete: The admixtures shall be procured from reliable and reputed manufacturers and approved by the Engineer. The method of application

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and other details shall conform to the manufacturer's specification and/or as instructed by the Engineer. The Contractor shall have the services of the manufacturer's supervisor at no extra cost to supervise the work, if desired by the Engineer.

- b) In Plaster: The concrete surface, to be plastered, shall be hacked to Engineer's satisfaction, cleaned thoroughly and kept wetted for 24 hours. The plaster shall be in cement sand mortar mixed in proportion varying from 1:1 to 1:4 by volume along with the approved waterproofing admixture and laid in appropriate thickness and in layers not exceeding 15 mm/layer or as per manufacturer's specification. The additive shall be of quality and type approved by the Engineer. If desired by the Engineer, the Contractor shall have the work supervised by the manufacturer's supervisor at no extra cost. On completion, the Plastered surface shall be cured continuously for a minimum period of 14 days like concrete.

3.26.04 Structural waterproofing

- a) Nozzles spaced as required after the concrete is completed shall be drilled into surfaces to be rendered watertight. Non-shrink cement grout with waterproofing compound as per manufacturers specifications shall be injected under pressure to seal all voids. Special care shall be taken at joints by providing additional nozzles. The pressure grouting shall be done on the internal surface.

- b) External Treatment

Two layers of (1:4) plaster of 12 mm thick each with waterproofing compound as per manufacturer's specification shall be provided on outer surface of concrete underground structures.

3.26.05 Protective coating on Inside Surface.

Two coats of cement based two components polymer modified flexible protective and waterproofing slurry having 1 mm thick for each coat shall be applied on the walls/floor after proper surface preparation as mentioned above. The slurry shall be applied by brush.

3.26.06 Bitumen Felt: Application for Tanking

This specification shall cover laying the waterproof course on the outside and inside of the walls and bases of structures.

The materials shall conform to IS: 1322, and the workmanship to IS: 1609. The bitumen felt should be hessian base and/or fibre base as specified in Drawing. If required by the Engineer, tests as specified in relevant IS Codes

shall be arranged by the Contractor without charging any extra to the Owner.

The Contractor shall execute this work in direct collaboration with one of the well-known specialized firm approved by the Engineer.

Cleaning the surface, keeping it dry, providing, necessary corner fillets and cement rendering and cutting chases, etc. shall be done as per drawings and/or instructions. If any protective brickwork on/against concrete sub-bases or walls are required, the same shall be provided. A twenty (20) years guarantee for satisfactory performances shall be given by the Contractor as well as his specialist sub-contractor jointly and severally, for this work. Free rectification of any defects noted in the work within this guarantee period will be carried out by the Contractor even if it is beyond the specified maintenance period of the contract as a whole.

3.26.07 Polyethylene Films: Application in Walls or base of structures

Waterproof treatment shall be applied as outlined and as per sequence given hereunder

- i) the concrete surface shall be made smooth with 12 mm cement plaster 1:6.
- ii) apply hot bitumen 80/100 grade (IS: 73-1961) at the rate of 1.0 Kg/Sq.m minimum
- iii) lay black polyethylene film 250-micron (IS: 2508-1977) with cut back bitumen adhesive in overlaps over hot bitumen surface, gently pressed, taking care not to puncture the film.

Alternatively, the overlaps shall be heat sealed by an electric iron having three parallel sealing bars. A long piece of plywood is to be placed below the polyethylene film to be heat-sealed. On the plywood a rubber gasket is to be laid to provide a cushion for better welding of the film. On the rubber padding, a cellophane tape is to be spread and on this the LDPE film, with 100 mm overlap, is to be stretched. On the overlapped film another cellophane tape is to be placed to prevent the heat sealer from sticking to the LDPE film. After this, the electric iron is to be pressed on the overlap joint for sufficient time so as to allow perfect welding. The operation is to be repeated for subsequent lengths of joints. After heat-sealing, the cellophane tape is to be removed and the joints are to be tested for leaks.

- iv) Lay 100 gm brown craft paper laminated with a layer of straight run bitumen,
- v) Lay hot bitumen 80/100 grade (IS: 73-1961) at 1.0 Kg/Sq.m minimum.

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- vi) Lay 250-micron polyethylene film as second layer similar to (iii)above.
- viii) Lay second layer of 100 gm. brown craft paper laminated similar to (iv) above.
- ix) Apply hot bitumen (straight run grade) to IS: 73-1961 at 1.0 Kg/Sq.m dusted with fine sand.
- x) Protecting with a layer of 75 mm plain cement concrete M-10, or a layer of brick laid in cement mortar 1:6 in case of wall apply a 12 mm thick plaster as shown on the drawing or a protective brick wall in 1:6 cement mortar as shown on the drawing.

3.27.00 Protective Coating on Concrete Surface

3.27.01 On Foundation

The outside faces of foundation of important structures will be protected from adverse effect of soil/underground water, if shown on drawing by using rubber/bitumen emulsion protective coating of approved manufacturer.

4.00.00 SAMPLING AND TESTING

4.01.00 General

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own cost unless otherwise specified in this specification. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test.

4.02.00 Cement

Representative samples will be taken from each consignment of cement received from the manufacturer/supplier for carrying out the tests for fineness (by hand sieving), setting time and compressive strengths as per guidelines of IS: 269. Soundness Tests may also be required to be carried out if required by the Engineer. The Contractor shall carry out the tests without any expense to BHEL. No cement from a particular consignment/batch will be used on the works unless satisfactory 3 (three) days and 7 (seven) days test results for compressive strength are known. The Engineer and Contractor will jointly associate themselves with the tests irrespective of whether they are carried out by the BHEL or the Contractor. These tests are of great importance, as their results will have a bearing on the acceptance of concrete or otherwise as per the terms and conditions of the Contract.

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4.03.00 Aggregates

The contractor shall carry out any or all the tests on aggregates as may be required by the Engineer in accordance with IS: 2386 PARTS-I to VIII. The acceptance criteria of the samples tested shall be in accordance with the requirements of the relevant Indian Standards.

4.04.00 Water

Sampling and Testing of water being used for concrete works as per IS: 3550 will be carried out by the Contractor at regular intervals and whenever directed by the Engineer. The acceptance criteria will be as per IS: 456.

4.05.00 Admixture

4.05.01 Air Entraining Agents

Initially, before starting to use A.E.A., relationship between the percentage of air entrained and the cylinder cube crushing strength vis-a-vis quantity of A.E.A. used for all types of concrete will be established by the Contractor by carrying out sufficiently large number of tests. After that, at regular intervals and whenever directed by the Engineer, the Contractor will check up the actual percentages of air entrained and corresponding crushing strengths to correlate with the earlier test results.

4.05.02 Other Admixtures

Tests for establishing the various properties of any other admixtures, which may be required to be added, shall be carried out by the Contractor.

4.06.00 Concrete

The sampling of concrete, making the test specimens, curing and testing procedure etc. shall be in accordance with IS: 516 and IS: 1199, the size of specimen being 15 cm cubes. Normally, only compression tests shall be performed but under special circumstances the Engineer may require other tests to be performed in accordance with IS: 516. Sampling procedure, frequency of sampling and test specimen shall conform to IS: 456. To control the consistency of concrete from every mixing plant, slump tests shall be carried out by the Contractor every two hours or as directed by the Engineer. Slumps corresponding to the test specimens shall be recorded for reference. The acceptance criteria of concrete shall be in accordance with IS: 456. Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the Contractor at his own cost. In the course of dismantling, if any damage is done to the embedded



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items or adjacent structures, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer.

5.00.00 ACCEPTANCE CRITERIA

5.01.00 Standard Deviation

Standard deviation shall be based on test results and determination of Standard deviation shall conform to IS: 456.

5.02.00 Acceptance Criteria

The strength requirements and acceptance criteria shall conform to IS: 456.

5.03.00 Inspection and Core Tests

Inspection of concrete work immediately after stripping the formwork and core test of structures shall conform to IS: 456.

5.04.00 Load Test

Load tests of structural members as per IS:456 may be required by the Engineer, when the strength of test specimen results falls below the required strength.

If the member shows evident failure, the Contractor shall make the structure adequately strong free of cost to BHEL.

The entire cost of load testing shall be borne by the Contractor. If a portion of the structure is found to be unacceptable, it shall be dismantled and replaced by a new structure as per specification. The entire cost of dismantling and replacement and restoration of the site being borne by the Contractor.

If, in the course of dismantling, any damage is done to the embedded items and or other adjacent structures, the same will be made good, free of charge by the Contractor to the satisfaction of the Engineer.

6.00.00 RATES AND MEASUREMENTS

6.01.00 Cast-in-situ Concrete

6.01.01 Rates

- a) The unit rates shall include the cost of labour, materials, equipment, handling, transporting, botching, mixing, placing in position, vibrating, compacting, finishing, curing, testing, etc. at all elevations. This shall include the cost of curing by regular wetting or by using curing compound.

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- b) The unit rates shall include for all working conditions including at locations under water, liquid, mud, in or under foul positions and extreme weather conditions.
 - c) The unit rates for exposed concrete works (including machine foundations) shall include all incidentals, rendering, smoothening with carborandum stone, finishing with a paste of cement sand mortar, curing, etc.
 - d) The unit rates shall include all arrangement for maintaining stability of structure during execution.
 - e) Nothing extra shall be payable for the handling/mixing of extra cement on account of any reason or pouring of second stage concrete.
 - f) Nothing shall be payable to the Contractor on account of facilities and arrangement provided by him for conducting ultrasonic pulse velocity (UPV) tests or other relevant tests to ascertain grade and quality, etc. of the concrete in case the concrete quality is in doubt and contractor has to establish the quality by further tests. In case of any defects, the Contractor shall rectify the same by cement/epoxy grout at his own cost.
- However, mandatory UPV test as specified in the drawings shall be carried out including arrangement of all its facilities, staging, etc. and shall be payable to the contractor as per BOQ item.
- g) The unit rates for controlling of the temperature of concrete shall include storing and mixing of ice, water, cooling of aggregate etc.
 - h) The quoted rate shall include the cost of MIX design, making of all trial mixes using admixtures and mixing in concrete etc. complete.

6.01.02

Measurements

- a) Actual volume of concrete work as executed or as per drawings issued, whichever is less shall be measured in cubic metres to the nearest two decimals.
- b) No deductions shall be made for the following:
 - i) Ends of dissimilar materials embedded inside for example, beams, posts, girders, rafters, purlins, trusses, corbels and steps upto 500 sqcm in cross section;
 - ii) Opening upto 0.1 sq.m.

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iii) Volume occupied by reinforcement, sleeves, anchor bolts, and similar items.

iv) Volume occupied by pipes, conduits, sheathing, etc. not exceeding 100 sq.cm. each in cross sectional area.

c) The concrete works of different grades; below and above ground floor finished level shall be measured separately, unless otherwise specified in the schedule of items. Accordingly rates shall be applied for concrete in foundation for concrete below ground floor finished level and concrete in superstructure for concrete above ground floor finished level.

d) For temperature control measures, measurement shall be done in terms of quantity of concrete in cum. in concreting of which the ice have been used or cooling of aggregates has been done to keep the temperature of freshly laid concrete to less than 23°C.

6.02.00 Reinforcement

6.02.01 Rates

a) The unit rates shall include for cover block, providing binding wire, welding, separator pieces between two or more layers of reinforcement required for keeping the steel in position, etc. at all elevations.

b) No extra will be paid for transportation from stores, cleaning, straightening of steel, cutting, bending, binding with annealed wire, welding, tack welding, placing the reinforcement modification of already embedded reinforcement, if required, due to faulty fabrication or placement and other cost of tools and plants, materials, labours, return of unused steel to the store, etc.

c) However, lap welding of reinforcement steel if permitted shall be paid under separate item as provided in the BOQ and no deduction for labour and binding wire saved for not providing lap length shall be made. Similarly, splicing of reinforcement bars using mechanical couplers if permitted shall be paid under separate item as provided in the BOQ and no deduction for labour and binding wire saved for not providing lap length shall be made.

d) No extra shall be paid for preparing and getting approved bar bending schedules (including all revisions).

e) Generally members are straight and have straight edges. However, for bending, binding, placing of reinforcement in any curved member in length

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or cross section or both, no extra payment shall be made.

6.02.02 Measurements

- a) Bar or any other type of reinforcement used like hard drawn steel wire fabric etc. for reinforced concrete shall be measured by weight in tonnes. The weight shall be arrived at by multiplying the actual or theoretical length measured alongwith standard hooks, cranks, bends, authorized laps, etc. whichever is less by the sectional weights. Claims for payment for this item shall be submitted with supporting documents giving the schedule of bars with sketches. The sectional weight to be adopted shall be IS Section weight. Nothing extra will be payable to the Contractor on account of, difference in weight, if any, due to different methods adopted for issue and measurement.
- b) Standard hooks, cranks, bends, authorised laps, supports, hangers and chairs which are covered in approved bar bending schedule shall be measured in tonnes.

6.03.00 Formwork and Staging

6.03.01 Rates

- a) The unit rates shall be inclusive of all staging, scaffolding, making the formwork watertight, etc. for all elevations and in all types of works.
- b) No separate payment shall be made for providing fillets, for rounding or chamfering at junctions, comers, etc.
- c) The unit rates shall include the cost of labour, materials etc. and the extra time, which shall be required for the removal of shuttering/ support for satisfactory completion of work.
- d) No extra payment shall be made on account of difficulty, wastage etc. for placement/removal of formwork between the network of closely placed steel beams or for the lacing/bracing portions and ribbed slab constructions.
- e) Payment for curved shuttering shall be made for curved members/wall whose centerline radius in plan is less than 6m.
- f) If the contact surface area in pockets is less than or equal to 0.1 sq.m. in each case, payment shall be done under item for providing formwork in pockets.

6.03.02 Measurements

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a) Formwork for different classes (types) shall be measured separately as the actual surface in contact with the concrete and paid on area basis unless included in the rate for concrete. The unit of measurement shall be in sq.m.

b) Openings upto 0.1 sq.m or boxing left for inserts etc. for facility of Contractor's work, shall be neglected as if nonexistent for the purpose of formwork measurement of surface in which the openings occur.

For suspended floor, no deduction shall be made for flange area of secondary steel beams.

d) No measurement shall be taken for the formwork in pockets, openings, chases, blockouts, etc. in concrete, the contact surface area is less than or equal to 0.1 sq.m. in each case.

e) For pockets, if the contact surface area is less than or equal to 0.1 sq.m. in each case, measurement shall be done under item for providing formwork in pockets.

e) Formwork, if required, for joints shown on drawing or instructed by the Engineer, shall be paid for the 'leading side' only.

6.04.00 Embedded Parts

6.04.01 Rates

a) The unit rate for erection of embedded steel parts, supplied by Engineer shall include transportation from Owner's store to the place of work, erection & installation including setting material in concrete, etc. complete.

b) The unit rate for MS pipe embedments and PVC pipe embedments shall include cutting, welding, fabrication, erection, embedding, and transportation to site. Unit rate shall also include the cost of the pipes.

c) Rate for expansion fasteners shall include cost of fasteners, installation, and fixing including cost of washers and nuts and site testing if required.

6.04.02 Measurements

a) The measurement of the embedded steel parts fabricated and installed by the Contractor shall be based on the calculated weight of steel sections in tonne corrected to second place of decimal.

b) Embedded steel parts supplied by Owner and installed by Contractor Measurement shall be done for the net weight of the embedments installed in tonnes correct to second place of decimal.

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- c) For PVC pipes/conduits, measurements shall be in quintals correct to second place of decimal for the net weight.
- d) For mild steel pipes, measurement shall be in quintals, correct to second place of decimal, for the net weight of the steel pipe supplied, fabricated, and installed.
- e) The lugs shall be measured in Kg. correct to second place decimal for the net weight.
- f) The expansion fasteners shall be measured in number according to tension capacity.
- g) The rails shall not be treated as embedded steel part and the track shall be measured in running metres along the centre line and paid for under separate item of work as specified in schedule of items. Other related civil items associated with the laying of track shall be measured separately and paid under respective items of works.

6.05.00 Groutings

6.05.01 Rates

Rate shall include the cost of surface preparation, admixtures, and curing.

6.05.02 Measurements:

- a) Measurement shall be in cubic decimeters.
- b) Measurement for grouting shall be by volume of the block out, pockets or bolt hole upto the top surface of foundation concrete and shall be calculated from the dimensions shown on the drawings.
- c) Measurement for underpinning shall be by volume between the top surface of the foundation concrete and the underside of the base plate, the plan dimensions being as indicated on the drawings.
- d) No deduction shall be made for shims, bolts, shear keys and such other embedments.
- f) Pressure injection grouting with cement based grout if required as per drawing shall be applied at appropriate spacing to cover the desired surface area and measurement shall be made for the surface area grouted in sqm as per BOQ item. However in water retaining structures, the structural grouting if required to ensure water tightness shall not be payable

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separately as deemed to be covered in water retaining concrete item of BOQ.

6.06.00 Joints

6.06.01 Rates

The unit rate shall include all the activities described in the schedule of items.

6.06.02 Measurements

a) Bitumen Board/Expanded polystyrene.

The measurement for bitumen board shall be based on actual finished surface area in square meters nearest to second decimal, for the specified thickness.

b) Water Stops

The measurement for water stops shall be in running metres of actual length of the joint covered, for specified thickness, width, and shapes. No separate measurement shall be made for laps/splices for cross-joints and mitered joints.

c) Metal Cover Strips

The measurement for Metal Cover Strips shall be based on actual finished surface area in square metres for the specified thickness.

d) Vibration Damping Resilient Pads

The measurement for this item shall be in square metres for the specified thickness, measured correct to the second place of decimal, of the actual finished surface area.

6.07.00 Dismantling/Demolishing Work – RCC and PCC and Chipping of Concrete

6.07.01 Rates

The unit rates shall include the cost of all necessary propping, shoring, underpinning scaffolding, safety measures, temporary enclosures, disposal/stacking of serviceable/unserviceable materials, etc. for all types of work and for all grades of concrete.

In the case of dismantling/demolishing work, the cutting of reinforcement shall also be included in the rate.

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In the case of chipping work, the cutting of reinforcement shall be paid separately.

If the serviceable material including reinforcement steel from dismantled structure is allowed to be used/taken out by bidder, suitable rebate shall be given by bidder.

6.07.02 Measurements

- a) Dismantling of PCC and RCC work shall be measured in cu.m separately. Measurement of all work, except hidden work shall be taken before execution of work and no allowance for increase in bulk shall be allowed. Specifications for deductions of voids, openings etc, shall be done on the same basis as that applied for construction work.
- b) Chipping of concrete, making holes/pockets etc. shall be measured in cubic decimeters (i.e. 0.001 cu.m.).
- c) Cutting of reinforcement in chipping work for making of pockets and openings shall be measured in sq. cm. of cross-sectional area.

6.08.00 Precast Concrete

This clause shall be read in conjunction with relevant provisions specified elsewhere for cast in-situ Concrete.

6.08.01 Rates

- a) The unit rate shall include cost of preparation of casting yard, formwork, concrete and its casting, finishing as specified, setting filling of gaps between adjacent pre-cast concrete units with concrete, or cement mortar, curing, handling, erection, grouting, welding, preparation of supporting surface, etc.

6.08.02 Measurements

The measurement of pre-cast concrete members shall be on the basis of volume of concrete in cubic metres nearest to second place of decimal. No deduction shall be made for volume occupied by reinforcement/inserts/sleeves and for openings up to 0.1 sq.m. The setting of element with cement mortar shall not be measured separately The filling of concrete cement mortar between the gaps of adjacent precast units shall be considered while computing the volume of pre-cast concrete work and shall be paid for under this item itself.



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7.00.00

LIST OF IS CODES AND STANDARDS FOR REFERENCE

All work under this specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not specifically covered by Indian standard Specifications, any other standard practice, as may be specified by the Engineer, shall be followed:-

IS: 73 - Indian Standard Specification for Paving Bitumen

IS: 216 - Indian Standard Specification for Coal Tar Pitch

IS: 383 - Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete

IS: 432 - Indian Standard Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for concrete Reinforcement

IS: 455 - Indian Standard Specification for Slag Cement

IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete

IS: 457 - Indian Standard Code of Practice for General Construction of Plain and Reinforced Concrete for Dams and other Massive Structures

IS: 516 - Indian Standard Specification for Methods of Test for Strength of Concrete

IS: 702 - Indian Standard specification for industrial bitumen.

IS: 1199 - Indian Standard Specification for Methods of Sampling and Analysis of Concrete

IS: 1322 - Indian Standard Specification for Bitumen Felts for



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Waterproofing and Damp-proofing

- IS: 1489 - Indian Standard Specification for Portland Pozzolona Cement
- IS: 1566 - Indian Standard Specification for hard drawn steel wire fabric for concrete reinforcement.
- IS: 1609 - Code of Practice for Laying Damp-proof Treatment using Bitumen Felts
- IS: 1786 - Indian Standard Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement.
- IS: 1791 - Indian Standard Specification for Batch Type Concrete Mixers.
- IS: 1838 - Indian Standard Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).
- IS: 2185 - Indian Standard Specification for Hollow Cement Concrete Blocks
- IS: 2210 - Indian Standard Specification for Design of Reinforced Concrete shell Structures and Folded Plates
- IS: 2386 - Indian Standard Specification for Methods of Test for Aggregates for Concrete - Part-I to VIII
- IS: 2502 - Indian Standard Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
- IS: 2505 - Indian Standard Specification for Concrete Vibrators, Immersion Type
- IS: 2506 - Indian Standard Specification for Screed Board Concrete Vibrators
- IS: 2514 - Indian Standard Specification for Concrete Vibrating Tables
- IS: 2571 - Code of practice for laying in-situ cement concrete floors.
- IS: 2645 - Integral cement water proofing compound
- IS: 2722 - Indian Standard Specification for Portable Swing Weigh Batches for Concrete (Single and Double Bucket type)



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IS: 2750 -	Indian Standard Specification for steel scaffoldings.
IS: 2751 -	Code of Practice for Welding of Mild Steel Bars used for Reinforced Concrete Construction
IS: 2770 -	Indian Standard Specification for Method of Testing Bond in Reinforced Concrete
IS: 3025 -	Indian Standard specification for Methods of Sampling and Test (Physical and Chemical) for Water used in Industry
IS: 3067 -	Code of practice for general design details and preparatory work for damp proofing and water proofing of building.
IS: 3201 -	Indian Standard Specification for Design and Construction of Precast Concrete Trusses
IS: 3370 -	Indian Standard Specification for Code of Practice for Concrete Structures for Storage of Liquids
IS: 3414 -	Code of practice for design and installation of joints in buildings.
IS: 3550 -	Indian Standard Specification for Method of Test for Routine Control for Water used in Industry
IS: 3558 -	Code of Practice for use of Immersion vibrators for Consolidating Concrete
IS: 3696 -	Safety Code for Scaffolding and Ladders
IS: 3812 -	Indian Standard Specification for Fly Ash for Use as Admixture for Concrete
IS: 4014 -	Code of practice for steel tubular scaffolding.
IS: 4031 -	Indian Standard Specification for Method of Tests for Hydraulic Cement
IS: 4082 -	Indian Standard Specification for Recommendation on Stacking and Storage of Construction Materials at site
IS: 4090 -	Indian Standard Specification for Design of Reinforced Concrete Arches
IS: 4634 -	Indian Standard Specification for Method of Testing



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Performance of Batch-type Concrete Mixes

- IS: 4656 - Indian Standard Specification for Form Vibrators for Concrete
- IS: 4925 - Indian Standard Specification for Concrete Batching and Mixing Plant
- IS: 4926 - Indian Standard Specification for Ready Mixed Concrete
- IS: 4990 - Indian Standard Specification for Plywood for Concrete Shuttering work
- IS: 4991 - Indian Standard Specification for Blast Resistant Design of structure for Explosion above ground
- IS: 4995 - Indian Standard Specification for Design of Reinforced Part-I & II Reinforced Concrete Bins for the Storage of Granular and Powdery Materials
- IS: 4998 - Indian Standard Specification for Design of Reinforced Concrete Chimneys.
- IS: 5256 - Code of practice for sealing joints in concrete lining on canals.
- IS: 5512 - Indian Standard Specification for Flow Table for use in Tests of Cement and Pozzolanic materials
- IS: 5513 - Indian Standard Specification for vacate Apparatus.
- IS: 5515 - Indian Standard Specification for Compaction Factor Apparatus.
- IS: 5525 - Recommendation for detailing of reinforcement in reinforced concrete works.
- IS: 5624 - Indian Standard Specification for foundation bolts.
- IS: 5751 - Indian Standard Specification for Precast Concrete Coping Blocks.
- IS: 5816 - Indian Standard Specification for Method of Test for Splitting Tensile strength of Concrete Cylinders.
- IS: 5891 - Indian Standard Specification for Hand operated Concrete Mixers.
- IS: 5892 - Indian Standard Specification for transit mixer and agitators.



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- IS: 6452 - Indian Standard Specification for High Alumina Cement for Structural Use
- IS: 6909 - Indian Standard Specification for Super sulphated Cement
- IS: 6923 - Indian Standard Specification for Method of Test for Performance of Screed Board Concrete Vibrators.
- IS: 6925 - Indian Standard Specification for Method of Test for Determination of Water Soluble Chloride in Concrete Admixtures.
- IS: 7242 - Indian Standard Specification for Concrete Spreaders.
- IS: 7246 - Indian Standard Specification for Table Vibrators for Consolidating Concrete.
- IS: 7251 - Indian Standard Specification for Concrete Finishers.
- IS: 7293 - Safety code for working with construction machinery.
- IS: 7320 - Indian Standard Specification for Concrete Slump Test Apparatus.
- IS: 7861 - Indian Standard Specification for Recommended Practice Part-I&II for Extreme Weather Concreting.
- IS: 7969 - Safety Code for Storage and Handling of Building Materials.
- IS: 8041 - Indian Standard Specification for Rapid Hardening Portland cement.
- IS: 8112 - Indian Standard Specification for high strength Ordinary Portland Cement.
- IS: 8142 - Indian Standard Specification for Determining Setting time of concrete by Penetration Resistance.
- IS: 8989 - Safety Code for Erection of Concrete Framed Structures.
- IS: 9012 - Recommended method for shortcreting.
- IS: 9013 - Indian Standard Specification for Method of Making, Curing, and determining compressive Strength of Accelerated-cured Concrete Test Specimens.



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- IS: 9077 - Code of Practice for Corrosion Protection of Steel Reinforcement in RB and RCC Construction.
- IS: 9103 - Indian Standard Specification for Admixtures for Concrete.
- IS: 10262 - Recommended Guidelines for Concrete Mix Design.
- IS: 13311 - Non-destructive testing of concrete.
- SP: 34 - Handbook of concrete, reinforcement and detailing.



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**Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301**



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CARPENTRY AND JOINERY

1.00.00 SCOPE

This section covers supply, fitting and fixing of timber frames to doors and windows with M S holdfasts, flush doors, windows, shutters, partitions, wall panelling, pelmets, shelves, furniture, etc. as shown in drawings, including a prime coat of approved paint, varnish, or fixing of decorative plastic laminate where called for. This shall also include the supply and fixing of all hardware and fixtures shown in drawing or specified.

2.00.00 INSTALLATION

2.00.01 Materials

a) Timber

Unless otherwise specified, all timber shall be best quality well seasoned CP teakwood free from large or loose knots, cracks or any other defects. All timber shall be treated with approved wood preservative before use, unless specified otherwise. The rough timber shall be approved by the Engineer before incorporating in the works and starting the carpenter's work.

b) Plywood

Plywood shall be of commercial quality or with decorative surface veneer. Unless specifically permitted otherwise, the adhesive used in plywood shall be phenol formaldehyde synthetic resin of BWP grade conforming to IS: 848.

c) Decorative Laminated Plastic Sheets

The colour, pattern, finish and texture shall be approved by the Engineer. The bulk supply shall be procured in full sheet sizes which will ensure the least number of joints in one surface.

d) Flush Doors

Flush doors shall be solid core doors with commercial or decorative faces and hardwood edges conforming to IS: 2202 (Part-1). The core for solid core doors shall be of block board or wood particle board. Manufacturer's literature and test certificates shall be submitted for the approval of the Engineer. The Contractor shall give a guarantee that the adhesive used is BWP grade phenol formaldehyde synthetic resin conforming to IS: 848.

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The thickness shall be as specified.

e) Panel Doors

Panel door shall be of teakwood shutter frame, unless otherwise noted and panels with teakwood/commercial ply/teakwood particle board. Other considerations shall be as mentioned in item (d) above.

f) Windows, Ventilators

Windows and ventilators shall made of teakwood shutter frame, unless specified otherwise and glazing of specified thickness shall be fixed with wooden beadings.

g) Fixtures

Fixtures for doors, windows, furniture etc. shall be as shown on drawing or specified.

2.02.00 Workmanship

2.02.01 General

The work shall be done by skilled carpenters as per details shown on drawing or instructed by the Engineer.

Framing timber and other work shall be close - fitting with proper wood joinery, accurately set to required lines or levels and rigidly secured in place. The surface of frames etc., which will come in contact with masonry after fixing, shall be given two coats of approved paint before fixing. Mastic caulking shall be done after fixing external door and window frames. Special care shall be taken to match the grain of timber or plywood, which will be subsequently polished. Screwing or nailing will not be permitted to the edge of plywood and particle board. The edge of all plywood, blackboard and particle board shall be finished with teakwood lipping unless otherwise shown on drawings.

Fixing to frames and partitions shall generally be with 40 mm x 6 mm x 300 mm long M S holdfasts bifurcated at end and grouted with 1:2:4 cement concrete. The gap between masonry and external door and window frame shall be caulked with polysulphide mastic. M.S. grills or guard bars shall be provided to windows where called for in the drawings.

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2.02.02 Finish

All carpentry work after finishing shall be sand papered smooth. A prime coat paint shall be given after inspection of the Engineer to all surfaces other than those, which shall be subsequently polished or covered with laminated plastic sheet.

2.02.03 Surface Treatment

When shown on drawings or called for, decorative ply or laminated plastic sheets shall be bonded under pressure to the surface to be finished. The adhesive used shall be of brand and brought to site in sealed containers. The rate of application and the length of time for which the pressure is to be applied shall be as per the manufacturer's instructions. The edge of sheets shall be protected by teak lipping or bevelled as shown on drawings.

3.00.00 ACCEPTANCE CRITERIA

3.00.01 Door and Window Frames

All frames shall be square and flat at the time of delivery and shall be checked for dimensions and corner angles. After fixing they shall be on a fine vertical plane. All external door and window frames shall be caulked with mastic.

3.02.00 Door and Window Shutters

All doors and window shutters shall be of proper size, shape, and design and free of warp. When fixed to frames, these shall operate smoothly without jamming and all latching or locking devices shall engage properly without undue pressure.

3.03.00 Partitions, Paneling, Pelmet, Furniture, etc.

3.03.01 General

These shall conform to drawings in all details. No unsightly nail marks etc. shall be permitted. Plywood grains shall be matched to give a uniform and pleasing appearance.

3.03.02 Partition

Shall be checked for rigidity of fixing, plumb and horizontal as well as vertical alignment.



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3.03.03 Pelmets

Shall be checked for rigidity of fixing and adequate clearance of fixture.

3.03.04 Cupboard Shutters

Shall operate smoothly without jamming and locks, bolts and double ball catches shall engage securely. Single ball catches shall not be used.

3.03.05 Drawers

Shall operate smoothly and have backstops to prevent them from being pushed too far. Locks shall engage securely.

3.03.06 Loose Furniture

When placed on a level surface, tables tops etc. shall be horizontal and the pieces stand stably on legs or supports.

4.00.00 IS CODES

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

IS: 848 - Synthetic resin adhesives for plywood (Phenolic and Aminoplastic)

IS: 1003 - Timber panelled and glazed shutters.

IS: 2191 - Wooden flush door shutter (Cellular and hollow core type).

IS: 2202 - Wooden flush door shutters (solid core type).

IS: 4021 - Timber door, window, and ventilator frames.

5.00.00 RATES AND MEASUREMENT

5.01.00 Rates



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Rates shall include of all activities mentioned in “Schedule of Item” for completion of the work. No separate payment shall be made for fixing, caulking, application of primer coat, polishing, providing of butt hinges, holdfasts, sliding/tower bolts, door stoppers, door closers and other fittings and fixtures.

5.02.00 Measurement

Measurement shall be done in Sqm for doors, windows, ventilators, shutters, partitions etc.

Measurement for wooden frame shall be in CuM.

Pelmets shall be measured in RM.



**TECHNICAL SPECIFICATION FOR
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INSULATION AND ALLIED WORKS**

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**ROOF AND UNDERGROUND STRUCTURES WATER
PROOFING, INSULATION AND ALLIED WORKS**

SPECIFICATION NO. PE-TS-999-600-C004



**Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301**



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**ROOF AND UNDERGROUND WATER PROOFING,
INSULATION AND ALLIED WORKS**

1.00.00 SCOPE

This section covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of roof and underground water-proofing, insulation and allied works for buildings and at locations covered under the scope of this package.

2.00.00 INSTALLATION

2.01.00 GRADING UNDERBED

The surface to receive the underbed shall be roughened and thoroughly cleaned with wire brush and water. Oil patches if any shall be removed with detergent. The surface shall be soaked with water and all excess water removed just before laying of the underbed.

The underbed shall not be laid under direct hot sun and shall be kept in shade immediately after laying so as to avoid quick loss of water from the mix and separation from the roof surface. The underbed shall be cured under water for at least 7 days.

The underbed shall be laid to provide an ultimate run off gradient not less than 1 in 120 and as directed by the Engineer. Upto an average thickness of 25mm the underbed shall usually be composed of cement and sand plaster. For higher thickness the underbed shall be made with cement concrete. The underbed shall be finished to receive the waterproofing treatment direct or insulation as the case may be.

2.01.01 Cement Mortar Underbed

The underbed grading plaster shall be average 25 mm thick maximum. It shall consist of cement and coarse sand in the ratio 1:4 nominal by volume. The sand and cement shall be thoroughly mixed dry and then water added. Each batch of mix shall be consumed before the initial set starts.

The plaster shall be fully compacted to the desired grade in continuous operation. The surface shall be even and reasonably smooth.

2.01.02 Cement Concrete Underbed

The underbed cement concrete shall be used where the subgrade is more than average 25 mm thick. It shall consist of cement concrete 1:2:4 nominal mix

by volume with 12 mm down stone chips and coarse sand. The aggregate shall be mixed dry and minimum quantity of water shall be added to make the mix workable.

The mix shall be laid to proper grade, fully consolidated and surface shall be smooth and even.

2.02.00 INSULATION

The Tenderer shall, along with the tender, send specifications of insulating materials he proposes to use and the proposed method of laying. Before bulk supply, the contractor shall send samples of insulating material to the Engineer, and after approval of the samples, the Contractor shall procure and transport the bulk material to the site. Whenever asked by the Engineer, the Contractor shall furnish test certificates from testing laboratory on the insulating and other properties of the materials.

After laying the insulation, the surface shall be made ready as required to receive the waterproofing treatment. If any plastering is used it shall be not leaner than 1:4 cement sand by volume and not thinner than 12 mm and it shall be cured for seven days.

2.02.01 Foam Concrete

This shall be of lightweight foam concrete of average 50 mm thickness or as specified or as shown on drawings. This may be laid in situ in suitable panels or precast blocks. The insulating properties shall be such that the thermal conductivity shall not exceed 0.125 Kcl/sq.m. hr degree C. Before starting the laying of foam concrete samples shall be prepared at site and got tested for approval of the Engineer.

The foam concrete laid shall be sufficiently strong to withstand the usual workload and standard loads expected on the roof. Any damaged portion shall be removed and replaced forthwith. Approval of the Engineer shall be taken before laying the waterproofing over the insulation.

While laying the foam concrete, samples from each batch of the mix shall be kept for test if so desired by the Engineer.

2.02.02 Expanded Polystyrene Blocks

The expanded polystyrene block Insulation shall be fire retardant quality and shall have a maximum thermal conductivity of 0.026 Kcl m/sq.m h °C. It must be strong enough to withstand without any deformation under the workload and standard loads expected on the roof.

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The Contractor shall lay the expanded polystyrene block as per manufacturer's approved specification. Only specifically experienced workers shall be used for this work. If the Engineer is not satisfied about the efficiency of the workers the Contractor shall secure manufacturers supervision at no extra cost to the Owner.

2.03.00 Fillets

Fillets at Junction of roofs and vertical walls shall be provided with the same insulating material as provided for the main roof insulation. The fillets shall be 150 mm x 150 mm in size unless otherwise shown on drawings or instructed by the Engineer.

Where there is no insulation over roof slab, fillets shall be cast-in-situ cement concrete (1:2:4) nominal mix volume.

2.04.00 Waterproofing Treatment

2.04.01 Bitumen Felt Treatment

Waterproofing treatment shall be laid by a specialist firm with long experience in the particular trade.

The waterproofing treatment for roofs with bitumen felts shall be done following relevant IS: 1346. Bitumen felt shall conform to IS: 1322 and Bitumen primer to IS: 3384.

The bonding materials shall consist of blown type conforming to IS: 702 or residual bitumen conforming to IS: 73 or a mixture of the two to withstand local conditions of prevailing temperature or gradient of roof surface. The Contractor shall convince the Engineer that the bonding material proposed to be used is suitable for the particular job.

The Contractor shall state the source from where he proposed to procure the materials. Samples of the self-finished felt shall be submitted in advance to the Engineer along with test certificates for his review. Test certificates for the bonding materials shall also be submitted and samples, if desired by the Engineer, shall be provided for confirmatory tests. Samples shall be submitted if instructed by the Engineer.

Minimum overlaps of 100 and 75 mm shall be given at the end and sides of strips of felt and properly bonded with bitumen. Joints in successive layers of felt shall be staggered.

Normal treatment with one layer of felt, heavy treatment with two layers of felt

or Extra Heavy treatment with three layers of felt shall be indicated. Brief details of the various treatments shall be as follows:

a) Normal Treatment - Five courses

- 1) Primer coat conforming to IS:3384 applied at the rate 0.27lits/sqm min.
- 2) Hot applied bitumen at the rate of 1.2 kg/sq.m. (min.)
- 3) Hessian base self finished felt, type 3, grade 1.
- 4) Hot applied bitumen at the rate of 1.2 kg/sq.m. (min.)
- 5) 20 mm thick pressed precast concrete tiles with 15 mm, thick 1:4 cement-sand mortar underbed.

b) Heavy Treatment - Seven Courses

With Hessian base felt

- 1) Primer coat conforming to IS:3384 applied at the rate 0.27lits/sqm min.
- 2) Hot applied bitumen at the rate of 1.2 kg/sq.m (Min.)
- 3) Hessian base self-finished felt, type 3, grade 1.
- 4) Hot applied bitumen at the rate of 1.2 kg/sq.m (Min.)
- 5) Hessian base self-finished felt, type 3, grade I.
- 6) Hot applied bitumen at the rate of 1.2 kg/sq.m (Min.)
- 7) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement: sand mortar underbed.

or

With fiber base felt

- 1) Primer coat conforming to IS:3384 applied at the rate 0.27lits/sqm min.
- 2) Not applied bitumen at the rate of 1.2 kg/sq.m (Min.)
- 3) Fiber base self-finished felt, type 2, grade 2.
- 4) Hot applied bitumen at the rate of 1.2 kg/sq.m (Min.)

5) Fiber base self-finished felt, type 2, grade 2.

6) Hot applied bitumen at the rate of 1.2 kg/sq.m (Min.)

7) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement: sand mortar underbed.

c) Extra Heavy Treatment – Nine courses

With fiber based felt

1) Primer coat conforming to IS:3384 applied at the rate 0.27lits/sqm min.

2) Hot applied bitumen at the rate of 1.2 kg/sqm. (min.)

3) Fiber-base self-finished felt type 2, grade 1.

4) Hot applied bitumen at the rate of 1.2 kg/sq.m (min.)

5) Fibre base self-finished felt type 2, grade 1.

6) Hot applied bitumen at the rate of 1.2 kg/sqm. (min.)

7) Fibre base self-finished felt type 2, grade 1.

8) Hot applied bitumen at the rate of 1.2 kg/sqm. (min.)

9) 20 mm thick pressed precast concrete tiles with 15 mm thick 1:4 cement: sand mortar underbed.

or

With Hessian base felt

1) Primer coat conforming to IS:3384 applied at the rate 0.27lits/sqm min.

2) Hot applied bitumen at the rate of 1.2 kg/sqm. (min.)

3) Hessian base self-finished felt, type 3, grade 1.

4) Hot applied bitumen at the rate of 1.2 kg/sqm. (min.)

5) Hessian base self-finished felt, type 3, grade 1.

6) Hot applied bitumen at the rate of 1.2 kg/sqm. min.

7) Hessian base self-finished felt, type 3, grade 1.

8) Hot applied bitumen at the rate of 1.2 kg/sqm. min.

9) 20 mm thick pressed precast concrete tiles with 15 thick 1:4 cement: sand mortar underbed.

However, in special cases, more courses, or a combination of fibre base and hessian base felts may be asked for.

The surface to receive the waterproofing treatment must be cleaned and dried satisfactorily and the Engineer's approval taken before starting the work. If any existing waterproofing treatment is being augmented the existing top course shall be completely removed and all damaged felts or other defects repaired.

The Engineer may instruct the Contractor to lay part of the stipulated courses at the first instant to be followed later on with the balance courses. This interim finish shall be done with a course of hot applied bitumen. While doing the balance again hot bitumen shall be applied to start with after repair of all damages to the already laid course.

After completion the surface shall be cleaned taking care that felt cuttings etc. do not find their way into rainwater down comers.

2.04.02

Elastomeric Membrane

a) Material

The material shall consist of high solid content Polyurethane based cold liquid applied coatings as per ASTM C836-89a comprising of urethane pre-polymers extended with flexible material, which cure by reaction with atmospheric moisture to give a continuous film which is rubbery and elastic or any other equivalent material permitted as per ASTM and approved by the Engineer. The material shall consist of high solid coating designed to give a high-build film. The material shall not be diluted. The coating shall have physical feature like high viscosity, 90% solids, high resistance to impact, abrasion and cracking, superior tensile strength, application limit of 70°C minimum, 300% elongation and forming a perfectly smooth permanently flexible seamless membrane which should have good adhesion to roof substrates (RCC, tiles, brick, and metals), having a minimum life of 10 years. It should also be resistant to acid (mild concentrated), alkalies and have a very low water absorption rate (0.5%) max. at ambient temp. after 7 days.

The pack shall not be older than 9 months after the date of manufacture and packing.

b) Primer coat

It shall consists of polyurethane (P.U.) or any other equivalent material. Primer coat shall be a special blend of moisture curing urethane pre-polymers in solvent. A single coat of this primer shall be applied by brush over the prepared bed as an adhesion coat of an application rate of minimum 6 sq.m per litre.

The primer shall be allowed to dry for minimum of 2hrs. time before the successive finishing coats of P.U. liquid membrane are applied.

c) Finishing coats :

The finishing coats shall consist of two successive liquid coatings of high solids content urethane pre-polymers or equivalent material to form an elastomeric membrane. The overall dry film thickness shall be 1.5mm subject to minimum 500 gm per sq.m per coat application rate.

Each coat shall be allowed to dry for minimum 12 hours before applying the next coat. The surface should be dry and smooth before application.

The coating shall be continued up the parapets/walls for a minimum of 150mm over the finished roof surface. It shall be continued into rain water pipes by atleast 100mm.

The final coat of P.U. liquid when tacky shall be sprinkled with the sand.

For edges, expansion joints and any vulnerable points a later of polyscrim cloth /fabric to be embedded between 2 finishing coats.

d) Surface Finish :

Areas of roof treatment which are vulnerable to accidental damage shall be provided with wearing course consist of minimum 20 mm thick PCC of Grade M15 (using 12.5mm size aggregate) cast in panel of maximum size of 1.20m x 1.20m and reinforced with 0.56mm diameter galvanised chicken wire mesh and sealing of joints using sealant or elastomeric compound.

When the roof surface is subjected to foot traffic or used as a working area, a cement mortar (1:4) shall be applied over the top most layer of roofing treatment. Over this, a layer of chequered cement concrete flooring tiles conforming to IS:13801 shall be provided in place of stone grit and cement painted. The tiles shall be laid as per IS:1443.

2.04.03 Waterproofing By Epoxy Resin Based Application

Exposed surfaces of cement concrete, lime concrete or brickwork to be treated for waterproofing by the resin-based application shall be thoroughly cleaned and the epoxy resin based material to be applied as directed by the manufacturer. The material shall not have any adverse effect on the surface on which it is applied and must stick to it uniformly to make a strong durable bond. It shall not be affected by short duration fire, sun exposure, and light duty traffic. The application shall be resistant to growth of fungus and proof against saltpetre action. If desired by the Engineer, a sample shall be prepared in advance and tested for waterproofness for 48 hours under 300 mm depth of standing water. The Contractor shall arrange the demonstration by providing free the materials and labour for the application as free of cost to Owner. This item shall carry a guarantee as specified.

2.04.02 Flashing

Unless otherwise stated flashing shall be done in the same way as the waterproofing except that the last layer shall be finished with two coats of bituminous primer. The flashing shall be extended up the vertical surfaces as shown on drawing. The flashing shall end in grooves in vertical walls. The grooves shall be at least 65 mm deep and caulked with waterproof mastic cement. The minimum overlap with horizontal roofing felt shall be 100 mm.

Where specified or directed by the Engineer, metal flashing shall be provided. The materials shall be 18 Gage or 22 G G.I. sheets, as specified or as directed by the Engineer.

2.05.00 WATER-PROOFING OF UNDERGROUND STRUCTURES

Basements, ducts, pits, tunnels (excluding tanks) etc below the ground water table and in contact with soil are covered under this. Bonding material shall be blown bitumen of 65/25 grade conforming to IS: 702.

Waterproofing shall be provided on the outside of walls and top of RCC slab and shall be carried out upto 150mm above ground level. The number of layers of bitumen felt to be used for walls and floor unless otherwise shown in the drawing shall be:

- a) 2 layers - for depths up to 5m below ground level
- b) 3 layers - for depths beyond 5m below ground level

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2.05.01

Method of laying the bitumen felts and workmanship shall be as per IS: 1609 and IS: 3067. Water proofing work shall be taken in hand only when the sub-soil water level is at its lowest; the site shall be kept dry by adequate arrangements for pumping out water till the work has been completed.

For this purpose drains shall be formed along the edges of the excavation but beyond the building line, with suitable collecting sumps.

In case of large excavation areas where it is necessary to dewater under the floor, additional land drains shall be formed across the excavation, to adequately drain the area.

Adequate arrangement shall be made to protect the sides of excavation from slipping while the work is in progress.

The base concrete or mud-mat shall be rendered smooth by a 20mm thick sand-cement plaster (6:1). Any sharp edges/corners, over which the waterproofing course is to be laid, shall be eased out by means of cement.

The surface must be dry before the next operation is carried out.

Water proofing/damp proofing treatment:

A) Heavy Treatment (Two layers of felt)

- i) Primer (For vertical faces only), as per I.S. 3384.
- ii) Hot applied blown bitumen at the rate of 1.2 Kg/m²
- iii) Hessian base, bitumen felt type 3 grades 2
- iv) Hot applied blown bitumen @ 1.2 Kg/m²
- v) Hessian base, bitumen felt type 3 grade 2
- vi) Hot applied blown bitumen @ 1.2 Kg/m²

B) Extra Heavy treatment (Three layers of felt)

- i) Primer (for vertical faces only) as per I.S. 3384
- ii) Hot applied bitumen at the rate of 1.2 Kg/m²
- iii) Hessian base bitumen felt type 3 grades 2
- iv) Hot applied bitumen at the rate 1.2 Kg/m²

v) Hessian base bitumen felt type 3 grades 2

vi) Hot applied bitumen at the rate of 1.2 Kg/m²

vii) Hessian base bitumen felt type 3 grades 2

viii) Hot applied bitumen at the rate of 1.2 Kg/m²

The surface must be dry before the next operation is carried out at each stage said above.

The laying of felt over the bitumen so applied that it shall always commence on the floor, and shall be carried over to the walls only after treatment of the floor is complete. The minimum over lapping at sides and ends of strips shall be 10cm. Point for subsequent layers completely sealed by blow lamp.

A protective flooring of either brick flat in cement mortar (1:3) or 6cm thick cement concrete (M 15) or a coat of cement plaster (1:3) 4 cm thick shall be constructed over the bitumen layers to prevent damage to the latter during subsequent construction of the structural floor.

The walls shall be treated in a similar way; the bitumen felts joining at the base with the projecting felt laid over the mud-mat. The wall surface shall be made smooth where necessary with a coat of cement plaster (1:3), the felts laid as for the floor, ensuring that the surface to be treated is dry and then a protective brick wall, 12.5 cm nominal thickness shall be built in cement mortar (1:3) over the projecting mud-mat, the space between the wall and felt being grouted with cement.

3.00.00

ACCEPTANCE CRITERIA AND GUARANTEE

The surface level shall be such as to allow quick draining of rains without leaving any pool anywhere. The finishing course shall be fully secured and shall have an even density. There shall not be any bubble formation or crushed or squeezed insulation or underbed.

The contractor shall give a guarantee in writing for all works executed under this specification supplemented by a separate and unilateral guarantee from the specified agency for the roof waterproofing treatment work. The guarantee shall be for materials and workmanship as under:

For Bitumen Felt Treatment under clause no. 2.04.01: 5 years in case of normal treatment, 10 years for heavy treatment and 20 years for extra heavy treatment.

For Elastomeric Membrane under clause no. 2.04.02: 10 (ten) years

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STRUCTURES WATER PROOFING,
INSULATION AND ALLIED WORKS**

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In case guarantee is more stringent in owner specification, more stringent guarantee shall be applicable. The mode of execution of the guarantee shall be such, which shall be acceptable to the Owner.

4.00.00 I.S. CODES AND STANDARDS

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

a)	IS: 73	-	Paving Bitumen
b)	IS: 702	-	Industrial Bitumen
c)	IS: 1203	-	Methods of testing tar and bitumen
d)	IS: 1322	-	Bitumen felts for waterproofing and damp proofing.
e)	IS: 1346	-	Code of practice for waterproofing of roofs with bitumen felts.
f)	IS: 1609	-	Damp-proofing Treatment using Bitumen Felts – Code of Practice
g)	IS: 3067	-	Code of practice for General design details and preparatory work for Damp-proofing and water-proofing of buildings
h)	IS: 3384	-	Bitumen primer for use in waterproofing and damp proofing.

5.00.00 RATES AND MEASUREMENT

5.01.00 Rates

Rates shall be for complete work, including the cost of all materials and labour, as detailed in the specification unless any portion is specifically excluded in the “Schedule of Items”.

No extra shall be paid for finishing around opening, sleeves, pipes, ducts, inserts, etc.



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No separate payments shall be made for cleaning of surface, treating of cracks and surface preparation.

5.02.00

Measurement

The finished work shall be measured in Sqm of actual surface area for the purpose of payment.

No deduction shall be made and no extra shall be paid for openings upto 0.4 sqm.



TITLE:
**TECHNICAL SPECIFICATION
FOR METAL DOORS, WINDOWS,
VENTILATORS, LOUVERS ETC.**

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METAL DOORS, WINDOWS, VENTILATORS, LOUVERS ETC.

SPECIFICATION NO. PE-TS-999-600-C005



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:
**TECHNICAL SPECIFICATION
FOR METAL DOORS, WINDOWS,
VENTILATORS, LOUVERS ETC.**

SPECIFICATION NO. PE-TS-999-600-C005
VOLUME - II B
SECTION - D | SUB-SECTION – D5
REV.NO. 00 DATE 16/12/2017
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METAL DOORS, WINDOWS, VENTILATORS, LOUVERS ETC.

1.00.00 SCOPE

This section covers supplying and/or erecting and installing of all metal doors, windows, ventilators, louvers, glazed partitions, etc. The scope of work shall also include the assembly and erection of all doors, windows, louvers, glazed partitions, etc. Supplying and/or fixing of all door and window accessories and hardware are also included in the scope.

2.00.00 INSTALLATION

2.01.00 Materials

Steel sections used for fabrication of doors, windows etc. shall be standard rolled steel sections specified in IS: 1038 and IS: 1361 or as specified.

Steel sheets for frames, shutters, louver blades etc. shall be of gauge mentioned in drawings and schedules.

Aluminium sections for fabricating doors, windows, partitions etc. shall be extruded sections conforming to IS:733 or IS:1285 or as manufactured by Indian Aluminium Company Limited or approved equivalent. Aluminium door, windows and ventilator shall be fabricated as per IS:1948 and IS:1949. The alloy used shall conform to IS Designation HE 9-WP of IS: 733.

Hardware and fixtures shall be as specified and the best quality from approved manufacturers shall only be used. The tenderer shall specifically state the particular manufacturer's materials he proposes to use. Improper alignment or faulty operation due to inadequate strength of hardware or fixture shall entirely be the Contractor's responsibility.

All hardware and fixtures shall be able to withstand repeated use. Door closures shall conform to IS: 3564 and shall be suitable for doors weighing 61-80 Kg. unless otherwise stated. Each closer shall be guaranteed against manufacturing defect for one year and any defect found within this period shall be rectified or shall be replaced free of charge. Concealed door closers shall be either floor mounted or transom mounted, suitable for installation with metal doors. It shall conform to the performance Requirements and endurance test stated in IS: 3564 - Appendix-A. The Contractor shall submit samples of each type of hardware to the Engineer. The approved samples shall be retained by the Engineer for comparison of bulk supply. The samples shall be returned to the Contractor towards end for incorporation in the job. The mastic for caulking shall be of best quality from a manufacturer approved by, the Engineer. In general, mastic for fixing of metals frames shall be as per IS:



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1081 or as approved by the Engineer.

2.02.00 Fabrication

2.02.01 Steel Doors, Windows, Ventilators, louvers etc.

a) Door Frames

Frames shall be fabricated from 16 gage(G) sheets. They shall, be mortised, reinforced, drilled, and tapped for hinge lock and bolt strikes. Where necessary, frames shall be reinforced for door closers. Welded construction with mitered Corners shall be used. Rubber door silencers shall be furnished for the striking jamb. Loose “T” masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floor anchors shall be installed. Frames shall be brought to site with floor ties/weather bars installed in, place.

b) Double Plate Flush Door Shutters

Door shutters shall be 45 mm thick, completely flush design and shall comprise of the outer sheets or 18 G steel sheets, rigidly connected and reinforced inside with continuous vertical 20 G stiffeners, spot welded in position at not more than 150 mm on centres.

Both edges of doors shall be joined and reinforced full height by steel channels placed immediately inside and welded to the door faces. Top and bottom of doors shall be reinforced horizontally as shown on drawing by steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and heads, shall have proper level on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Pairs or double doors shall have meeting-stile edges bevelled or rebated. Where shown on drawing, or called for in the schedule of items, the doors shall be sound deadened by filling the inside voids with mineral wool or other suitable approved materials.

Doors shall be mortised, reinforced, drilled, and tapped in shop for hinges, locks, and bolts. They shall also be reinforced for closers, push-plates, and other surface hardware where necessary. Any drilling and tapping required for surface hardware shall be done at site. Where shown drawing, provision shall be made for fixing glazing, vision panels, louvers etc. glazing mouldings shall be of 18 G steel or extruded aluminium sections and suitable for fixing 6 mm. glass. Louvers blades shall be V or Z shaped and made out of 16 G sheets.



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c) Single Sheet Door Shutters

Single sheet doors shall be made from best quality 18 G mild steel sheets, and shall present a flush surface on the outside. The inside shall be stiffened with semi tubular edge and central stiffening rail, which shall convey the lock and other fixture. The frames shall be made from best quality, 16 G mild steel sheets.

Wherever required, provisions for fixing glass panes, louvers etc. shall be made.

The manufacturing shall be done as specified in 2.02.01 (b) "Double Plate Flush Door Shutters."

d) Sliding Door

Sliding doors shall be either double plate or single plate Construction made out of 18 gauge steel sheets with adequate stiffeners. The contractor shall specify the weight of the door in his shop and submit the manufacturer's catalogue of the sliding gear he proposes to use. Where called for the Contractor shall make provision for openings to the door for monorail beams. Doors shall close positively to exclude rainwater from seeping in. When called for, sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

e) Door Threshold

Door threshold shall be provided. Doors without threshold shall have bottom tie of approved type.

f) Steel Windows, Sashes, and Ventilators etc.

These shall conform in all respects to IS: 1038 and IS: 1361 latest editions. The details as called for in the above codes shall be applicable for coupling mullions, transoms, weather bars, and pivot arrangements for ventilators, etc. or as called for. All welds shall be dressed flush on all exposed and contact surfaces. Where composite unit openings are required the individual window units shall be joined together with requisite transoms and mullions. All windows shall be outside glazed, fixed with putty or metal glazing beads as specified. Where aluminium glazing beads are specified, they shall be extruded aluminium channel 9.5 mm x 9.5 mm x 1.6 mm (Indal Section No. 2209) unless otherwise shown on drawings. Aluminium beads shall be given one coat of zinc chromate primer before fixing to windows.



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2.02.02**Aluminium Door, Windows, and Frames**

Extruded sections shall have a minimum 3 mm wall thickness. All sections shall be approved by the Engineer before fabrication is taken up. Doors frames, mullions, transom etc. shall be anodized in a bath of sulphuric acid to provide a clear coating of minimum 15 micron thickness. The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent Coating shall be applied to the sections before shipment from the factory.

All work shall be fitted and shop assembled to a first class job, and ready for erection. Shop joints shall be made to hair lines and then welded or braced by such method as will produce an uniform colour throughout the work. Work on the above, other than described, shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joints shall be made in concealed locations and on edges of doors. Field connections of all work may be made with concealed screws or other approved type of fasteners. Glazing beads shall be snap fit type without visible screws and shall be of sizes to accommodate 6 mm thick glazing. All work shall be adequately braced and reinforced as necessary for strength and rigidity.

2.03.00**Shop Coat or Paint**

The shop Paint for steel doors, windows etc. shall be best lead or zinc chromate primer paint from, approved manufacturer. All surfaces shall be thoroughly cleaned of rust, grease, loose mill scales etc. and given one coat of shop paint. Portions like mullions, transoms etc. that will be inaccessible after assembly of units shall be given an extra coat of paint before assembly.

Where called for, all steel doors, windows, etc. shall be hot dip galvanized to give a coating weight of 1½ - 2 oz. per sqft. One coat zinc chromate primer coat shall then be applied as shop paint.

Portions of aluminium frame, which come in contact with masonry construction shall be (before shipment from workshop) protected with a heavy coat of alkali resistant paint. Aluminium coming in contact with other incompatible metals shall be coated with zinc chromate primer.

2.04.00**Handling & Storage of Fabricated Material**

All metal doors, windows, etc. shall be packed and crated properly before dispatch, to ensure that there will be no damage to the fabricated materials. Loading into wagons and trucks shall be done with all care to ensure safe arrival of materials at site in undamaged condition.



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When taking delivery of items supplied by Owner, the Contractor shall satisfy himself that the items supplied are up to the specified standard. Any defect detected shall promptly be brought to the notice of the Engineer.

All metal doors, windows etc. shall be stored under cover in a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminium products by rust, mortar etc.

2.05.00**Assembly & Erection at Site**

In general, the fixing of steel doors, windows, ventilators, louvers, etc. shall conform to IS: 1081. The Contractor shall assemble and install all steel doors, windows, sashes, fixed metal louvers, etc. including transoms and mullions for composite units in respective places, keening proper "Lines and levels", and in approved workmanlike manner, to give trouble free and leak-proof installations. Installation shall be done according to instructions of the manufacturer, and/or as approved by the Engineer. If required by the Engineer, the installation shall have to be carried out under the supervision of the manufacturer's staff. The Contractor shall take all precaution against damage of the components during installation. Necessary holes, chases, etc. required for fixing shall be made by the Contractor and made good again as per original, after installation, without any extra charge.

After installation of steel doors, windows, etc. all abrasions to shop-coat of paint shall be retouched and made good the same quality of paint used in shop coat.

All coupling mullions, transoms, frames, etc. in contact with adjacent steel and other members, shall be well bedded in mastic. The Contractor shall bring to the site the cement in original sealed containers of manufacturer and shall apply it as per the instruction. For all frames supplied by either the owner or the Contractor, mastic shall be supplied by the Contractor and caulking done properly as per drawings, specifications and as per instructions of the Engineer.

Door shutters, partitions hardware fixtures etc. shall be fixed only after major equipments have been installed in rooms.

Wherever required, nylon cords of approved quality shall be supplied along with pivoted sashes and shall be of adequate length to terminate one metres from the floor. Loose ends of cords shall end in metal or plastic pull as approved by the Engineer.

2.06.0**Fire proof Door**



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Fire proof doors shall be provided at all fire exit points as specified and also to restrict the spread of fire within buildings whether from internal fire or from external fire. The construction details of door shall conform to the requirements stipulated in IS:3614(Part-1). Doors shall comply with the testing requirement mentioned in IS:3614 (Part-2). The doors shall be approved by Tariff Advisory Committee and shall have minimum 2 hrs. fire rating.

Metal covered (on both sides) Doors having insulating core filled up with mineral wool shall be used at all fire exit points and shall open out side.

All necessary accessories and hardware shall also be supplied along with doors. Fire proof door shall be provided with zinc silicate primer (minimum DFT 75 micron) after blast cleaning the surface to near white metal surface and shall be finished painted with epoxy based painting.

3.00.00 ACCEPTANCE CRITERIA

3.01.00 For fabricated Items

- a) Overall dimensions shall be within ± 1.5 mm of the size shown on drawings.
- b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to ± 1.5 mm from the axis of the member.
- c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm for double leaf doors; the gap at the meeting stiles shall not be more than 1.5 mm.
- d) Door leaves shall be undercut where shown on drawings.
- e) Doors, windows, frames, etc. shall be on a true planes, free from warp or buckle.
- f) All welds shall be dressed flush on exposed and contact surfaces.
- g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures
- h) Provision for hardware and fixtures to be installed at site.
- i) Glazing beads shall be cut with mitered corners.
- j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.
- k) Shop coats shall be properly applied.

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3.02.00	For installed Items l) Exposed aluminum surfaces shall be free from scratches, stains, and discoloration. Anodized surfaces shall present a uniform and pleasing look. a) Installations shall be at correct location, elevation and in general, on a true vertical plane. b) Fixing details shall be strictly as shown on drawings. c) Assembly of composite units shall be strictly, as per drawings with mastic caulking of transoms and mullions, gaskets, weather strips etc. complete. d) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry. e) All openable section shall operate smoothly without jamming. f) Locks, fasteners etc. shall be engage positively. Key shall, be non-interchangeable. g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint. h) Aluminium doors, windows, etc. shall be free from scratches stain or discoloration.	
4.00.00	INFORMATION TO BE SUBMITTED	
4.01.00	With Tender	
	a) Names of manufacturers for Doors, windows etc.	
	b) Manufacturer's catalogue for all hardware and fixtures proposed to be used.	
4.02.00	After Award	
	a) Before starting fabrication of all metal doors, windows, etc. the Contractor shall submit detailed fabrication drawings to the Engineer for approval. The fabrication shall be started only after approval of drawings.	
	b) He shall submit a programme of work to be done for the approval of the Engineer.	
	c) Before bulk supply, he shall submit for the approval of the Engineer samples of all bought out items and samples of each type of fabricated items. The samples shall be retained by the Engineer for comparison of	

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bulk supply and returned to the Contractor towards the end for final incorporation in the job.			
5.00.00	IS CODES		
All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.			
	Specification for Wrought Aluminium and Aluminium Alloy bars, rods and sections (for general engineering purpose)	-	IS: 733
	Specification for Wrought Aluminium and Aluminium Alloy, extruded round tube, hollow section (for general engineering purpose)	-	IS: 1285
	Steel doors, windows, and ventilators	-	IS: 1038
	Steel windows for industrial, building	-	IS: 1361
	Aluminium doors windows, and ventilators	-	IS: 1948
	Aluminium windows for industrial buildings	-	IS: 1949
	Steel doorframes	-	IS: 4351
	Code of practice for fixing and glazing of Metal (steel and aluminium) doors, windows and Ventilators.	-	IS: 1081
	Specification for Fire-check Doors – Part 1: Plate, Metal covered and Rolling type	-	IS: 3614
	Hot Rolled Steel Sections for Doors, Windows and Ventilators – Specification	-	IS: 7452
6.00.00	RATES AND MEASUREMENT		
6.01.00	Rates		
Rates shall be applicable of all elevation. Rates shall include preparation of working drawings (if required), supply of material, fixtures, gaskets, erection			



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of unit, caulking and jamming of frames, including cutting/drilling/welding, grouting, grinding, making good of the structure for installing the unit etc. complete as per "Schedule of Items".

Rates shall also include cost of surface preparation, application of primer, enamel painting or anodizing as applicable.

Rate for fire proof door is inclusive of providing insulation core, primer, shop painting (epoxy based), all hardware as specified in Schedule of items.

6.02.00

Measurement

Supply and installation of doors, windows, and ventilators shall be measured in Sqm or Kg as per BOQ item. If measured in sqm, it shall be for net outer to outer (excluding frame) area of doors, windows, and ventilators of each type used as described in "Schedule of Items". Frame for steel or aluminium shall be measured in Kgs. Wooden frames shall be measured in Cum. Measurement for aluminium partition frames shall be in Kg. Panelling and glazing shall be paid separately if not covered in BOQ item description.

Measurement for fire proof door shall be in SqM in net area outer to outer of the door.



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ANNEXURE-A

SCHEDULE OF FIXTURES

A. TIMBER DOORS

1. For single leaf panel/flush doors
 - i) 100 mm brass butt hinges with screws - 3 Nos.
 - ii) 150 mm brass tower bolts with screws - 1 No.
 - iii) 100 mm x 225 mm clear plastic push Plate with counter sunk brass screws - 1 No.
 - iv) 30 mm brass ring pull handle with Plates and screws - 1 No.
 - v) 150 mm brass coat hook with screws - 1 No.
 - vi) Heavy duty, cylinder looks on active leaf - for flush door. For door-closure, see "Door Schedule".

B. ALUMINIUM DOORS

1. For double leaf door
 - i) Concealed hanging arrangement for door leaves.
 - ii) Concealed two points bolt encasing simultaneously at head and threshold on inactive leaf, operable from inside.
 - iii) Heavy duty, cylinder look on active leaf.
 - iv) Pull handle of approved design on both leaves.
 - v) Doors stops for both leaves.
 - vi) Overhead door closure for both leaves.



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ANNEXURE-A

C. STEEL DOORS AND WINDOWS

1. Doors

a) Double leaf doors

i) 100 mm butt hinges	- 3 Nos. on each leaf.
ii) 300 mm aluminum tower bolt	- 2 Nos. (top and bottom) On inside of inactive Leaf. 1. No. (Top only) On inside active leaf.
iii) 200 mm anodized aluminum pull handle	- 1 No. of each leaf.
iv) Door stop of approved design	- 1 No. of each leaf.

NOTE: For locks, door closure and threshold, see "Door Schedule".

b) Single leaf doors

i) 100 mm butt hinges	- 3 Nos.
ii) 300 mm aluminum tower bolt	- 2 Nos. top & bottom of Inside face
iii) 200mm anodised aluminum Pull handle	- 1 No.
iv) Door stop of approved design	- 1 No.

NOTE: For locks, door closures and threshold, see "Door Schedule".

2. Windows, Ventilators, etc.

a) Side Hung Windows

i) Hinges	- As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
ii) 12" peg stays	- 1 No. per leaf



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- iii) 2 point handles - 1 No. per leaf
- b) Top Hung Ventilators (Projecting Out)
 - i) Hinges - As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
 - ii) Adjustable sliding fabrication assemblies - 2 Nos. per leaf.
 - iii) 2 point handles - 1 No. per leaf.
- c) Bottom Hung Ventilators (Projecting in)
 - i) Hinges - As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
 - ii) Concealed side arms for opening adjustment. - 2 Nos. per leaf.
 - iii) Spring Catch - 1 No. per leaf.



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ANNEXURE-A

D. ALUMINIUM WINDOW, VENTILATORS, ETC.

(As per IS-1948 latest editions)

a) Side Hung Windows

i) Hinges	- As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
ii) 300 mm peg stays	- 1 No per leaf
iii) 2 point handles	- 1 No per leaf

b) Top Hung Ventilators (Projecting out)

i) Hinges	- As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
ii) Adjustable sliding fabrication assemblies	- 2 Nos. per leaf
iii) 2 Point handles	- 1 No. per leaf

c) Bottom Hung Ventilation & (Projecting In)

i) Hinges	- As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
ii) Concealed side arms for opening adjustment	- 2 Nos. per leaf
iii) Spring Catch	- 1 No. per leaf



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**TECHNICAL SPECIFICATION
FOR GLASS AND GLAZING**

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Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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GLASS AND GLAZING

1.00.00 SCOPE

This section covers supplying and fixing of all glass and glazing including all clips, putty, mastic cement etc. wherever required as per specifications.

2.00.00 INSTALLATION

2.01.00 General

The Contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing and partitions, from approved manufacturer like Hindustan Pilkinton or equivalent, having uniform refractive index and free from flaws, specks, and bubbles. The glass shall be brought to site in the original packing from the manufacturer and cut to size at site.

Materials

- a) Glare reducing or heat absorbing glass shall be "Calorex" of Hindustan Pilkinton or approved equivalent and special care shall be taken to grind smooth and round off the edges before fixing.
- b) Clear glass shall be flat draw sheet glass and shall be at least 4 mm thick. Sheet glass for doors shall be minimum 5.5 mm thick.
- c) Wired glass shall be thick- rolled glass with centrally embedded 42g wire mesh of Georgian type. This may be of clear or coloured glass, as required.
- d) Obscure glasses shall have a cast surface in one side.
- e) Coloured and figured glass shall be as per approved sample.
- f) In general, the putty shall conform to IS: 400 and be of best quality from approved manufacturer. It shall be brought to site in the manufacturer's original packing.
- g) Neoprene gaskets with snap-fit glazing beads shall be fixed as per manufacturer's instructions and shall sit snugly against glass to give a leak proof installation.

2.03.00 Glazing, Setting, and Finish

All glazing clips, bolts, nuts, putty, mastic cement etc. as required shall be supplied by the Contractor.



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All glass shall be thoroughly cleaned before putting in position. Each glass pane shall be held in place by special glazing clips of approved type. As specified in relevant I.S. Codes, four glazing chips shall be provided per glass pane, except for large panes where six or more clips shall be used as per engineer's instructions. All holes that may be necessary for holding the clips glazing heads and all other attachments shall be drilled by, the Contractor.

Glass panes shall be set without springing, and shall be bedded in putty and back puttied, except where mouldings or gasket are specified, putty, mastic cement etc. shall be smoothly finished to the even line and figured glass shall be set with smooth side out.

Where owner will supply glass, the Contractor shall cut it to size and fix them in the same as specified above.

The Contractor shall supply necessary glazing clips, putty, mastic cement etc.

After completion of glazing, the Contractor shall remove all dirt stains, excess putty etc. clean glass panes and leave the work in perfectly acceptable condition. All broken cracked or damaged glass shall be replaced by new ones at the contractor's own cost.

3.00.00

ACCEPTANCE CRITERIA

- a) All installation shall be free from cracked, broken, or damaged glass. Edges of large panes of thicker glass and heat absorbing glass shall be inspected carefully for chipped, cracked, or underground edges.
- b) Glazing shall be carefully done to avoid direct contact with metal frames.
- c) All glass shall be embedded in mastic or fixed by neoprene gaskets to give a leak proof installation.
- d) At completion, the panes shall be free from dirt, stains, excess putty etc. to the complete satisfaction of the Engineer.

4.00.00

I.S. CODES

Following are some of the important I.S.Codes relevant to this Section:

IS: 3548 - Code of practice for glazing in building.

IS: 1081 - Code of practice' for fixing and glazing metal doors, windows ventilators.



TITLE:

**TECHNICAL SPECIFICATION
FOR GLASS AND GLAZING**

SPECIFICATION NO. PE-TS-999-600-C006

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5.00.00

RATES

Rates of glass and glazing if not included in respective items for supply and installation of window, ventilator, and partitions shall be paid separately as per BOQ items provided. No separate payment shall be made for glazing clips, mastic cement, putty, screws; rails, etc. nor for drilling holes in frames for inserting glazing clips.



TITLE:

**TECHNICAL SPECIFICATION FOR
ROLLING STEEL SHUTTERS AND
GRILLS**

SPECIFICATION NO. PE-TS-999-600-C007

VOLUME - II B

SECTION - D

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ROLLING STEEL SHUTTERS AND GRILLS

SPECIFICATION NO. PE-TS-999-600-C007



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**TECHNICAL SPECIFICATION FOR
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ROLLING STEEL SHUTTERS AND GRILLS

1.00.00 SCOPE

This Section covers the design and supply of materials, fabrication, delivery and erection of Rolling Shutters/Grills with motor drive and/or manual operation including all accessories as hereinafter specified.

2.00.00 INSTALLATION

2.01.00 Components

- a) Slats for rolling shutters shall be made from tested bright cold rolled, annealed M.S. strips, not less than 0.9 mm thick for shutters upto 4.5 M wide and not less than 1.25 mm thick for shutters having width more than 4.5 M, wide and above, machine rolled at 75 mm rolling centers, interlocking with each other. The profile will be such as to prevent excessive deflection under specified wind load.
- b) Rolling grills shall be constructed out of 6mm rods at 35 mm on centers running horizontally flexible connected with vertical links spaced not more than 200 centers. Alternatively, rolling grills shall be made from perforated slats of approved design reinforced with 6mm dia rods.
- c) End locks shall be heavy type M.C.I./C.I. and shall be provided at each end of alternate slats unless specified otherwise.
- d) Bottom bars shall be finished with two angles not less than 6 mm thick for external shutters. When shown on drawings, a flexible weather strip shall be applied to make tight contact with the floor.
- e) Guides shall be of such depth as to retain the shutter under a wind pressure of 100 Kg/Sq.m.
- f) Shafts shall be of steel pipe of sufficient size to carry the tensional load with a maximum deflection of 1/360th of span. Grease packed ball bearings or bushings shall be provided for smooth trouble free operation.
- g) Hoods shall be formed of not less than 20 gauge steel, suitable reinforced to prevent sag.
- h) Locks shall be slide bolt and hasp, or cylinder lock operable from one or both sides. Provision securing hand chain with pad-lock, provision for removable handle for hand cranks etc. shall be made as prescribed by the Engineer.



TITLE:

**TECHNICAL SPECIFICATION FOR
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- i) Power unit shall be suitable for 3 phase, 50 cycles, 400-volt A.C. power supply and be either floor or wall mounted unit. The motor shall be of sufficient capacity, to move the shutter in either direction at a speed of 0.3 metres per second. In addition to the gear motor each standard power unit shall include a magnetic brake, a reversing starter with built-in overload protection, a geared limit switch and one push button station located inside the building unless otherwise stated in drawing.

It is desirable that the bottom bar of motor operated doors shall be provided with a sensitive edge, electrically connected to stop the travel of the door on meeting an obstruction.

- j) Operating chains shall be of tested quality, heavily galvanized and with all ends rounded to assure smooth operation and hand protection.
- k) Reduction gears shall be high strength grey cast iron, machine moulded from machine out patterns.

2.02.00 Manually Operated Shutters/Grills

Manually operated shutters shall be easily operable by one person. The speed of operation shall be about 1.3 metres per second. In general, manually operated shutters shall be push pull type for opening up to 9 Sq. metre in area. Larger shutters shall, be either chain and gear operated or crank and gear operated. The crank handle shall be removable. All shutters shall be lockable from one or both sides as desired by the Engineer.

2.03.00 Power operated Shutters/Grills

These shall be operable from a push button station conveniently located beside the door. One emergency hand chain/crank operation shall also be provided for use in case of failure of the electric system. Where called for, externally mounted shutters shall be operated by control mechanism located inside the building.

2.04.00 Shop Coat

Shutters shall be painted with one coat of red lead or zinc chromate primer. Where specified, doors shall be galvanized and subsequently painted one coat of zinc chromate for adhesion of field coat.

2.05.00 Erection

Door shall be installed by the manufacturer or his authorized representative and all work shall be as per manufacturer's instructions. Any drilling or cutting

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	to concrete, masonry etc. shall be made good after erection of shutters and all abrasion to shop coat shall be touched up. All electrical work shall be in strict accordance with the latest Indian Electricity Rules. 3.00.00 ACCEPTANCE CRITERIA AND GUARANTEE 3.01.00 Shop Inspection After completing the manufacture of the different components of the rolling shutter, an arrangement for shop inspection by the Engineer shall be made to check the conformity with approved shop drawings. 3.02.00 Field Inspection After installing the shutters, the Contractor shall test the performance of the shutter in the presence of the Engineer. The doors shall be smoothly operable under all ambient conditions. All control and locking devices shall give fault free performance. 3.03.00 Guarantee The Contractor shall give one year's guarantee for the successful operation of the shutters. This shall be supported by a separate and unilateral guarantee from the manufacturer of the shutters. 4.00.00 I.S. CODE IS: 6248 - Metal rolling shutters and rolling grills. 5.00.00 RATES AND MEASUREMENT 5.01.00 Rates Rates for rolling shutters and grill shall include the cost of the locks, guide channels, cost of drive as specified. In case of electrically operated rolling shutters, the rate shall also include the mounting of controls, wire and wiring from the nearest junction box, conduit and other electrical connections and cost of electric motor. 5.02.00 Measurement Supply and installation of rolling shutter and grill shall be measured in Sqm in net outer to outer (including frame) area of each type used as described in “Schedule of Items”.	



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MISCELLANEOUS METAL

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Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
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MISCELLANEOUS METAL

1.00.00 SCOPE

This section covers supply, fabrication and erection of miscellaneous metal items of light nature in gates, balcony and stair hand rails, structural works, ladders, hangers, masonry anchors, anchor bolts, fasteners, chain link fencing, barbed wire fencing etc. as specified or shown on drawing or as instructed by the Engineer. The above items shall be of fabricated or cast of mild steel, aluminium, brass, cast iron, M.S.& galvanized M.S. sheets, aluminium sheets, expanded metal, wire mesh as shown on drawings or specified.

2.00.00 INSTALLATION

2.01.00 Fabrication/casting

2.01.01 General

All work shall be done according to approved shop drawings. All workmanship shall be equal to the best practice in modern structural or foundry shop.

2.01.02 Shop Connections

- a) All shop connections shall be riveted or welded except when noted otherwise on drawings.
- b) Welding of steel shall be done in accordance with IS: 816.
- c) Welding of aluminium shall be done accordance with IS: 2812, "Arc welding of Aluminium and Alloys." Special care shall be taken to grind smooth all welded surface that shall remain exposed to view. Welds shall be electrically continuous if so required by the Engineer.

2.01.03 Shop Coat

Before leaving the shop, all metal work shall be thoroughly cleaned by effective means of all loose mill seals, rust and foreign matter. Except where encased in concrete, all steelwork shall be given one coat of approved metal protective paint, applied by brush thoroughly and evenly, well worked into joints and other open spaces. All paint shall be applied to dry surfaces. When specified steel work shall be galvanised or painted with a coat of zinc chromate primer. Aluminium surfaces, which shall come in contact with masonry, shall be given one coat of bituminous paint.

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2.02.00	Erection				
2.02.01	Bracing				
	The Contractor shall provide all necessary temporary guys and braces to ensure alignment and stability of the members and to take care of all loads to which the structure may be subjected, including erection of equipment and operation of the same.				
2.02.02	Temporary Bolting-Up				
	As erection proceeds the Contractor shall plum up and level all members and shall securely bolt up to take care of all dead load, wind load and erection stresses. Wherever erection equipment or other loads are carried by members during erection, proper provision shall be made to take care of the stresses resulting from the same.				
2.02.03	Turned Bolt				
	For field connections where bolting is specified, holes for the turned bolts may be reamed in the field, if required. All drilling or reaming for turned bolts shall be done after the parts to be connected are assembled.				
2.02.04	Welding				
	Where specified on drawings, welding shall be done in accordance with IS: 816 for steel and IS: 2812 for Aluminium & Alloys.				
2.02.05	Cutting and Fitting				
	No cutting of sections, flanges, webs of angles shall be done without the approval of the Engineer. Where indicated on the drawings holes, cuttings, etc. shall be provided as required for installation, to the work by the other Contractors. No additional holes or cuttings, than those shown on drawings, shall be made without the approval of the Engineer.				
2.02.06	Drifting				
	Correction minor misfits and a reasonable amount of reading and cutting of excess stock from rivets may be permitted. For this, light drifting may be allowed to draw holes together. Twist drills shall be used to enlarge as necessary to make connections, reaming that weakness the members or make it impossible to fill the holes properly or to adjust accurately after reaming shall not be allowed.				
	Any error in shop work which prevents the proper assembling and fitting of				



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parts by moderate use of drift pins or a moderate amount of reaming and slight chipping and cutting shall immediately be called to the attention of the Engineer and approval of the method of correction obtained. The use of cutting torches to enlarge or alter rivet holes shall not be permitted.

2.02.07 Spot Painting

All field rivets and bolts and also any serious abrasion to shop paint shall be spot painted with the same materials and used for the shop paint or equivalent.

2.02.08 Good

All cutting to concrete or masonry shall be made good to the satisfaction of the Engineer.

2.02.09 Grouting

All bearing plates, loose, lintels and beams, etc. shall be set to proper grade and level by the Contractor and the Engineer's approval obtained before proceeding with the grouting. Grouting shall be done in 1:1½:3 concrete with 6 mm down stone chips or as specified in schedule of items.

2.02.10 Anchor Fasteners

The anchor fasteners shall be of two type viz. light duty for carrying tensile load upto 0.5MT per fasteners and heavy duty for carrying tensile load of 0.5MT to 5.0MT per fasteners. These anchor fasteners shall be fixed into concrete. The Contractor shall submit the Manufacturer's literature showing the average pull out and average shear value for anchor of various sizes. Anchors shall be fixed in position strictly as per the manufacturers instructions and as approved by the Engineer.

Heavy Duty Anchor Fasteners

The safe tensile load carrying capacity of the anchors shall be arrived by providing the minimum factor of capacity of 2.5 for the characteristic load of the anchor. Minimum size of anchor shall be M8 (8mm). All anchors shall be from the approved manufacturers like HILTI or equivalent.

- a) Anchor fasteners shall be supplied and fixed in position by the contractor. Anchor fasteners can be of mechanical bonding or chemical bonding.
- b) Capacity of the anchor shall be established after considering the effect of concrete grade, embedment depth, concrete thickness, anchor spacing and edge distance from the concrete edge.
- c) The selection for the particular type of bonding for the anchors shall be made after considering the concrete grade, available embedment depth, load to be transferred, space available for installing anchors.



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- d) The mechanical bonding anchor are torque controlled anchors made from carbon steel of grade 8.8 as per IS:1367 part 3. Anchors in bolt as well as nut version are acceptable. The bolt version anchors consists of bolt washer, sleeves, plastic section, expansion sleeves and a cone. Nuts version anchor consists of nuts, threaded rod, washer, sleeves, plastic section, expansion sleeves and a cone. All steel component of anchor shall be electro galvanised to minimum 5 micron coating thickness. The plastic section shall be of polyacetal Derlin 100 or equivalent.
- e) Chemical bonding anchor shall consist of foil capsule and threaded rod. The foil capsule shall contain the resin and hardener. The threaded rod shall have chiselled tip. The behaviour of anchors under fire shall conform the heating curves as per ISO:834. Anchors of size M8 to M24 shall conform to grade 5.8 and anchors of size M27 to M39 shall conform to grade 8.8 as per IS:1367 part 3. All steel components of the anchors shall be electro-galvanised to minimum 5 micron thickness.

Light Duty Anchors

This anchor shall comprise of stud, nut, washers, expansion sleeve. The one end of the stud shall have thread and the other end shall have cold formed conical head. All steel components of the anchors shall be electro-galvanised to minimum 5 micron thickness. The expansion sleeve shall preferably be of stainless steel of SS316. The anchors shall conform to minimum grade 5.8 as per IS:1367 part 3.

2.02.11 Pipe Joints

MS pipes or GI pipes shall be joined by threaded sockets or by welding. Cast iron pipes shall be socket and spigot joined and caulked with hemp and molten head.

2.03.0 FENCING

2.03.01 Chain Link Fencing

The material requirement shall conform to IS: 2721 latest edition. The chain link fencing shall be woven from 3.15mm dia. wire with mesh size of 50mm. The mesh wire shall not vary from specified dia. by more then ± 0.05 mm. all steel wire shall be hot dipped galvanised wire. The dia shall be measured over the galvanised coating. The line wire shall be 4.0mm dia. mild steel. The stirrup wire for securing the line wire to the intermediate post (RCC/structural steel) shall be 2.5 mm diameter mild steel. The tying wire for securing the chain link fencing to the line wire shall be 1.6mm diameter mild steel. Hair pin chain staples for fastening down the bottom of galvanised chain line fencing to the concrete sill shall be 3.15mm wire. The ends shall be bent outwards for securing anchorage.



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Cleat for eye bolts shall be of uniform size and shall consist of mild steel angle of 75 x 50 x 8 mm. The eye bolts strainer shall consist of bolt with welded eye sufficiently threaded and fitted with a nut and washer. Two-way eye bolt strainer shall have suitable ring nuts fitted after the wires have been strained on one side. Stretcher bar shall consist of mild steel flats 25 x 4.75 mm. They shall be secured to the cleats by steel bolts.

The chain link fencing shall be strained between each pair of straining posts and secured to each straining posts by means of a stretcher bar. One of top line wire shall be threaded through appropriate adjacent row of mesh, care being taken that no meshes in the row are bypassed by the line wire except where deviation is necessary at the straining posts. The second top line wire shall be strained in front of the fencing. The fencing shall be attached to the top and bottom line wire by wire ties spaced at 150mm apart and to the other middle line wire by wire ties spaced at 450mm apart.

The bottom of fencing shall be treated as follows:

Continuous concrete sill 125mm wide x 225mm high for full length between posts shall be cast with the top 25mm above GL and 25mm below the chain link fencing. Hair pin staples shall be threaded through the bottom row of mesh at 750mm c/c and set in the sill to a depth of 150mm.

2.03.02

Barbed Wire Fencing

The barbed wire shall be conform to IS:278 latest edition. The barbed wire shall be galvanised and galvanising shall conform to the requirement laid down for 'light-coated wire' of IS:4826 and it shall be smooth and relatively free of lumps etc. Wire with excessive roughness blisters, salammoniac spots shall be rejected. The barbed wire shall be made from two line wire and two point wire of 2.5 mm thickness each. The barbs shall have four point and shall be formed by twisting two point wires, each two turns, tightly around both or one line wire (Type A - around both line wire, Type B - around one line wire) making altogether four complete turns. The barbs shall be so finished that four points are set and located or locked as far as possible at right angle to each other. The barbs shall have a length of not less then 13mm and not more than 18mm. The distance between two barbs shall be 75 ± 12 mm.

Straining posts shall be provided at all ends and corners of fences or at changes in direction or acute variation in level and at intervals not exceeding 66 M on straight lengths of fence. Intermediate posts shall be spaced at regular intervals not exceeding 3.0m. Struts shall be fitted to all straining posts behind the chain link fabric in the direction of line of fence. There shall be four evenly spaced row of line wire in all. The top line wire shall be doubled, making five line wire in all. The bottom wire shall be closed to the ground. Each line wire shall be strained tightly by means of eyebolts strainers or winders at each straining points. Each line wire shall be secured to each intermediate post by a



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wire stirrup passed through a hold in the post and secured to the line wire by three complete turns on each sides of the post. The barbed wire shall be fitted with one dropper at the centre of each bay, secured to the wire so that they could not be bunched together. Droppers for barbed wire shall be of mild steel of not less than 25 x 4.75 mm thick with 38 x 4.85 mm half round staples for fastening the barbed wire to them. Bracing for the rows of barbed wire shall be approved by the Engineer.

3.00.00

ACCEPTANCE CRITERIA

- a) All items shall be correct shape, size, weight etc. shown on drawings and schedule of items.
- b) For installed items, the tolerances shall be as follows
 - i) Permissible deviation from, straightness – 1 in 1000.
 - ii) Seats, stiffener connections etc. shall be as per approved drawings and shall not interfere with architectural clearances.
- c) All castings shall be free from blowholes, cracks, and other blemishes.
- d) All MS wire fencing shall be in true vertical plain, and shall not bulge.

4.00.00

IS CODES

IS:278	Specification for Galvanised Steel Barbed wire for fencing.
IS:816	Code of practice for use of Metal Arc welding for general construction in mild steel.
IS:1367	Industrial Fasteners – Threaded steel fasteners - Technical supply condition.
IS:2721	Specification for Galvanised Steel Chain Link fence fabric.
IS:2812	Arc welding of Aluminum and Alloy

5.00.00

RATES AND MEASUREMENTS

5.01.0

Rates

Rates shall include supply, fabrication and installation for misc. metals works as required for completion of works like gates, fencing, handrails, ladders, hangers, anchors etc., unless otherwise specified in Schedule of Items. Rate for fencing shall also include excavation, concreting and supply, erection



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& fabrication of post (post made of either structural steel or reinforced cement concrete), unless any specific item is excluded.

5.02.0

Measurements

Measurement for MS gates shall be in MT.

Measurement for galvanised MS wire fencing shall be in Sqm.

Measurement for Anchors shall be in nos. for the type as specified in schedule of items.

Measurement of other misc. metals shall be done in MT unless otherwise specified in schedule of items.



**TECHNICAL SPECIFICATION FOR
MASONRY AND ALLIED WORKS**

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MASONRY AND ALLIED WORKS

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Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
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TECHNICAL SPECIFICATION FOR MASONRY AND ALLIED WORKS

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MASONRY AND ALLIED WORKS

1.00.00 SCOPE

This section covers furnishing, installation including handling, transporting, batching, mixing, laying scaffolding, centering, shuttering, finishing, curing, protection, maintenance and repair of common building materials till handing over of masonry and allied works for use in structures and locations covered under the scope of this package.

2.00.00 MATERIALS

a) Brick

Bricks for general masonry work shall be of class designation 7.5 of nominal dimensions as per standard specification under IS: 1077, well burnt, of uniform size, shape and colour, free from cracks, flaws or modules of free lime and emit clear ringing sound when struck. Fractured surface shall show uniform texture free from grits, lumps holes etc. Water absorption after 24 hours immersion shall not exceed 20% by weight for bricks. Dimensional tolerance shall not exceed 8% of the size shown in drawings for bricks. All bricks shall have rectangular faces and sharp straight edges. The bricks shall show no efflorescence after soaking in water and drying in shade.

Each brick shall have the manufacturer's identification marks clearly marked on the frog. Representative samples shall be submitted and approved samples shall be retained by the Engineer for further comparisons and reference. Any brick not found up to the specification shall be removed immediately from site at the Contractor's own cost.

Bricks shall not be dumped at site. They shall be stacked in regular tiers, even as they are unloaded; to minimize breakage and defacement of bricks. Bricks selected for different situation of use in the work shall be stacked separately.

b) Stone

All stones shall be obtained from approved quarries, hard, tough, durable compact grained, uniform in texture and colour and free from decay, flaws, veins, cracks and sand holes. The surface of a freshly broken stone shall be bright, clean, and sharp and shall show uniformity of texture, without

loose grains and free from any dull, chalky, or earthy appearance. Stone showing mottled colours shall not be used for face work. A stone shall not absorb more than 5 per cent of its weight of water after 24 hours immersion. The type of stone shall be as specified on drawings and/or instructed by the Engineer. Samples shall be submitted by the Contractor and approved samples shall be retained by the Engineer for comparison of bulk supply.

c) Cement

Cement used shall be Ordinarily Portland Cement or Portland Slag Cement or Portland Pozzolana Cement conforming to IS Codes and shall be fresh when delivered. In special cases, Rapid Hardening Portland Cement, Low Heat Cement etc. may be permitted or directed to be used by the Engineer. The Contractor shall submit the manufacturer's certificate for each consignment of cement procured to the Engineer. If at any time, the Engineer feels that the cement being used by the Contractor is not up to specification, he may stop the work and send the samples of the cement to a testing laboratory for standard tests and all expenses incurred thus shall be borne by the Contractor. The Contractor shall also have no claim for this type of suspension of work.

The cement shall be stored above the ground level in perfectly dry and watertight sheds. The bags shall be stacked in a manner so as to facilitate removal or first in first out basis. Any material considered defective by the Engineer shall not be used by the Contractor and shall be removed from the site immediately.

d) Coarse Aggregate

Coarse aggregates shall be as per IS: 383 latest editions, consisting of hard, strong and durable pieces of crushed stone and shall be free from organic or clay coatings and other impurities like disintegrated stones, soft flaky particles etc. and any other material liable to affect the strength, durability or appearance of concrete.

Aggregates other than crushed stone conforming to the provisions of specification may be used if permitted by the Engineer.

Washing of aggregates by approved means shall be carried out, if desired by the Engineer.

Grading of coarse aggregates shall generally conform to IS: 383 and shall be such as to produce a dense concrete or the specified proportions and strength and of consistence that will work readily into position without

segregation.

Aggregates shall be stored on brick soling or an equivalent platform so that they do not come in contact with dirt, clay, grass, or any other injurious substances at any stage.

Aggregate of different size shall be kept in separate stacks. If so desired by the Engineer aggregate from different sources shall be stacked separately with proper care to prevent intermixing.

e) Sand

Sand shall be hard, durable, clean, and free from adherent coatings or organic matter and shall not contain clay balls or pellets. The sand shall be free from impurities such as iron pyrites, alkalis, salts, coal, mica, shale or other laminated materials in such forms or quantities as to affect adversely the hardening, strength, durability or appearance of mortar, plaster or concrete or to cause corrosion to any metal in contact with such mortar, plaster or concrete. All sand shall be properly graded and shall be as per relevant IS Code. Sand for concrete shall conform to IS: 383.

f) Water

Water shall be clean, fresh and free from organic matters, acids or soluble salts and other deleterious substances which may cause corrosion, discoloration, efflorescence etc.

g) Reinforcement

Reinforcement steel shall be clean and free from loose mill scales, dust, loose rust, oil and grease or other coatings, which may impair proper bond. Structural steel shall conform to IS: 2062. Mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement shall conform to IS: 432. Cold twisted steel bars shall conform to IS: 1786. Hand drawn steel wire fabric shall conform to IS: 1566. Hexagonal wire netting shall conform to IS: 3150. All steel bars including and above 10 mm diameter shall be of tested quality. All wire netting shall be galvanized.

Reinforcement bars shall be stored off the ground and under cover if so desired by the Engineer. If necessary, a coat of cement wash shall be given to the bars to guard against rusting.

3.00.00 INSTALLATION

3:01.00 Soling

3.01.01 Brick Soling

The ground shall be dressed, consolidated by ramming, or by light rolling and a 12 mm thick cushion of sand laid. On the sand cushion the bricks shall be laid with fine joints and placed firmly in position by hammering with wooden mallet. The surface shall be free from undulations. The 'frog' side shall be on the underside. The joints shall be broken the in all direction and bricks cut as required. The pattern of laying and number of layers shall be as per Schedule of item. Orientation shall be as desired by the Engineer. After laying of each layer of bricks sand shall be spread over and worked into the joints to pack the bricks tight.

3.01.02 Stone Soling

The stones for soling shall be selected on the basis of thickness of soling specified in the Schedule of Items. The larger stones shall be laid and the gaps filled by smaller stones. The interstices shall then be firmly packed with sand by flooding with water.

3.02.00 Brick-on-Edge

Excavation shall be done close to the brick dimensions and in perfect alignment. Bricks shall be firmly placed by hammering with wooden mallets and sides and joints packed firmly with earth so that the edging is not disturbed easily. Alignment and level shall be acceptable to the Engineer.

3.03.00 Masonry

3.03.01 General

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and bonded with dowels, inserts etc. as shown on drawings.

3.03.02 Cement Mortar

Cement mortar shall be prepared with materials specified in clause 2.00.00. Sand for masonry mortar shall conform to IS: 2116. Cement and sand in the specified proportion shall be mixed dry thoroughly and minimum water added to attain required workability.

Surplus mortar droppings from masonry, if received on surface free from dirt may be mixed with fresh mortar if permitted by the Engineer who may direct addition of additional cement without any extra payment. No mortar, which has stood for more than half an hour, shall be used.

3.03.03 Brick Masonry

Bricks shall be soaked by submergence in clean water for at least two hours in approved vats before use. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final position so as to embed fully in mortar. Inside faces shall be buttered with mortar before the next bricks is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar.

Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing.

Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickworks two bricks thick or more shall have both faces in true plane. Brickwork of lesser thickness shall have one selected face in true plane.

3.03.04 Exposed Brickwork

Brickwork in superstructures, which is not covered by plaster, shall be as shown on drawing and executed by specially skilled mason. Courses shall be truly horizontal and vertical joints truly vertical. Wooden straight edges with brick course graduations and position of window sills and lintels shall be used to control uniformity of brick courses. Masons must check workmanship frequently with plumb, spirit level, rule, and string. All brickwork shall be cleaned at the end of days work. If face bricks are specified, the brickwork shall be in composite bricks, with face bricks on the exposed face and balance in routine bricks, but maintaining the bond fully. Where face bricks are not specified, bricks for the exposed face shall be specially selected from routine bricks. All exposed brickwork on completion of work shall be rubbed down, washed clean, and pointed as specified. Where face bricks are used carborandum stone shall be used for rubbing down.

3.03.05 Reinforced Brickworks

Reinforcements shall be as specified. All reinforcements shall be thoroughly cleaned and fully embedded in mortar. Where M.S. bars are used as reinforcement, these shall be lapped with dowels if left in R.C. columns or welded to steel stanchions.

3.03.06 Stone Masonry

Stones shall be thoroughly soaked before laying. Stones shall be laid on their natural quarry beds. Individual stones shall be fitted with mallet and properly wedged to reduce thickness of mortar joints. Thickness of joint shall be not less than 8 mm and not greater than 25 mm. At least two stones shall run the full width of the wall for every square meter of surface area.

3.03.07 Exposed Stone work

Stonework, which is to be kept exposed, shall be as shown on approved drawing. It shall be executed by specially skilled mason. Stones used for exposed face shall be specially selected. All exposed stone faces shall be kept clean and free from mortar and pointed up neatly as the work proceeds in a manner called for in the drawings or instructions. A sample wall, 10 Sq.M. area shall be built and approved by the Engineer and all works shall match with this sample.

3.03.08 Composite Masonry

Where stonework facing with brick masonry backing is specified the bond between them shall be achieved by bond stones of dimensions and frequency as desired by the Engineer.

3.03.09 Expansion & Separation Joints

Location of joints shall strictly be as shown on drawings or as instructed by the Engineer. Expansion joints shall be as shown on drawings and specified. Expansion joint filler boards and sealing strips shall have minimum transverse joints. Transverse joints shall meet the approval of the Engineer.

Separation joints shall be with standard waterproof paper or with alkathene sheets about 1 mm in thickness. Length and sealing of laps shall be to the satisfaction of the Engineer.

3.03.10 Mouldings, Cornices, Drip Course

These shall be made as shown in drawings. Bricks or stone shall be cut and

dressed as required. If no subsequent finish is envisaged, these shall be rubbed to correct profile with Carborundum stone.

3.03.11 Curing

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

3.03.12 Embedding of fixtures

All fixtures shall generally be embedded in mortar and masonry units shall be cut as required.

3.03.13 Encasing of Structural Steel

This shall be done by building masonry work round flanges, webs etc., and filling the gap between steel and masonry by minimum 12 mm thick mortar. Encased members shall be wrapped with chicken wire mesh when shown on drawings or instructed by the Engineer. The minimum lap in chicken wire mesh shall be 50 mm.

3.04.00 Damp Proof Course (DPC)

Unless otherwise specified Damp-proof course shall be 40 mm thick 'artificial stone' in proportion 1:1½:3 cement sand stone-chips (10 mm down) with admixture of a waterproofing compound as approved by the Engineer. The percentage of admixture shall be as per manufacturer's specifications but not less than 2% by weight of cement. The top surface shall be double chequered and cured by ponding for seven days.

3.05.00 Damp Proof Membrane

Damp proof treatment using fibre or hessian base bitumen felt shall be 6, 8 or 10 course treatment as specified in IS: 1609. The number of courses shall be as shown as drawings or as specified. Sequence of work shall be as directed by the Engineer. Extreme care shall be taken to prevent damage to felt during and after laying. The Contractor shall be obliged, at his own expense, to rectify any leakage appearing within 5 years of installation by removing and renewing the coats at the point of leakage.

Where shown on drawing, damp proof membrane with one layer bitumen paper or one layer alkathene sheet shall be laid with minimum 150 mm lap under slabs on grade.

3.05.00

Plinth Protection

Plinth of buildings shall be protected with brick-on-edge paving of minimum 750mm width unless otherwise shown on the drawings. The treatment shall consist of laying bricks in cement mortar 1:6 (1 cement: 6 sand) over a 75mm thick bed of dry graded brick aggregate, 40mm nominal size, grouted with sand. The top shall be finished with 1:2 cement mortar pointing (1 cement: 2 sand). Plinth protection shall be laid with a minimum outward slope of 1 in 50. The brick aggregate shall be well graded, broken from well burnt or slightly overburnt and dense brickbats. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt or any other foreign matter.

The ground shall first be prepared to the required slope around the building. The high portions of the ground should be cut down; hollows and depressions filled up to the required level from the excavated earth and rammed so as to give uniform outward slope. The bed shall be watered and rammed with heavy iron square rammers. Surplus earth, if any, shall be disposed off beyond a lead of 50m or as directed by the Engineer.

Over this, 75mm thick bed of aggregate of 40mm nominal size, shall be laid with a minimum outward slope of 1 in 50. Aggregates shall be carefully laid and packed, bigger sized being placed at the bottom. The brick aggregates shall be consolidated dry with heavy iron rammers.

The aggregates shall then be grouted evenly with sand at the rate of 0.6 cubic metre per square metre area, adequately watered to ensure filling of voids by sand and again rammed with heavy iron rammers. The finished surface shall give uniform appearance. After the subgrade has been compacted thoroughly, brick flooring with bricks of specified strength in cement mortar 1:6 (1 cement: 6 sand) shall be laid.

The bricks shall be laid on edge in Diagonal/Herring Bone Bond or other pattern as specified or as directed by the Engineer. Bricks shall be laid on 12mm thick mortar bed and each brick shall be properly bedded and set home by gentle tapping with handle of trowel or wooden mallet. Its inside face shall be buttered with mortar before the next brick is laid and pressed against it. On completion of the portion of flooring, the vertical joints shall be fully filled from the top with mortar. The surface shall present a true plain surface with the required slope.

The pointing shall be done in cement mortar 1:2 (1 cement: 2 sand). The mortar shall be pressed into the joints and shall be finished off flush and level with the edges of the bricks so as to give a smooth appearance. The edges shall be neatly trimmed with a trowel and a straight edge. The mortar shall not spread over surface of the masonry.



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Brick flooring & pointing shall be kept wet for a minimum period of seven days. These shall be protected from rain by suitable covering when the mortar is green.

4.00.00 I.S. CODES

Some of the important relevant codes for this section are:

- IS: 1127: Recommendations for dimensions and workmanship of natural building stones for masonry work.
- IS: 1597: Code of Practice for Construction of stone Masonry.
- IS: 1609: Code of Practice for laying Damp proof treatment using bitumen felts.
- IS: 2212: Code of Practice for Brickwork.
- IS: 2250: Code of Practice for preparation and use of masonry Mortar.
- IS: 5134: Bitumen Impregnated Paper & Board.

5.00.00 RATES AND MEASUREMENTS

5.01.00 Rates

Unit rate for masonry work shall include the following:

- a) Raking out joints for plastering or pointing or finishing the joint flush as the work proceeds.
- b) Preparing top sand sides of existing wall for joining old with new work.
- c) Providing, dismantling and removing the scaffolding.

Unit rate for DPC shall be inclusive of formwork and bitumen painting.

5.02.00 Measurement

Brickwork in wall of half brick thickness shall be measured separately in Sqm stating the wall thickness and more than half brick thickness shall be measured by volume. Plaster thickness shall not be considered for computation of volume.

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Masonry work in sub structure and super structure shall be measured separately, unless otherwise specified in the Schedule of items.

No deductions shall be made and no extra payment shall be made for following:

- a) Opening upto 0.1 Sqm each in area. In calculating the area of the opening lintels or sills shall be included along with the size of the opening.
- b) Drainage holes and recesses for cement blocks to embed holdfasts for doors, windows etc.
- c) Pipe and fixtures upto 300mm dia. and nothing extra shall be paid for the mortar used for fixing.
- d) Ends of dissimilar materials (i.e. joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps, etc); up to 0.1 sqm in section;
- e) Chases of section not exceeding 50 cm in girth;
- f) Iron fixtures, such as wall ties and hold fasts for doors and windows;
- g) Cement concrete blocks as fcr hold fasts and holding down bolts;
- h) Wall plates, bed plaros, and bearing of slabs, CHAJJAS and the like, where thickness does not exceed 10 cm and bearing does not extend over the full thickness of wall;

Reinforcement in masonry work shall be paid separately under respective items.

Damp proof course shall be measured in Sqm. No deduction shall be made and no extra shall be paid for opening upto 0.1 Sqm in area.

Plinth protection shall be measured under respective item of works executed required for completion of the work as specified.



**TECHNICAL SPECIFICATION FOR
FINISH TO MASONRY AND CONCRETE**

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FINISH TO MASONRY AND CONCRETE

SPECIFICATION NO. PE-TS-999-600-C010



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TECHNICAL SPECIFICATION FOR FINISH TO MASONRY AND CONCRETE

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FINISH TO MASONRY AND CONCRETE

1.00.00 SCOPE

This Section covers finishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of finishing items for masonry and concrete. This shall also include the work to be done to make the surface suitable for receiving the finishing treatment.

Before commencing finishing items the Contractor shall obtain the approval of the Engineer regarding the scheduling of work to minimize damage by other trades. He shall also undertake normal precaution to prevent damage or disfiguration to work of other trades or other installation.

2.00.01 INSTALLATION

2.01.00 Preparation of Surface

All joints in masonry walls shall be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be rushed down with stiff wire brush to remove all loose dust from joints and thoroughly, washed with water. All laitance shall be removed from concrete to be plastered.

For all types of flooring, skirting and dado work, the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

At any point, the level of base shall be lower than the theoretical finished floor level by the thickness of floor finish. Any chipping or filling to be done to bring the base in the required level shall be brought to the notice of the Engineer and his approval shall be taken regarding the method and extent of rectification work required.

Prior to commencement of actual finishing work, the approval of the Engineer shall be taken as to the acceptability of the base.

2.02.00 PLASTERING

2.02.01 Mortar

Mortar for plastering shall be as specified.

For sand cement plaster, sand and cement in the specified proportion shall be

mixed dry, on a watertight platform and minimum water added to achieve working consistency. The sand for plaster shall conform to IS: 1542.

No plaster, which has stood for more than half an hour, shall be used; plaster that shows tendency to become dry before this time shall have water added to it.

2.02.02 Application of Plaster

Plaster, when more than 12 mm thick, shall be applied in two coats a base coat followed by the finishing coat. Thickness of the base coat shall be sufficient to fill up all unevenness in the surface; no single coat, however, shall exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat; the overall thickness of the coats shall not be less than the minimum thickness shown on the drawings. The undercoat shall be allowed to dry and shrink before applying the second coat of plaster. The undercoat shall be scratched or roughened before it is fully hardened to form a mechanical key. The method of application shall be 'thrown on' rather than 'applied by trowel'.

To ensure even thickness and true surface, patches of plaster about 100 mm to 150 mm square or wooden screed 75 mm wide and of the thickness of the plaster, shall be fixed vertically about 2000 mm to 3000 mm apart, to act as gauges. The finished wall surface shall be true to plumb, and the Contractor shall, without any extra cost to the Owner, make up any irregularity in the brickwork with plaster.

All vertical edges of brick pillars, doorjambs etc. shall be chamfered or rounded off as directed by the Engineer. All drips, grooves, mouldings and cornices as shown on drawing or instructed by the Engineer shall be done with special care to maintain true lines, levels and profiles. After the plastering work is completed, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

2.02.03 Finish

Generally, the standard finish shall be used unless otherwise Shown on drawing or directed by the engineer. Wherever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the engineer regarding the texture, color and finish.

a) Standard Finish

Wherever punning is indicated, the interior plaster shall be finished rough; otherwise the interior plaster shall generally be finished to a smooth surface.

The exterior surface shall generally be finished with a wooden float.

b) Neat Cement Finish

Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one (1) kg. per Sq.M. and rubbed smooth with a trowel.

c) Coloured Plaster Finish

This shall be done in the same way as specified in Clause 2.02.02 but using Coloured cement in place of ordinary cement. When coloured plastering is specified in more than one coat, the topcoat only shall be made with coloured cement.

Coloured cement shall be either ready mixed material or may be obtained by mixing pigments and cement at site, as approved by the Engineer. The pigments to be mixed with cement shall conform to Appendix-A of IS: 2114 latest editions.

Samples of colouring material shall be submitted to the engineer for approval and material procured, shall conform in all respects to the approved samples, which shall remain with the Engineer. All coloured cement and/or pigments shall be stored in an approved manner in order to prevent deteriorations.

d) Pebble-dash Finish

Mortar of required thickness consisting of 1 part cement and 4 parts sand by volume shall be applied in the usual manner as described under plastering Clause 2.02.02. While the mortar is still plastic small pebbles or crushed stone of size generally from 10mm to 20mm as approved by the Engineer shall be thrown on the plastered surface. The aggregate shall be lightly tapped into the mortar with a wood float or the flat end of oil a trowel, in order to ensure satisfactory bond between the dashing and the mortar.

e) Rough-cast Finish

A wet plastic mix of 3 parts coloured cement 6 parts sand and 4 parts aggregate by volume (gravel or crushed stone of size from 6 mm to 12 as approved by the Engineer) shall be thrown on to the wall by means of a plaster's trowel and left in the rough condition.

f) Scraped Finish

Ordinary plaster as described under Clause 2.02.02 after being leveled and allowed to stiffen for a few hours, shall be scraped with a steel straight edge to remove the surface skin. The pattern shall be as approved by the Engineer.

g) Textured Finish

Mortar consisting of 1 part cement and 3 parts sand by volume shall be applied in a manner as specified under “Plastering” Clause 2.2.2 Ornamental treatments in the form of horizontal or vertical rib texture fan texture etc. shall be applied by means of suitable tools to the freshly applied plastered surface, as approved by the Engineer.

h) Sand Faced Plaster

The plaster shall be applied in 2 coats. The first coat or the scratch coat should be approximately 14mm and shall be continuously carried out without break to the full length of wall or natural breaking points such as doors, windows, etc. The scratch coat shall be dashed on the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar proportion for this scratch coat shall be as specified in the respective item or work. The scratch coat shall be cured for at least 7 days & then allowed to dry. The second coat shall be 6mm thick and it shall not be applied until at least 10 days have elapsed after the application of scratch coat. Before application of the second coat, the scratch coat shall be evenly damped. This coat shall be applied from top to bottom in one operation & without joints; finish shall be straight, true, & even. The mortar of this coat shall be as specified under the respective item of work. White sand for finish shall be used for the second coat & for finishing work. Sand for finish shall be of even coarse size & shall be dashed on the surface & sponged.

2.02.04 Curing

All plastered surfaces after laying shall be watered, for a minimum period of seven days, by an approved method, and shall be protected from excessive heat and sunlight by suitable approved means. Moistening shall commence, as soon as the plaster has hardened sufficiently and not susceptible to damage. Each individual coat of plaster shall be kept damp continuously, for at least two days, and then dried thoroughly, before applying the next coat.

2.03.00 Pointing to masonry

All Joints of brickwork shall be raked out to a depth of 10 mm with a hooked tool made for the purpose while the mortar is still green. The brickwork shall

then be brushed down with a stiff wire brush, so as to remove all loose dust from the joints and thoroughly washed with water. Mortar consisting of 1 part cement and 3 parts clean, sharp, well graded sand by volume shall be pressed carefully into the joints and finishes with suitably tools to shape as shown on the drawings. Any surplus mortar shall be scalped off the wall face leaving the surface clean.

The pointed surface shall be kept wet for at least three days for curing.

2.04.00 Plaster with Metal Lath

The supports, hangers, brackets, cleats etc. shall be as shown on drawings and/or as approved by the Engineer. These shall have a coat of prime paint before and another coat of approved paint after erection.

The metal lath shall be expanded metal, with 12 mm x 38 mm mesh, 16 thick and 3 mm wide strands. Side laps shall be minimum 12 mm and end laps 25 mm minimum. The plastering shall be minimum 20 mm thick measured from the back of lath and applied in two-layers. The mortar for plastering shall consist of 1 part cement and 4 parts sand by volume mixed as specified in plastering, Clause 2.02.01. The application, finish etc. shall be as specified under relevant clause above. Where called for a 2 mm Plaster of Paris punting shall be applied over plaster as a finishing coat to give perfectly smooth and even finish.

2.05.00 Lime Punning

For plastered surfaces, where an even smooth surface is specified, lime punning with 5 parts of shell lime properly slaked, strained and aged, mixed with 1 part clean, washed, sieved, fine sand by volume shall be done. The thickness of lime punning shall be not less than 2 mm and more than 3 mm. The plastered surface shall be saturated with water before application of the lime punning. The punting shall be applied by skilled workman and given a smooth and even finish free from undulations, cracks etc. and to the satisfaction of the Engineer.

2.06.00 Plaster of Paris Punning

Plastered surfaces, where specified shall be finished with Plaster-of-Paris punning. The material shall be from approved manufacturers and approved by the Engineer. The thickness of the punning shall be 2 mm and shall be applied by skilled workmen. The finish shall be smooth, even and free from undulation, cracks etc.

Before bulk work is taken in hand, a sample of punning shall be done on roughly 10 Sq.M. areas and approval of the Engineer taken. The work shall

then be taken in hand as per approved sample.

2.07.00

Stone Facing

Stone facing where specified shall be done as shown on design drawings and approved shop drawings. The stone shall be as specified on drawings. Samples of stone shall be submitted to the Engineer for approval and then bulk purchase made. The Contractor shall submit three copies of shop drawings for the Engineer's approval before commencing the work.

The thickness of facing stone shall be not less than 25 mm unless otherwise specified on drawings.

The stone slabs shall be cut and finished to sizes as per pattern shown on drawings. They shall be fastened to wall with suitable non-corrodible anchorage as approved by the Engineer. Where mild steel clamps, stays etc. are used for anchorage, they shall be galvanized (weight of zinc coating shall not be less than 700 gms per square meter of surface) to prevent rust stains developing on the finished surface. There shall be at least 12 mm gap between the stone and masonry, which shall be filled up and packed by a mortar of 1 part cement and 3 parts of sand by volume. After the mortar is set and cured for at least four days, the exposed surface shall be rubbed and polished as approved by the Engineer.

The completed surface shall be neat, or uniform texture and acceptable to the Engineer.

Where pointing is specified on drawings it shall be done by mortar as specified on drawings.

3.00.00

ACCEPTANCE CRITERIA

Finish to masonry and concrete shall fully comply with the Specifications, approved samples and instructions of the Engineer with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the body of the specification or as shown on drawings.

4.00.00

I.S. CODE

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.



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IS: 1661: Code practice for cement and cement-lime plaster finish on wall & ceilings.

IS: 4101: code of practice for external facings and veneers.

5.00.00 RATES AND MEASUREMENT

5.01.00 Rates

Rates shall also include providing, dismantling and removing of scaffolding, surface preparation, curing and all type of surface, shapes/ profiles and at all elevations.

5.02.00 Measurement

All plastering shall be measured net (on surface area on which it is applied) in Sqm. Plaster work shall be classified according to the type used and shall be measured separately. Plaster on ceiling and walls shall be measured separately. Soffits of stairs shall measured as plastering on ceiling.

No deduction shall be made for opening not exceeding 0.5 Sqm and for ends of beams, joints, etc. also no payment shall be made for reveals, jams, soffits, sills of these openings.

50% deduction shall be made for opening exceeding 0.5 Sqm but not exceeding 3.0 Sqm each and no addition shall be made for reveals, jams, soffits, sills etc.

In case of opening exceeding 3.0 Sqm each, deduction shall be made for opening but jams, soffits, and reveals shall be measured and paid for.



TITLE:
TECHNICAL SPECIFICATION FOR
PAINTING, WHITEWASHING,
POLISHING

SPECIFICATION NO. PE-TS-999-600-C011			
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PAINTING, WHITEWASHING, POLISHING

SPECIFICATION NO. PE-TS-999-600-C011



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:
**TECHNICAL SPECIFICATION FOR
PAINTING, WHITEWASHING,
POLISHING**

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PAINTING, WHITE WASHING, POLISHING, ETC.

1.00.00 SCOPE

This section covers painting, white washing, varnishing, polishing etc. of both interior and exterior surfaces of wood work, masonry, concrete plastering, plaster of paris, false ceiling, structural and other miscellaneous steel items, rain water down comer, floor and roof drains, soil, waste and service water pipes, and other ferrous and non-ferrous metal items.

Copper, bronze, chromium plate, Nickel, stainless steel and aluminium shall generally not be painted or finished except if otherwise specified.

Before commencing painting, the Contractor shall obtain the approval of the Engineer in writing regarding the schedule of work to minimize damage; disfiguration or staining to work of other trades or other installations.

2.00.00 INSTALLATION

2.00.01 Materials

Materials shall be highest grade products or well-known approved manufacture and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade, with labels intact and seals unbroken. All materials shall be subject to inspection, analysis and approved by the Engineer. It is desired that materials of one manufacturer only shall be used as far as possible and paint of one shade is obtained from the same manufacturing batch. Each and every supply of primer, finish paint etc. shall be accompanied by manufacturer's test certificate. All paint shall be subject to analysis from random samples taken at site from painters bucket, if so desired by the Engineer.

All prime coats shall be compatible to the material of the surface to be finished as well as to the finished coats to be applied.

All unspecified materials such as snellac, turpentine or linseed oil shall be of the highest quality available and shall conform to the latest IS standards. All such materials shall be made by reputable recognized manufacturers and shall be approved by the Engineer.

All colours shall be as per painting schedule and tinting and matching shall be done to the satisfaction of the Engineer. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Engineer.



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a) White Wash/Colour Wash

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the engineer, and shall conform to IS: 712 latest editions. Samples of lime shall be submitted to the Engineer for approval, and lime as per approved sample shall be brought to site in unslaked condition. After slaking, it shall be allowed to remain in a tank for two days and then stirred up with a pole, until it attains the consistency of thin cream. 100 grams of gum to 6 liters of white wash water and a little of indigo or synthetic ultramarine blue shall be added to the lime. Mineral colour not affected by lime shall be added to white wash to get the required tint/shade approved by the Engineer.

b) Dry distemper

Shall be made from suitable pigments, extenders, lime proof tinters, water-soluble binders etc. and shall conform to IS: 427. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for a day's work shall be prepared.

c) Oil Bound Washable Distemper

Shall be of oil emulsion type containing suitable preservatives and shall conform to IS: 428. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for a day's work shall be prepared.

d) Waterproof Cement Paint

Shall be made from best quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS: 5410.

e) Acrylic Emulsion Paint

Shall be water-based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide conforming to IS: 5411 (Part-1). It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, shall be able to withstand washing with mild soap and water without any deterioration in colour, or without showing flaking, blistering, or peeling.



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f) Synthetic Enamel Paint

Shall be made from synthetic resins and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and resist interior surfaces. White and pastel shades shall not yellowing and darkening with aging. The paint shall conform to IS: 2932 and IS: 2933.

g) Aluminium Paint

Shall be in two pack containers and shall resist weathering. The paint shall conform to IS: 2339.

h) Varnishing

Shall be best quality alkyd varnish suitable for brushing over the tint of paint or light natural wood and shall not darken or yellow with age.

i) French Polish

Shall be made from best quality shellac, denatured spirit and other suitable alcohol soluble ingredients and made by a well known approved manufacturer. The material shall conform to IS: 348.

French polish shall not be used on bare wood it shall only be used as finishing coat on wood after the woods pretreated with a liquid wood filler conforming to IS: 345 is applied and rubbed out.

j) Bitumen paint (black bituminous anti-corrosive paint)

Bitumen based anti-corrosive paint conforming to IS: 158 shall be used.

2.00.02

Storage

The Contractor shall arrange for safe and proper storage of all materials and tools. The storage space if allotted within the building shall be adequately protected from damage, disfigurement, & stains. Paint shall be kept covered at all times and mixing shall be done in suitable containers. All necessary precautions shall be taken by the contractor to prevent fire.

2.01.00

Preparation of surface

Before starting the work the Contractor shall obtain the approval of the Engineer regarding the soundness & readiness of the surface to be painted on.



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2.01.02 Wood

All surfaces shall be free from, dirt and loose or peeling paints. The surface shall be rubbed down smooth. All nails & screws shall be sunk below the surface and filled with putty after applying an under coat. Small knots that do not justify cutting and sap streaks shall be covered with minimum 2 coats of pure shellace coating applied thinly & extended 25 mm beyond the area. All large, loose, or resinous knots shall be removed and filled with sound wood. All work shall be done as per IS: 2338.

2.01.02 Masonry, Concrete, and Plastered Surface

Surface shall be free from all oil, grease, efflorescence, mildew, loose paint, or other foreign and loose materials. Masonry cracks shall be cleaned out and patch filled with mortar similar to the original surface and uniformly textured. Where this type of resurfacing may lead to the finishing paint being different in shade from, the original surfaces, the resurfaces area shall be treated with minimum one coat of cement primer, which should be continued to the surrounding area for a distance of minimum 100 mm.

Surface with **Mildew or Efflorescence** shall be treated as below:

All mildewed surfaces shall be treated with an approved fungicide such as ammoniacal wash consisting of 7g of copper carbonate dissolved in 80ml liquor ammonia and diluted to water, or 2.5 percent magnesium silicofluoride solution and allowed to dry thoroughly before paint is applied.

2.01.03 Metal

The surface preparation shall be done in accordance with IS:1477(Part-1) 'Code of practice for painting of ferrous metals in building' and as directed by Engineer. All metal surfaces shall be absolutely clean, dry, and free from rust, scales, weld slag, flux deposit, wax, grease, dried soap films, foreign matters like cement mortar etc and free from existing loose red oxide zinc chromate primer and should be removed by means of wire brushes, hand scrappers, sand paper, emery cloth, emery papers, or by mechanical power tools etc. or as directed by Engineer. For exposed chemical resistant paints, surfaces shall be blast cleaned to near white metal. All galvanized iron surfaces shall be pretreated with a compatible primer according to the manufacturer's direction. Any abrasion in shop coat shall be touched up with the same quality of paint as the original coat. The actual painting work should be commenced only after obtaining clearance from the Engineer regarding proper cleaning of the surface.



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2.02.00 Application

2.02.01 General

The method of application shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Contractor shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer and obtain his approval prior of application of finishing paints.

Proper tools and implements shall be used. Scaffoldings used shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor notes.

Painting shall be done by skilled labours in a workmanlike manner. All materials shall be evenly applied so as to free of sags, runs, crawls, or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paint.

All priming undercoat for painting shall be applied by brush only, and rollers spray equipments etc. shall not be used.

No work shall be done under conditions that are unsuitable production of good results. No painting shall be done when plastering is in progress or is drying. Application of paint, which seals the surfaces to moisture shall only be done after the moisture on and below the surface has dried out.

All coats shall be thoroughly dry before succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered property by applying the specified number of coats, further coats shall be applied by the Contractor when so desired by the Engineer.

All primers and undercoats shall be tinted to approximate the colour of the finishing coats. Finished coats shall be of exact colour and shade as per approved samples and all finish shall be uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

Painting on ferrous metal surface shall, be done as per IS: 1477 (Part I & 2). The total dry thickness of film should not be less than 120 Micron.

2.02.02 White Washing

The surface where white washing is to be applied shall be cleared of all loose materials and dirt. All holes and irregularities of the surface shall be filled up



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with lime putty and shall be allowed to dry up before white washing.

One coat of whitewash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke and another from left to right before the previous one dries up. Second coat shall be applied and in case the Engineer feels that one or more coats are required the Contractor shall do so without any extra cost to the Owner. No brush marks shall show on the finished surface.

2.02.03 Dry Distemper

New plastered surface shall be allowed to dry for at least two months. New lime or lime cement plastered surface shall be washed with a solution of 1 part Vinegar to 12 parts water or 1:50 sulphuric acid solution and for 24 hours after which the wall shall be thoroughly washed with clean water. For cement-plastered surface, the surface shall be washed with solution of 100 gms. of zinc sulphate to 1 litre of water and allowed to dry.

Dry distempering shall be done as per manufacturers instruction. In applying the distempers the brush, should first be applied horizontally and immediately crossed off perpendicularly. Brushing shall not be continued too long, otherwise brush marks may result.

2.02.04 Oil bound washable distemper

The distemper shall be applied after surface is primed with an alkali resistant primer, and followed by minimum two coats of oil bound washable distemper all as per manufacturer's instruction.

2.02.05 Waterproof Cement Paint

Surface to be coated with cement paint shall be washed and brushed down. As soon as the moisture has disappeared, the surface shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and prevent cracking. After the first coat has dried (24 to 48 hours) the second coat shall be applied in a similar manner. The finished surface shall be kept moist by occasional sprinkling with water for seven days after painting.

2.02.06 Acrylic Emulsion Paint

Paint shall be applied after providing one coat of cement primer solvent of approved quality and primer shall be conform to IS: 109. Lime gauged cement plastered surfaces shall not be painted for at least one month after plastering. A sample patch shall be painted to check alkali reaction if so desired by the Engineer. Painting shall be done strictly as per manufacturer's specification.



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2.02.07 Synthetic Enamel Paint

Shall be applied on properly primed surface. Subsequential coat shall not be applied till the previous coat is dry. The previous shall be lightly sand papered for better adhesion of subsequent coats.

2.02.08 Aluminium Paint

The paint, supplied in two pack containers shall be mixed and applied strictly as per manufacturer's direction. When more than one coat of paint is required or indicated, the next coat shall only be applied after the previous coat become hard dry.

2.02.09 Clear Synthetic Varnish

The Varnish shall be applied on wood surface after (a) filling, (b) staining & (c) sealing operations are carried out. The application of a combination of filler and stain shall not be permitted.

For the finishing coats of varnish, the surface shall be allowed to dry and be rubbed down lightly, wiped off and allowed to dry. Careful attention to cleanliness is required for varnishing. All dust and dirt shall be removed from the surface as well as from the neighbourhood. Damp atmosphere and draughts shall be avoided, and exposure to extreme heat or cold & dampness shall not be allowed.

The varnish shall be applied liberally with a brush and spread evenly over a portion of the surface with light strokes to avoid frothing. It shall be allowed to flow on white the next section is being laid on excess varnish shall then be scrapped off the brush and the first section be crossed, recrossed and then laid off lightly. The varnish once it has begun to set shall not be retouched. In case of any mistake in application, the varnish shall be removed and the work started afresh.

The varnish shall be minimum of two coats, with the first coat being a flatting varnish. This shall be allowed to dry hard and be flatted down, before applying the next coat. Sufficient time must be allowed between coats to get a hard dry surface before next coat is applied. All work shall be as per relevant IS Code.

2.02.10 French polish

All unevenness of the surface shall be rubbed down to smoothness with sand paper and the surface shall well dusted .The pores in the shall be filled up with



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a paste of whitening in water or methylated spirit with a suitable pigment like burnt siemme or umber.

After application of the filler paste, the French polish shall be applied with a pad of woollen cloth covered by a fine cloth. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles so that the polish is sparingly but uniformly applied over the entire area to give an even surface. A trace of linseed oil may be used on the pad for case of application. The surface shall be allowed to dry before further coats are applied in the same manner. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit, and rubbed lightly and quickly with circular motions to leave the finished surface with a uniform texture and high gloss.

2.02.11 Chemical Resistant Paint

For chemical resistant paints, epoxy, chlorinated rubber, or vinyl butryl paint system shall be used. Manufacturer's recommendation shall be followed regarding the paint system, exposed to moderately to severe corrosive condition and subject to acid/alkali spillage & fumes, shall be followed.

2.03.00 Protection

Furniture and other movable objects, equipment, fittings and accessories shall be moved, protected and replaced upon completion of work. All stationary equipment shall be well covered so that no paint can fall on them. Work finished by other agencies shall be well protected. All protections shall be done as per instructions of the Engineer.

2.04.00 Cleaning up

In addition to provisions in general conditions the Contractor shall, upon completion of painting etc. remove all marks and make good surfaces, where paint has been splashed or splattered, including all equipment, fixtures, glass, furniture, fittings etc. to the satisfaction of the Engineer.

3.00.00 ACCEPTANCE CRITERIA AND TESTING

- a) All painted surfaces shall be uniform and pleasing in appearance.
- b) All varnished surfaces shall be of uniform texture and high glossy finish.
- c) The colour, texture etc. shall match exactly with those of approved samples.
- d) All stains, splashes, and splatters of paints and varnishes shall be removed from surrounding surfaces.



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Testing

- a) As, each part of the work is under progress, i.e. preparation of surface, providing primer, providing different coats of finishing paints, it shall be passed by the Engineer. Variation from the drawings or specification or standard etc. shall not be accepted. The Contractor shall ascertain from the Engineer as to which parts will be inspected and passed from time to time. The Contractor shall provide all necessary arrangement for inspection of the painting work during its different working phase. The Contractor shall provide necessary scaffolding, approach for inspection of the above as per direction and satisfaction of the Engineer. All the necessary cost for scaffolding, approach, platform, lighting arrangement testing and inspection shall be borne by the Contractor. Such inspection and testing will not, however, exonerate the Contractor from his responsibilities for proper workmanship, material etc.
- b) The Contractor shall carry out all sampling and necessary testing in accordance with the relevant Indian Standards and shall conduct such tests as called for by the Engineer. Where no specific testing procedure is mentioned in the relevant codes, the tests shall be carried out as per the prevalent accepted Engineering practice as per the direction of the Engineer. Tests shall be done in a laboratory, approved by the Engineer, and cost of testing shall be borne by the contractor.
- c) Material/workmanship unsuitable for acceptance shall be removed and replaced by the Contractor. The work shall be redone as per Specification of the contract and direction of the Engineer without extra cost to owner.

4.00.00

I.S. CODE

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

IS: 348	Specification for French polish
IS: 427	Specification for Distemper, dry colour as required.
IS: 428	Specification for Distemper oil emulsion, colour as required.
IS: 1477 (I & II)	Code of Practice for painting of ferrous metal in buildings.



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- IS: 2338 Code of Practice for finishing of wood and wood based materials.
 (I & II)
- IS: 2339 Specification for Aluminium, Paints for general purposes in dual containers.
- IS: 2395 Code of Practice for painting concrete, masonry, and Plaster surface.
- IS: 2932 Specification for enamel, exterior type-1.
- IS: 5410 Specification for cement paint, colour as required.

5.00.00 RATES AND MEASUREMENT

5.01.00 Rates

Rates shall be unit rates for complete items described in the “Schedule of Items”.

Rate shall include cleaning, preparation of surface, supply and application of primer, painting and providing all protection and scaffolding required at site.

5.02.00 Measurements

Painting over the concrete/masonry/wooden surface shall be measured net (on the surface area on which it is applied) in Sqm.

No deduction shall be made for opening not exceeding 0.5 Sqm and ends of beams, joints, etc. also no payment shall be made for reveals, jams, soffits, sill of these openings.

50% deduction shall be made for opening exceeding 0.5 Sqm but not exceeding 3.0 Sqm each and no addition shall be made for reveals, jams, soffits, sills etc.

In case of opening exceeding 3.0 Sqm each, deduction shall be made for opening but jams, soffits, and reveals shall be measured and paid for.

Corrugated surfaces shall be measured flat and measured area shall be increased by 15%.

Painting of structural steel works shall be measured in M.T. of fabricated steel (as per section D-17 clause 6.02.00 i.e Mode of measurement of technical specification for fabrication of structural steel works) unless specified otherwise.



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Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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FLOOR FINISH AND ALLIED WORKS

1.00.0

SCOPE

This section covers furnishing, installation, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes, and allied items of work as listed below

a) In Situ Finishes

- i) Integral finish to concrete base
- ii) Terrazzo finish
- iii) Granolithic finishes
- iv) Patent Stone
- v) Metallic Hardener like “Ironte”/Hardonate Finish
- vi) Mastic Asphalt finishes
- vii) Chemical Resistant finish

b) Tiled Finishes

- i) Terrazzo tile
- ii) Chequered tile
- iii) Glazed tile
- iv) Tesse rae (Mosaic etc.)
- v) Chemical Resistant
- vi) Rubber, Vinyl etc.
- vii) Stone Slab including Kota Stone.

1.01.00

Base

The base to receive the finish is covered under other relevant specifications.



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1.01.01 Sequence

Commencement, scheduling and sequence of the finishing works shall be planned in detail and must be specifically approved by the Engineer in view the activities of other agencies working in that area. However, the Contractor for the finishing items shall remain fully responsible for all normal precautions and vigilance to prevent any damages whatsoever till handing over.

2.00.00 INSTALLATION

2.00.01 Special Materials

Basic materials are covered elsewhere under the Specification. In general, all such materials shall be as per relevant Codes where available. In all cases these materials shall be of the best quality available indigenously unless specified otherwise.

The materials for finishing items must be procured from well-reputed specialized manufacturers and on the basis of approval of samples by the Engineer. The materials shall be ordered, procured and stored well in advance to avoid compulsion to use substandard items to maintain in the construction schedule.

2.00.02 Workmanship

Only workers specially experienced in particular items of finishing work shall be engaged, where such workers are not readily available, with the Engineer's permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular cases where the Engineer so desires the Contractor shall get the finishing items installed by the manufacturer.

2.00.03 Preparation of the Base Surface

The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Engineer and his approval shall be taken regarding method and extent of such rectification work.

For all types of flooring, skirting, dado and similar locations, the base to receive the finish shall be adequately roughened by chipping, raking out joints and cleaning thoroughly all dirt, grease etc. with water and hard brush and detergent if required, unless otherwise directed by the manufacturer of any special finishing materials or specifically indicated in this specification.



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To prevent of water from the finishing treatment the base shall be thoroughly soaked with water and all excess water mopped up.

The surface shall be bone dry where adhesives are used for fixing the finishes.

Prior to commencement of actual finishing work the approval of the Engineer shall be taken as per the acceptability of the surface.

2.01.00 In Situ Finishes

2.01.01 Integral Finish To Concrete Base

While the surface of the concrete laid as per specification for 'Cement Concrete' has been fully compacted and levelled but the concrete is still 'green' thick slurry, made with neat cement shall be applied evenly and worked in with iron floats. When the slurry starts to set it shall be pressed with iron floats to have a firm compact smooth surface without trowel mark or undulations. This finish shall be as thin as possible by using 2.2 kg. of cement per Sq.M. of area.

The surface shall be kept in shade for 24 hours and then cured for at least 7 days continuously by flooding with water. The surface shall not be subjected to any load or abrasion till 21 days after lying.

As desired by the Engineer the surface, while still 'green' shall be indented by pressing strings, the marking shall be of even depth, in straight lines and the panels shall be of uniform and symmetrical patterns.

2.01.02 Terrazzo Finish in Situ

It shall consist of an underbed and a topping laid over an already laid and matured concrete base.

a) Thickness

Unless otherwise specified the total thickness of the 'finish shall be minimum 40 mm for horizontal and 25 mm for vertical surface of which the topping shall be not less than 10 mm. While the topping shall be of uniform thickness the underbed may vary in thickness to provide necessary slopes. The vertical surface shall project out 6 mm from the adjacent plaster or other finish. Necessary cutting into the surface receiving the finish shall be done to acc ate the specified thickness. All junctions of vertical with horizontal shall be rounded neatly to uniform radius of 25 mm.

b) Mix

i) Underbed

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The underbed for floors and similar horizontal surfaces shall consist of a mix of 1 parts cement, 1½ parts sand and 3 parts stone chips by volume. For vertical surfaces the mix shall consist of 1 part cement to 3 parts sand by volume. The sand shall be coarse. The stone chips shall be 10 mm down well graded. Only sufficient water to be added to give a workable consistency.

ii) Topping

The mix for the topping shall be composed of cement, colour Pigment, marble dust and marble chips. Proportions of the ingredients shall be such as to produce the terrazzo of colour texture and pattern approved by the Engineer. The cement shall be white or gray or a mixture of the two to which pigment shall be added to achieve the desired colour. To 3 parts of this mixture 1 part marble powder by volume shall be added and thoroughly mixed dry. To 1 part of this mix 1 to 1½ parts of marble chips by volume shall be added and thoroughly mixed dry again.

The pigment must be stable and nonfading. It must be very finely ground. The marble powder shall be from White marble and shall be finer than IS Sieve No.: 30. The size of marble chips shall be between 1 mm to 20 mm. Sufficient quantity to cover each visible area shall be prepared in one lot to ensure uniform colour. Water to make it just workable shall be added to a quantity that can be used up immediately before it starts to set.

c) Laying

The underbed shall be laid in panels. The panels shall not be more than 5 Sq.M. in area of which no side shall be more than 2.5 M. long. For exposed locations the maximum area of a panel shall be 2.0 Sq.M. The panel shall be laid in alternate bays or chequered board pattern. No panel shall be cast in contact with another already laid until the latter has contracted to the full extent.

Dividing strips made of aluminium or glass shall be used for forming the panels. The strips shall exactly match the total depth of underbeds plus topping.

After laying, the underbed shall be levelled compacted and brought to proper grade with a screed or float. The topping shall be laid after about 24 hours while the underbed is still somewhat "green" but firm enough to receive the topping. A slurry of the mixture of cement and pigment already made shall be spread evenly and brushed in just before laying the topping. The topping shall be rolled for horizontal areas and thrown and pressed for vertical areas to

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extract all superfluous cement and water and to achieve a compact dense mass fully bonded with the underbed. The surface of the topping shall be trowelled over, pressed and brought to a smooth dense surface showing a minimum 75% area covered by marble chips in a even pattern of distribution.

d) Curing

The surface shall be left for curing for about 12 to 18 hours and then cured by allowing water to stand on the surface or by covering with wet sack for four days.

e) Grinding and Polish

When the surface has sufficiently hardened it shall be watered and ground evenly with rapid cutting coarse grade (no.80) grit blocks, till the marble chips are exposed and the surface is smooth. Then the surface shall be thoroughly washed and cleaned. A grout with already prepared mixture of cement and pigment shall be applied to fill up all pinholes. The surface shall be cured for 7 days by keeping it moist and then ground with fine grit blocks (no.: 120). It shall again be cleaned with water, the slurry applied again to fill up any pinholes that might have appeared and allowed to be cured again for 5 days. Finally, the surface is ground a third time with very fine grit blocks (no.: 320) to get smooth surface without any pinhole. A suitable machine shall do the grinding. Where grinding machine can not be used hand grinding may be allowed when the first rubbing shall be with carborundum stone of coarse grade (no.:60), second rubbing with medium grade (no.: 80) and final rubbing and polishing with fine grade (no.: 120). The surface shall be cleaned with water, dried, and covered with soil free, clean sawdust if directed by the Engineer. The final polishing shall be postponed till before handing over if desired by the Engineer. Just before handing over the surface shall be dusted with oxalic acid at the rate of 0.33 gm. per. Sq.M., water sprinkled on to it and finished by buffing with felt or hessian bobs. The floor shall be cleaned with soft moist rag and dried. However, all excess wax polish to be wiped off and the surface to be left glossy, but not slippery.

2.01.03**Granolithic Finish**

Granolithic finish shall either be laid monolithically over base concrete or separately over hardened base concrete.

a) Thickness

The finish shall be average 20 mm and minimum 12 mm thick, unless specified otherwise.

b) Mix

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The mix shall consist of 1 part cement: 1 part coarse sand 2 parts coarse aggregate by volume. The coarse aggregate shall be very hard like granite and well graded between 6 mm and 12 mm. Minimum quantity of water to get workability shall be added.

c) Laying of Monolithic Topping

The concrete base shall be laid as per specification "Cement Concrete" and levelled upto the required grade. The form shall remain sufficiently protruding to take the finish.

Within about 3 hours of laying the base while it is still fully -green- the topping shall be laid evenly to proper thickness and grade. If considered necessary the surface ' of the base shall roughened by wire brushing. Unless manual operation is permitted by the Engineer, mechanical vibrators of suitable design shall be used to press the topping firmly and work vigorously and quickly secure full bond with concrete base.

The laitance brought to the surface during compression shall be removed carefully without disturbing the stone chips. The surface shall then the lightly trowelled to remove all, marks. When sufficiently set, hand trowelling shall be done to secure a smooth surface without disturbing the stone chips.

For large areas the laying shall be in panels of maximum 25 Sq.M. area. The panels shall be laid in chequered board pattern.

d) Laying of Topping Separately on Hardened Base

The base concrete shall be prepared as stated in clause 2.00.03 and a slurry of neat cement applied just prior to laying the granolithic concrete mix (1:1:2). The method of compaction etc. shall be same as for monolithic topping.

Curing

Immediately after laying, the finish shall be protected against rapid drying. As soon as the surface had hardened sufficiently, it shall be kept continuously moist for at least 10 days by means of wet gunny bags or pounding of water on the surface. The floor shall not be exposed to heavy traffic during this period.

f) Grinding

If grinding is specified, it shall start only after the finish has fully set. Clause 2.01.02 (e) shall be followed. However, the Engineer shall decide upon the ultimate polish required.



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g) Finishing

Where specified, sodium, silicate or magnesium or zinc silico fluoride treatment shall be done. The number of coats to be applied shall be as per approved drawings or as instructed. The concentration and method of application of the solutions shall be as specified in IS: 5491.

2.01.04

Patent Stone

It shall consist of an underbed and a topping laid on an already laid and matured concrete base.

a) Thickness

The patent stone finish shall have thickness as stipulated under clause 2.01.02 (a) except that the topping shall be 12 mm thick.

b) Mix

i) Underbed

The mix shall be as stipulated under clause 2.01.02 (b).

ii) Topping

The mix for the topping shall consist of 1 part cement and 2 part stone aggregate 6mm nominal size by volume.

c) Laying

The Patent Stone finish including the underbed shall be laid in alternate bays or in Chequered board pattern. No panel shall be cast in contact with another already laid till the contraction of the latter has already taken place.

The maximum area of each panel shall be 3 Sq.M. of which no side shall be more than 2 M. long.

A cement grout shall be applied and worked into the surface to receive the finish; the underbed then laid, compacted, and leveled to proper grade with a screed or float. The topping shall be applied evenly on the underbed while it is not fully set but firm enough and rolled and pressed to get full bond. The topping shall be trowelled to a dense finish to the satisfaction of the Engineer. All trowel marks shall be mopped out with a soft cloth to give a clean smooth surface.



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After the surface is sufficiently set, the finished floor shall be kept moist for 7 days for curing. If desired the finish shall be polished as directed by the Engineer.

2.01.05 Metallic Hardener Like 'Ironite'/'Hardonate' Finish

This will consist of a topping (incorporating iron particles) to bond with concrete base while the latter is 'green'.

a) Thickness

Unless otherwise specified the metallic hardener finish shall be of 12 mm depth.

b) Material

The hardening compound shall be uniformly graded iron particles free from non-ferrous metal impurities, oil, grease, sand soluble alkaline compounds or other injurious materials when desired by the engineer, actual samples shall be tested.

c) Mix

Proportion of the metallic hardener shall be as specified or as indicated by the manufacturer. However, in absence of any such direction 1 part metallic hardener shall be mixed dry, with 4 parts cement, by weight. To this mixture 6 mm nominal size stone chips shall be added in proportion of 1 part cement (mixed with hardener) to 2 parts of stone chips by volume and uniformly mixed. Minimum quantity of water shall be added to make it workable.

d) Laying

The concrete floor shall be laid as per specification 'Cement Concrete' and levelled upto required grade. The forms, if any, shall remain sufficiently projecting to make the finish. The surface shall be roughened by wire brush as soon as possible.

The finish shall be laid while the concrete underbed is still very 'green' within about 3 hours of laying of the latter. The finish shall be of uniform thickness and even dense surface without trowel marks, pin holes etc. This topping layer shall be pressed firmly and worked vigorously and quickly to secure full bond with the concrete base. Just when the initial set starts the surface shall be finished smoothened with steel trowel.



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The finished floor shall be cured for 7 days by keeping it wet.

2.01.06 Mastic Asphalt Finish

This is a one-layer treatment on concrete or brick base.

a) Thickness

The thickness shall be as specified in the drawing.

b) Materials

Bitumen shall be industrial Bitumen of the grade 90/15 and 75/15 conforming to IS: 702.

Mineral filler shall be dry stone dust passing through 75 micron IS Sieve.

Fine aggregate shall be crushed and graded natural limestone or other hard work.

Coarse aggregate shall be crushed siliceous stone or other approved aggregate 6 mm stone chips shall be used for finish upto 20 mm thick & 10 mm chips for thicker finish.

c) Composition

Bitumen mastic shall conform IS: 1195 and shall be either brought to site in blocks weighing about 25 Kg or prepared at site. If brought in blocks, these shall be remelted in mechanically agitated mastic cookers and coarse aggregate, preferably preheated fed in successive portions until the complete change is thoroughly, incorporated. At no stage during the remelting and mixing process, shall the temperature exceed 205°C.

d) Laying

The hot mastic shall be laid on dry base surface cleaned thoroughly by wire brushing and sweeping. The mastic shall be leveled and when cooled to some extent shall be finished with a wooden float with addition of small quantity of fine sand if required. No load shall be allowed till the finish has cooled to normal temperature.

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	The mastic shall be laid in suitable panels of about 1.5 Sq.M. in area each formed by formers. Succeeding panels shall be laid overlapping the finish panel so as to melt its edges and form a continuous finish without joint. 2.01.07 Chemical Resistant in Situ Finish Chemical resistant in situ finish shall be as epoxy resin with suitable filler material over a primer. The minimum thickness shall be 6 mm. About its performance the Engineer shall have to be fully satisfied by test results and examination of similar treatment already in existence. The contractor shall get it done by a specialized Manufacturer and get guarantee of performance from the organization and pass it on to the Owner in addition to his own guarantee. 2.02.00 Tiled Finish These shall include finish tiles, stone slabs, and similar manufactured or natural items over already laid and matured base of concrete or masonry by means of an underbed or an adhesive layer. 2.02.01 Terrazzo Tile Finish The finish will consist of manufacture terrazzo and an underbed. a) Thickness The total thickness including the underbed shall be minimum 40 mm for floors 30 mm for walls unless otherwise specified. The skirting, dado and similar vertical surfaces shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the tiled finish, to accommodate the specified thickness shall be done. b) Tiles: Terrazzo The tiles shall, unless specifically permitted in special cases be machine made under quality control in a shop. The tile shall be pressed hydraulically to a minimum of 140 Kg. per Sq.cm. Each tile shall bear on its back permanent and legible trademark of the manufacturer. All angles of the tiles shall be right angles all arises sharp and true, colour and texture of the wearing face uniform throughout.	

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Maximum tolerance allowance length and breadth shall be ± 1 mm and the thickness ± 3 mm. Face of the tile shall be plane, free from pinholes and other blemishes.

The tiles shall be composed of a backing and topping. The topping shall be of uniform thickness not less than 10 mm.

The total thickness including the topping shall be as specified but not less than 20 mm in any case.

The backing shall be composed of 1 part ordinary gray cement and 3 parts of stone chips by weight mixed with water.

The topping shall be as specified under clause 2.01.02 (b).

The tile shall be cured at the shop for at least 14 days before delivery to the site. First grinding shall be given to the tiles at the shop before delivery. Tiles shall be packed properly to prevent damage during transit and storage. The tiles must be carefully stored to prevent staining by damp, rust, oil, and grease or other chemicals.

Tiles made in each batch shall be kept and used separately so that colour of each area of the floor may remain uniform.

The manufacturer shall supply along with the tiles the grout mix containing cement and pigment in exact proportions as used in topping of the tiles. The containers for the grout mix shall be suitably marked to relate it to the particular type and batch of tiles.

c) Mix: Underbed

The underbed for floor and similar horizontal surfaces shall be 1 part lime putty: 1 part surkhi: 2 parts coarse sand by weight mixed with sufficient water to form a stiff workable mass. For skirting and dado and all vertical surfaces it shall be about 12 mm thick and composed of 1 part cement and 3 parts coarse sand by weight.

d) Laying

The underbed mortar shall be evenly spread and brought to proper grade and consolidated to a smooth surface. The surface shall be roughened for better bond. Before the underbed had time to set and while it is still fairly moist but firm, cement shall be hand dusted over it or a cement slurry applied and the tiles shall immediately be placed upon and firmly pressed by wooden mallet on to the underbed until it achieves the desired level. The tiles shall be kept soaked for about 10 minutes just before laying. The

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joints between tiles shall be as close as possible and not more than 1.5 mm wide.

Special care shall be taken to check the level of the surface and the lines of the joints frequently so that they are perfect.

When tiles are required to be cut to match the dimensions these shall be sawn and edges rubbed smooth. The location of cut tiles shall be planned in advance and approval of the Engineer taken.

At the junction of horizontal surface with vertical surface the tiles on the former shall enter at least 12 mm under the latter.

After fixing, the floor shall be kept moist and allowed to mature undisturbed for 7 days. Heavy traffic shall not be allowed.

If desired dividing strips as specified under Clause 2.01.02(c) may be used for dividing the work into suitable panels.

e) Grinding and Polishing

Procedure shall be same as Clause 2.01.02(e). Grinding shall not commence earlier than 14 days after laying of tiles.

2.02.02**Chequered Tile Finish**

The finish shall consist of manufactured gray or coloured cement tiles or terrazzo tiles with chequered face and an underbed laid over concrete or brick surface.

a) Thickness

Thickness shall be same as in clause 2.02.01 (a).

b) Tiles: Chequered

The tiles shall have chequers not less than 2.5 cm. c/c and not more than 5 cm. c/c. Depth of grooves shall be not less than 5 mm. The grooves shall be uniform and straight.

The tiles shall conform to clause 2.02.01 (b) except that these may have the topping in terrazzo or plain gray cement or colour pigment added to cement.

c) Under-bed

As per clause 2.02.01 (c).



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- d) Laying
As per clause 2.02.01 (d).

- e) Grinding and Polishing

As per clause 2.02.01 (e) except that the tiles shall be ground and polished by hand and after laying taking special care in polishing the grooves properly and uniformly.

2.02.03

Glazed Tiles Finish

This finish shall be composed of glazed earthenware tiles with an underbed laid over a concrete or masonry base.

- a) Thickness

The total thickness shall be between 20mm and 25mm including the underbed.

The tile finish on vertical surface shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the finish, to accommodate the specified thickness shall be done.

- b) Tiles: Glazed

The tiles shall be of earthenware, covered with glaze white or coloured, plain or with designs, of 150 mm x 150 mm nominal sizes and 5.5 mm to 6 mm on thick unless otherwise specified. The tolerance shall be ± 1.5 mm for length and breadth and ± 0.5 mm for thickness specials like internal and external angles; beads, covers, cornices, corner pieces etc. shall match. The top surface of the tiles shall be glazed with a gloss or matt, unfading stable finish as desired by the Engineer. The tiles shall be flat and true to shape. The colour shall be uniform and fractured section shall be fine grained in textures, dense and homogeneous. The tiles shall be strong and free from flaws like cracks, craze, specks, crawlings, etc. and other imperfections. The edge and the underside of the tiles shall be completely free from glaze and the underside shall have ribs or indentations for better anchorage with the fixing mortar.

The coloured tiles, when supplied, shall preferably come from one batch to avoid difference in colour.

- c) Mix: Underbed



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The mix for the underbed shall consist of 1 part cement and 3 parts coarse sand by weight mixed with sufficient water or any other mix if specified.

- c) Laying
Same as clause 2.02.01 (d).

- e) Finishing

The joints shall be cleaned and flush pointed with white cement and cured for 7 days by keeping it wet. The surface shall be cleaned with soap or suitable detergent, washed fully, and wiped with soft cloth to prevent scratching before handing over.

2.02.04

Tesserae Finish (Mosaic etc.)

This finish consists of manufactured vitreous, glass, ceramic or similar hard small pieces set in an underbed over a concrete or masonry surface, already laid.

- a) Thickness

The total thickness including the underbed shall be between 16 mm & 25 mm.

- b) Tesserae Finish

These shall usually be 6 mm thick small piece of ceramic vitreous china, tinted glass, or similar hard wearing, strong, and durable material in desired shapes and sizes and patterns.

The supply shall come in the desired pattern in full or sections conveniently for handling, stuck to pieces of strong thick paper on the surface to be exposed. The gum used for this purpose must be water soluble and non-staining. The sections shall be properly marked to avoid mistakes and master drawing shall be available at the site for guidance.

- c) Mix: Underbed
Same as clause 2.02.03 (c)

- d) Laying

The specification for laying if given by the manufacturer of the item shall be followed provided it is approved by the Engineer. Otherwise clause 2.02.03 (d) shall generally be followed. However, instead of gray cement the slurry shall be made with white cement to fix the panels. The paper-mounted patterns in sections shall be carefully placed and pressed in position true to lines and levels. Earliest possible the paper shall be peeled



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off and surface examined and cleaned, joints flush pointed with white cement and cured for 7 days by keeping it wet.



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2.02.05 Chemical Resistant Tiled Finish

This shall include all varieties of special tiles used for specific chemical resistance function and an underbed over already laid concrete or masonry.

a) Tiles

The chemical resistant tiles shall be of the best indigenous Manufacture unless otherwise specified and shall be resistant to the chemical (both acid and alkali). The tiles shall have straight edges, uniform thickness, plain surface, uniform nonfading colour, and textures.

Usually the chemical resistant tiles shall not absorb water more than 2% by weight. The tiles shall have at least compression strength of 700 Kg/cm². The surface shall be abrasion resistant and durable.

b) Laying

The mortar used for setting or for underbed these tiles shall be durable, strong and chemical resistant epoxy mortar. The grout, which shall be to the full depth of tile, shall have equal chemical resistant properties. Joints shall be pointed if so desired. The setting and fixing shall be according to the manufacturer's specification approved by the Engineer.

2.02.06 Rubber, Vinyl, or Vinyl Asbestos Tiles Finish

This shall include various types of tiles manufactured from rubber, vinyl etc. set with an adhesive on concrete or masonry base. An underbed may be required to secure desirable surface and grade.

a) Thickness

The thickness of the tiles shall be as incorporated in drawing.

b) Tiles

Unless otherwise desired the tiles shall be squares of approved dimensions. The tolerance in dimensions shall be ± 1.5 mm.

The face of the tiles shall be free from porosity, blisters, cracks, embedded foreign matters or either physical defects which affect appearance or serviceability. All edges shall be cut true and square. The colour shall be nonfading and uniform in appearance, insoluble in water and resistant to alkalies, cleaning agents and usual floor polishes.

Each tile shall be marked on the back legibly and indelibly with



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manufacturer's trademark, the thickness, sizes, batch number, and date of manufacturer.

Tiles shall be delivered securely packed and stored in clean, dry well ventilated place at a temperature near about to that the tiles shall be called upon to stand ultimately.

Adhesive to be used for sticking the tiles shall be approved by the tile manufacturer. The adhesive shall have a short drying time and long life in addition to toughness.

c) Mix: Underbed

The underbed where required to make up the specified thickness or to give the required grade or to get the right type of surface shall be composed of 1 part like putty:1 part cement: 3 parts coarse sand mixed with just sufficient water to make it workable.

d) Laying

The tiles shall be kept in the room to be tiled for at least 24 hours to bring them to the same temperature as the room. For air-conditioned space, the air-conditioning shall be completed before tiling is taken up.

The surface to receive this finish shall be firm even textured but not too smooth, without undulations and other deficiencies. If an underbed is laid the same shall be cured for at least 7 days by keeping it moist and then fully dried.

The surface shall be thoroughly cleaned. All loose dust particles shall be removed. Oil and grease if any shall be completely cleaned by use of detergent.

The adhesive shall be applied to fully dry surface in desired thickness uniformly. The adhesive shall also be applied to the backs and edges of the tiles and allowed to surface dry. The tiles shall be placed neatly on the surface exactly to the approved pattern and set with a suitable tool. If the edges tend to curl, weights are to be used to keep the edges down. Special care shall be taken to avoid formation of air pockets under the tiles. The joints shall be very fine. Any adhesive squeezed out through the joints shall be removed immediately.

e) Finishing

If any adhesive mark is there on the surface a soft cloth soaked in solvent shall be used to wipe it off. The surface shall be cleaned with soft soap,



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dried, and polished with an approved type of polish just before handing over.

2.02.07

Stone Slab Finish: Marble, Stone, and Similar Fine Grained Stone including Kota stone

a) Thickness

The underbed shall be minimum 12 mm and average 20 mm thick. The slabs will be 20 mm thick.

b) Stone Slab

The stone slabs shall be made from selected stock, which is hard, sound, homogeneous and dense in texture and free from flaws. Angles and edges shall be true, square, and free from chipping and surface shall be plane. The slabs shall preferably be machine cut to the required dimensions. Tolerance of ± 5 mm in dimensions and ± 2 mm in thickness will be allowed. Unless specified the slabs shall be minimum 300 mm x 300 mm.

The stone slabs shall come from specific regions and in specified quality with top surface fine chisel dressed. All sides shall also be fine chisel dressed to the full depth to allow finest possible joints.

The slabs shall be delivered to the site well protected against damages and stored in dry place under cover.

c) Mix: Underbed

Same as clause 2.02.01 (c).

d) Laying

The sides and top surface of the slabs shall be machine rubbed or table rubbed with coarse sand stone and washed before laying.

The underbed mortar shall be evenly spread and brought to proper level on the area under each slab. The slab shall be laid over the underbed, pressed, and tapped down with wooden mallet to the proper level. The slab shall then be lifted and the underbed corrected as necessary and allowed to stiffen a little. Next, thick cement slurry shall be spread over the surface. The edges of the slab shall be buttered with slurry of cement, gray / white / mixed with pigment matching the colour of the stone slabs. The slab shall be gently laid and tapped with wooden mallet to bed properly to a very fine joint and to the required level. All surplus cement slurry shall be removed and the surface mopped clean with wet soft cloth. The laid finish shall be cured for 7 days by keeping it wet.



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e) Polishing, Finishing

Fine chiselling shall be done to remove the slight undulations that usually exist at the joints. The polishing and finishing shall be done as specified under clause 2.02.01 (e). However, the joints shall be so fine in the case of stone slabs that grouting shall not be called for.

2.02.08 Stone Slab Finish: Sand Stone and Similar Coarse Grained Stone Finish

Generally clause 2.02.07 shall be followed except that the workmanship and finish shall not be fine as which are explained hereunder.

The slabs shall be rough chiselled or fine chiselled as specified. Tolerance may be allowed upto ± 6 mm for rough finish, but no sharp unevenness and shall be allowed. For fine chiselling the unevenness shall be limited to ± 2 mm. The sides shall be chisel dressed at least to half slab depth so that the maximum deviation from straight line shall be within 25 mm. Beyond this depth the edge may be slightly splayed.

The joint thickness shall be kept limited to 5 mm in case of rough finish and 3 mm in case of fine finish unless wider joints are specified. The joints shall be grouted with white or coloured cement. If fine joints in the flooring are specified, the edges of slabs shall be cut in such a way that it shall form an inverted 'Y'.

3.00.00 ACCEPTANCE CRITERIA

The finish shall be checked specially for:

- a) Level, Slope, Plumb as the case may be
- b) Pattern and Symmetry
- c) Alignment of joints, dividing strip etc.
- d) Colour, texture
- e) Surface finish
- f) Thickness of joints
- g) Details at edges, junctions etc.

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	h) Performance i) Precautions specified for durability 4.00.00 I.S. CODES All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed. IS: 777 : Glazed earthenware tiles IS: 1196 : Code of practice for laying bitumen mastic flooring. IS: 1197 : Code of practice for laying of rubber floors IS: 1237 : Cement concrete flooring tiles IS: 1443 : Code of practice for laying and finishing of cement concrete flooring tiles. IS: 2114 : Code of practice for laying in situ terrazzo floor. IS: 3461 : PVC asbestos floor tiles IS: 4860 : Specification for acid resistant bricks IS: 5518 : Code of practice for laying of flexible PVC Sheet and tile flooring. IS: 5491 : Code of practice for laying in situ granolithic floor topping. 5.00.00 RATES AND MEASUREMENT 5.01.00 Rates Rates shall be for the complete work (including dividing strips, ironite, metals, tiles etc. if any) as per the schedule of items. Rates shall be applicable for application on horizontal and vertical surfaces at all elevations and for all types of work including stairs tread and riser, laying in desired pattern and panels, cost of specials (if any) rounding of corners, mouldings etc.	



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Rates shall be including provision of side shuttering (if required) for casting of floor in alternate panels and or without dividing strips.

5.02.00

Measurement

The finished surface shall be measured in Sqm for area unless otherwise specified. Deduction shall not be made for opening or embedded articles having area not exceeding 0.1 Sqm.



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SHEET WORK IN ROOF AND SIDING

SPECIFICATION NO. PE-TS-999-600-C013



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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<u>SHEET WORK IN ROOF AND SIDING</u> 1.00.00 SCOPE This section covers supply, cutting & fabrication and erection of corrugated/plain asbestos, corrugated galvanized iron, aluminum, permanently colour coated troughed zinc-aluminium alloy coated M.S. sheet or other sheet for covering to roof and sides at various elevations as specified. 2.00.00 INSTALLATION 2.01.00 Storage of Materials All materials shall be stored by the Contractor in proper way to prevent all damage. 2.02.00 Workmanship The workmanship shall be according to best construction practice to give a watertight finish to the satisfaction of the Engineer. Fixing of gutters and down pipes shall be according to IS: 2527. 2.02.01 Asbestos Sheeting Asbestos sheets of profiles as specified shall be fixed with minimum 150 mm end lap and side laps as per manufacturer's specification. Hook bolts or J-bolts shall be 8 mm dia. at 305 mm centres. Six (6) mm dia. galvanized iron seam bolt and nut with G.I. flat washers and bitumen washers shall be used for stitching ridge cappings, corner pieces, ventilators, north light curves etc. 2.02.02 C.G.I. Sheeting and Aluminium Sheeting Side laps shall be 2 corrugations for roof and one corrugation for side sheeting. End laps shall be minimum 150 mm for roof and 100 mm for side sheeting. In ridges and hips where plain sheets are used, the end laps shall be minimum 100 mm. Holes in C.G.I. sheets shall preferably be made on the ground. The sheets should be placed on purlins/trestles and holes punched in the ridge of the corrugation from the outside inward for obtaining proper seating of limpet washers. Sheets shall be secured to sheet framing by 8 mm dia. galvanised iron hooks or J-bolts and maximum spacing of the bolts shall be 305 mm. The length of the hook or J-bolts shall be to suit the sections of the bearers. Sheets shall also be bolted at the ends at every third corrugation with 6 mm dia. galvanized iron seam bolts and G.I. flat washers and bituminous washers.		

- i. Troughed zinc-aluminium alloy coated not less than 150 gm/sq.m M.S. sheets having 0.6 mm minimum thickness (or High tensile steel sheet having

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	minimum yield strength of 350 Mpa of 0.5mm minimum thickness) shall be used for the cladding system. The outer side (exposed face) shall be permanently colour coated with PVF₂ paint of minimum DFT 20 microns over primer and the inner side (internal face) shall be coated with same paint of minimum DFT 12 microns over primer. These shall be fixed directly to runners. The sheets shall meet the general requirement of IS:14246 and shall conform to class 3 for the durability. ii. FLASHING, CAPS, TRIM CLOSURES ETC. All flashings, trim closures caps etc. required for the metal cladding system shall be made out of plain sheets having same material and coating specification as mentioned above for the outer face of the sandwiched metal cladding. 3.00.00 ACCEPTANCE CRITERIA The installations shall present a neat appearance and shall be checked for water tightness. The following shall be checked: a) Side and end laps b) Absence of cracks, holes or damages in sheet c) Spacing of bolts d) Provision of double washers (G.I. and asbestos or bituminous washers) e) Proper installation of flashing. 4.00.00 I.S. CODE All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed. - IS: 3007 : Code of practice for laying of asbestos cement sheets. - IS: 2527 : Code of practice for fixing rainwater gutters and down pipes for roof drainage. - IS: 1626 : Specification for asbestos cement building pipes, gutters and fittings. - IS: 277 : Specification for galvanized steel sheets (plain and	



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corrugated).

5.00.00 RATES AND MEASUREMENT

5.01.00 Rates

Rates shall be unit rate for complete item described in “Schedule of Items” and shall include all wastage.

5.02.00 Measurement

Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done. Profiled sheeting shall be measured flat and not girthed. Opening less than 0.40 Sqm shall not be deducted. No extra shall be paid for extra labour in cutting and for wastage etc. No payment shall be made for laps, flashings, sealing, fasteners etc. in sheeting works.



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SUSPENDED CEILING

SPECIFICATION NO. PE-TS-999-600-C014



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

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SUSPENDED CEILING

1.00.00 SCOPE

This section covers supply and installation of suspended ceiling together with the suspension system as shown on drawing or specified in schedule of item with all materials, labour and equipments. The work shall also include providing of openings in the ceiling for lighting, air-conditioning diffusers etc. as shown on drawings or as instructed by the Engineer.

2.00.00 INSTALLATION

2.01.00 Suspension System

2.01.01 General

Suspension system shall consist of the grid supporting the ceiling panels, intermediate runner supports for the grid if any and hangers, wall angles etc. required to suspend the grid or the runners from structural works, slabs and beams.

All members of the suspension system shall be of sufficient strength and rigidity to carry, the ceiling boards or sheets in a true and level plane without exceeding a deflection of 1/360th of their span. All joints in ceiling panels shall run straight and cross joint shall be at perfect right angles. Angle moulds where shown on drawings shall be securely fixed to walls. All drillings of structural concrete and installation of suitable anchoring device for installation including welding of the suspension system shall be included in the rate. All M.S. sections used for supports etc. shall be given one coat of synthetic enamel paint over a coat of red lead primer.

2.01.02 Metal Grid Suspension System

Aluminium grid ceiling system shall be "Bead lock" as manufactured by W A Beard shell and Co. Pvt. Ltd. or Ajit India Limited or approved equal. Steel grid ceiling system shall be 'Jolly Snap Grid' as manufactured by Jolly Board Limited or approved equal.

Steel tees as intermediate members and steel channels, as end pieces will be assembled in the form of grid. Size of tees and channels shall be as required.

The cross-tees shall intersect main tee runners in pattern shown on drawing and positively locked together with intersection members. All perimeter areas shall have tee runners fixed to vertical wall surfaces and end channels shall be

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	fixed to runners leaving return air space between vertical wall and channels, unless otherwise shown on drawings. Angle cleats or other suitable fixing device shall be fixed to the structural beams above for fixing of hangers. Main runners shall be hung by M.S. flats, angles, rods or 12G or heavier galvanized tie wire hangers at maximum 1.2 metre centres. Extra hangers shall be provided at light fixtures that are supported from the ceiling system. The spacing of main and cross runners shall be as shown on drawings. Turnbuckles shall be provided in M.S. rods for adjustment in levels. 2.02.00 Ceiling Panels 2.02.01 Material Ceiling panels shall be best quality material in thickness and properties called for in the “Schedule of items”. The Contractor shall submit test certificates to the Engineer for approval before bulk supply. The ceiling panels may be of following type: a) Plaster of Paris board (decorative) b) Expanded polystyrene insulation board with plastic fascia. c) Fibre Insulation board. d) Bonded wooden particle board (Plain and decorative) e) Glass fibre reinforced polystyrene sheets. f) Flat asbestos sheets (with plastic fascia). 2.02.02 Installation of Ceiling Panels Installation of Ceiling panels shall be strictly as per manufacturer’s instruction. For concealed grid system, tiles shall be fixed to the supporting grid in manner shown on drawing or as specified by the manufacturer. Where V joints in tiles are called for in drawings, these shall be in true lines. Where flush surface is required, the joints shall be filled with approved filler material and finished to give a neat uniform surface. Special care shall be taken to neatly finish the ceiling at junctions with walls, light fixtures, diffusers etc. 2.02.03 Aluminium Lineal Ceiling System	



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Aluminium lineal ceiling system shall be “Luxalon 84C ” or approved equal and the installation shall be strictly as per manufacturer’s instruction/ specification subject to approval of the Engineer.

Aluminium lineal ceiling shall comprise of plain panels, 84 mm wide and 12.5 mm deep with a 23.9 mm recessed flange, roll formed out of 0.5 mm thick aluminium alloy panels stove enamelled on both sides, fixed on roll-formed carriers made of enamelled 0.95 mm thick aluminium, 32 mm wide and 39 mm deep with prongs to hold panels in the module of 100mm, at maximum spacing 1.2 M centre to centre. The carriers shall be suspended from roof by 4 mm dia galvanised steel wire hangers with special height adjustment clips made out of spring steel at maximum spacing of 1.2 M c/c. Hangers shall be fixed to roof by ‘J’ hooks and nylon inserts. 25 mm thick resin bonded mineral wool (spintex 300 or equivalent) insulation bound in polythene shall be laid on top of panels. Lineal ceiling shall be fixed in pattern as per detailed drawings.

3.00.00 SAMPLES

Samples of Ceiling panels and metal suspension system components as noted below shall be submitted for Engineer's approval:

- Panels : 3 samples approximately 300 mm square/long each
- Suspension System : 3 samples of short length : each of main and secondary system

4.00.00 SHOP DRAWINGS

Shop drawings shall be submitted for approval as required and approval shall be obtained prior to delivery of suspended ceiling components. Shop drawings shall be co-ordinated with all related work and shall show the following information:

- A reflected ceiling plan of areas indicated to receive the ceiling showing electrical and mechanical features.
- Typical Intermediate framing for support where required.
- Hanger fastening details.
- Panels - unit support at ceiling penetrations.
- Details of splicing method for main and cross runners.
- A table indicating load bearing capacity of main and cross runner



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- g) A note stating that the suspension system member furnished will not deflect more than $1/360$ of the span under the indicated loading.

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5.00.00	ACCEPTANCE CRITERIA Finished ceiling shall be at the correct plane and present a pleasing and uniform appearance, free from, sags, warps, disfigured, or damaged board. Cutouts for light fixtures, diffusers etc. shall be of exact dimensions and in exact locations.	
6.00.00	RATES AND MEASUREMENT	
6.01.00	Rates	
	Rates shall be for the complete item called for in the “Schedule of Items”. No extra payment will be made for alignment and adjustment of lighting fixtures, air-conditioning diffusers, access panels etc. The rate shall include all cutting and wastage from standard size sheets, runners/carries etc.	
6.02.00	Measurement	
	Actual area of work shall be measured in Sqm correct to second place of decimal. However, no deduction will be made for opening upto 0.25 Sqm. each in area.	



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**WATER SUPPLY, DRAINAGE
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Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
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WATER SUPPLY, DRAINAGE AND SANITATION**1.00.00****SCOPE**

This section covers supply of all materials labour and incidentals required for supply, laying and installation of under/over ground pipes for water supply, drainage and sanitation with all fittings, fixtures and jointing, construction of ancillary works like manholes, drop connections, gully chambers, septic tank, soak pits, surface drain etc.

The supply and installation of water supply/sanitation fixtures and accessories like water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap container etc. with all fittings, fixtures, water supply/sanitation pipes and water storage tanks etc.

2.00.00**MATERIAL**

All materials, fittings, fixtures, and appliances shall be of the best quality conforming to relevant Indian Standard and shall be procured from approved manufacturers. Unless specifically allowed by the Engineer, the Contractor shall submit samples of fittings and fixtures, which will be retained by him for comparison when bulk supplies are received at the site. Ultimate choice of type, model, and manufacturer lies completely with the Engineer.

It shall be the responsibility of the Contractor to procure the materials selected by the Engineer. Hence orders are to be placed with the manufacturers in time, so that the materials are available at the site well ahead of their requirement.

The materials brought to the site, shall be stored in a separate secured enclosure away from the building materials. Pipe threads, sockets, and similar items shall be specially protected till final installation. Brass and other expansive items shall be kept under lock and key. Fragile items shall be checked thoroughly when received at the site and items found damaged shall not be retained at the site.

2.01.01**Pipes and Pipe Fittings**

For water supply, galvanised mild steel pipe of medium grade confirming to IS: 1239 shall be used. The galvanising shall not be less than 400gm/sqm of pipe surface area. Galvanising shall be smooth and shall be subjected to testing as per IS: 2633 for uniformity of coating. The zinc coating shall be free from defects.

For Roof drainage and building sanitation works following type of pipe are coved in this Section:



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- a) Cast Iron pipe
- b) Steel pipe (lined, coated with bituminous composition, out coated with cement concrete or mortar or galvanized)
- c) Concrete pipe
- d) Asbestos cement pipe
- e) PVC pipe
- f) Stoneware pipe
- g) Vitrified pipe
- h) Lead pipe (not to be used for portable water)

2.02.01

Fixtures

All material, fittings, fixtures, appliances, accessories shall be of approved quality and shall be procured from reputed brands like Hindustan/Pasriware/Cera or equivalent or as approved by Engineer. The bidder shall procure the fixtures from the above named reputed manufacturers and shall mention in his bid the type & make of the fixtures he intends to use.

All items brought to the site must bear the manufacturer's identification mark. Procurements shall be made well in advance and should get inspected & approved immediately by the Engineer. All fixtures shall be adequately protected, covered, and plugged till handing over.

All fittings, gratings, fasteners, unless specified otherwise, shall be chromium plated. The chromium plating shall be of grade-2 (10micron thickness) confirming to IS: 4827. Powder coating shall be of approved colour and shall have minimum thickness (DFT) of 20micron. Stainless steel accessories shall be of grade SS-304 and from reputed manufacturer (like Salem Steel) and shall be polished bright finish.

Unless specified in the contract the fixtures shall be as specified hereinafter.

Water closet

a) **European type**

It shall consist of European type glazed vitreous china basin (confirming to IS: 2556, part-II), with siphon open front solid plastic seat and plastic



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cover, low level glazed stoneware flushing cistern with valve less fittings, supply connections and necessary fittings. All fittings shall be chromium plated. Colour of basin, cistern, seat and cover shall be as approved by the Engineer.

b) Squatting type

It shall consist of Orissa pattern glazed vitreous china squatting pan with integral foot rests (confirming to IS:2556, part-III) and high level cast iron flushing cistern with valve less fittings, supply connections and necessary fittings. All fittings shall be chromium plated. The flushing cistern shall be painted as specified by the Engineer.

Urinals

It shall consist of wall type glazed vitreous china urinals (conforming to IS:2556), cast iron automatic flushing cistern complete with supply connections, flush pipe, lead pipes, gratings, traps and all other necessary fittings. Frequency of automatic flushing shall be approximately once every five minutes. For every four urinals (maximum) located together may be served by one cistern of adequately capacity. All fittings shall be chromium plated.

Wash Basin

It shall be made of glazed vitreous china conforming to IS:2556, part-IV. The basin shall be flat back, wall hung by painted cast-iron brackets and complete with hot and cold CP brass faucets with nylon washers, PVC connection pipe with CP brass nuts, CP brass chain with rubber plug, 32mm dia. Chromium plated brass waste of standard pattern, 32mm dia. CP brass trap union complete with necessary fittings.

Sink

It shall be made of glazed vitreous china conforming to IS:2556, part-V. It shall be wall hung by painted cast iron brackets and complete with one CP brass faucet with nylon washers, PVC connection pipe with CP brass nuts, CP brass chain with rubber plug, 40mm dia. chromium plated brass waste of standard pattern, 40mm dia. CP brass trap union complete with necessary fittings.

Bathroom mirror

It shall be made of the best quality 6 mm thick glass and produced by a reputed mirror manufacturer. It shall be wall mounted with adjustable revolving brackets. The brackets, screws, and other fittings shall be chromium plated.



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Glass shelves

Class shelves shall consist of 6 mm thick clear glass with guardrails and shall be wall mounted with brackets. All brackets, guardrails, and screws shall be chromium plated.

Towel rail

Towel rails shall be 20 mm dia chromium plated MS pipes wall mounted with steel brackets. The brackets, screws etc. shall also be chromium plated.

Soap holder

It shall be made of chromium plated strong members. The holders shall be wall mounted with chromium-plated screws.

Liquid Soap Dispenser

It shall be round and easily revolving with removable threaded nozzle. The body, bracket for wall mounting and screws shall be chromium plated.

Toilet roll holder

It shall be made of glazed vitreous china with suitable cover cum cutter. Wall mounting screw shall be chromium plated.

Valve, cocks, Taps

All valves, stop cocks, taps etc. shall conform to relevant Indian standard specification and shall be of best quality from approved manufacturers. These shall be suitable for normal working pressures. Nominal size and material shall be as required / specified.

2.03.00 Water Storage Tank

Water storage tank shall be PVC of approved brand and make (Syntex or equivalent). Reservoirs made of concrete masonry or fabricated steel shall be covered by respective work specifications.

3.00.00 INSTALLATION

3.01.00 General

Basic layouts may be available in the drawings provided, the details might



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have to be supplemented by the Contractor and get the approval of the Engineer before installation. Special attention shall be given to economise the layout. Symmetry of layout is very important. Fittings meant for operation shall be located and oriented to allow easy reach and operation. Maintenance, repairs, and replacements of pipes, fittings, and fixtures must be conveniently possible. All pipe lines, locations of fittings and fixtures, etc. shall be as per drawings or as directed by the Engineer. Correctness of lines, plumb, orientation, symmetry, and levels shall be strictly ensured. All items shall be fully secured against movement in any direction and so located as to allow easy maintenance.

All pipelines, fittings, and fixtures shall be installed leak proof. When the works under scope of this specification linked up with works executed by others, the connections shall be such as to prevent any splashing or spilling or emission of foul odour and gases.

3.02.00 Portable water supply Pipe Lines

3.02.01 Laying

In addition to fulfilling the functional requirements all pipelines shall be laid true to line, plumb and level and shall run on the surface of the walls, ceiling or in chases. Any deviation shall need approval of the Engineer. Meticulous care shall be taken to avoid chances of airlock and water hammer.

Pipes shall be laid on continuous unyielding surface or on reliable supports at least one near each joint and spacing as directed by the Engineer. The support must be strong, neat and shall have provisions for securing the pipes in every direction and easy maintenance. All pipes used for water supply should be thoroughly and efficiently disinfected before taken in to use.

3.02.02 Back Flow

The layout of pipe work shall be such that there is no possibility of back flow towards the source of supply from any cistern or appliances, whether by siphonage or otherwise. All pipe works shall be so laid or fixed and maintained as to be and to remain completely watertight, thereby avoiding waste of water, damage of property and the risk of contamination of the water conveyed.

3.02.03 Contamination

There shall be no cross connection whatsoever between a pipe/fitting for conveying or containing wholesome water and a pipe/fitting for containing impure water or water liable to contamination or of uncertain quality of water which has been used for any other purpose. No piping shall be laid or fixed so



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as to pass into or through any sewer, scour outlet or drain or any manhole connected therewith.

3.02.04 Underground Piping

Underground piping shall be laid at such a depth that it is not likely to be damaged by traffic and other loads and frost, where applicable. The size and depth of the trench shall be as approved by the Engineer. Back filling shall be done with selected fine earth, unless otherwise permitted, in 150 mm layers and carefully consolidated. Special care shall be taken while filling in the vicinity of the pipe to avoid damage. Before backfilling, the laid pipe shall be fully tested and approved.

Where the pipe rests on rock it may be bedded on a layer of fine selected material or concrete to avoid local point support. The trench shall be so treated by gradient and filling in the area that it does not act as a drainage channel.

3.02.05 Concealed Piping

Where desired by the Engineer or shown on the drawings the pipes shall be concealed in masonry or concrete of the structure. The Contractor may co-ordinate with the building Contractor for leaving the chases, openings, and conduits as necessary. However, the Contractor will rectify if required the chases, openings, and conduits, supplement and make good after laying and testing of the concealed pipelines.

3.02.06 Jointing of Pipes

All G.I. pipes shall be properly thread/weld jointed and made completely water tight and durable. Burr from the joints shall be removed after screwing. Union joints shall be provided for all required location to facilitate maintenance.

3.02.07 Painting

Where required, underground G.I. pipes shall be given 2 coats of bituminous paint on the outside after laying. When painting is to be done above ground G.I. pipes shall be given one coat of red lead or zinc chromate primer and top coats shall be minimum 2 coats of best quality paint as specified.

3.03.00 RAINWATER DOWN COMERS

3.03.01 Pipes

Rainwater down comers shall be standard Cast Iron or Asbestos Cement Pipes.



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In case where specifically desired, M.S. pipes may also be used. M.S. pipes shall be painted outside with two coats of anticorrosive paints under a coat of primer.

Rainwater down comers shall run along and be secured to walls, columns etc. Where desired by the Engineer these may have to be installed in chases cut in the structure. All pipes shall be well secured and supported by adequately strong brackets. The brackets may be wrought iron clevis type, split ring type, or perforated strap iron type as approved by the Engineer. For vertical runs each pipe shall hang freely on its brackets fixed just below the socket. Suitable spacer blocks shall be provided against the vertical surface to which the pipe is fixed.

All bends and junctions shall be supplied with watertight cleanouts.

Roof and floor drains and yard gullies shall be installed, if required, by cutting into the structure and grouted with 1:2:4 cement concrete. All gutters shall be provided with removable gratings.

All horizontal pipes shall have a minimum fall of 1 in 100.

3.03.02 Khurras

The khurras shall be constructed before the work in parapet wall is taken up and it shall be 45x45 cm in size, unless otherwise specified and shall be formed of cement concrete of M-20 grade.

3.03.03 Gutters

The gutters shall be made of G.I. or A.C and procured from reputed specialised manufacturers. Each section shall be sufficiently rigid, edges and corners straight and the slopes perfectly uniform. G.I. gutters shall have the edges strengthened by suitable means.

Unless noted otherwise the gutters shall have a minimum fall of 1 in 120. Adequate number of string supports shall be provided so that there is no sagging even when the gutter is full. Each joint must have a support. Unless otherwise specified the supports shall be fabricated M.S. brackets. All junctions shall be thoroughly watertight. The joints may be made by riveting, bolting or soldering. All joints between successive lengths of gutters shall have an overlap of at least 5 cm. The drop in the overlap shall always be in the direction of the fall of the gutter. Ends of gutters shall be closed watertight. Junction with rainwater down comers shall be made fully watertight and secured.

3.04.00 SOIL AND DRAINAGE PIPES



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3.04.01 Gradients

If not specified the minimum gradients of soil and drainage pipeline shall be as follows:

100 mm nominal dia	:	1 in 35
150 mm nominal dia	:	1 in 65
230 mm nominal dia	:	1 in 120
300 mm nominal dia	:	1 in 200

3.04.02 Relation with water supply pipelines

Unless specifically cleared by the Engineer, under no circumstances shall drainage and sewer pipes be allowed to come close to water supply pipelines.

3.04.03 Laying

Each separate pipe shall be individually set for line and for level. Where lengths of sewer or drain pipes are laid in trench, properly painted sight rails shall be fixed across the trench at a height, equal to length of the boning rod to be used, above the required invert level of the drain or sewer at the point where the sight is fixed. More sight rails shall be required at manholes, change of gradient and intermediate positions if the distance for sighting is more than 50 ft. apart. The excavation shall be boned in at least once in every 6 ft. The foot of the boning rod shall be set on a block of wood of the exact, thickness of the wall of the pipe. Each pipe shall be separately and accurately boned between sight rails.

3.04.04 Support and Protection of Pipelines

All pipes shall be laid with sockets leading uphill. Preferably the pipe shall rest on solid and even foundations for the full length of the barrel. However, the pipe manufacturer's instruction as approved by the Engineer shall be followed in the matter of support and jointing.

To achieve full and continuous support, concrete for bedding and packing is the best. Where pipes are not bedded on concrete, the floor shall be left slightly high and carefully placed so that the pipe barrels rest on undisturbed ground. If anywhere the excavation has been carried too low packing shall be done in concrete. Where laid on rock or very hard ground which cannot be easily excavated to a smooth surface, the pipes shall be laid on a cradle of fine concrete floor of gravel and crushed stone over laid with concrete or on a well consolidated gravel and crushed stone bed as desired by the Engineer. PVC or similar pipes shall be laid directly on stable soil and packed with selected soil.



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The minimum support and protection for glazed stoneware pipes shall be as follows:

- a) When cover is less than 2 metre below ground level and where pipes are unavoidably exposed above ground surface, the pipes shall be completely encased or surrounded with concrete.
- b) Where pipes are laid on soft soil with the maximum water table laying at the invert of the pipe, the sewer shall be bedded on concrete.
- c) Where the pipes have to be laid on soft soil with the maximum water table rising above the invert of the pipe, but below the top of the barrel, the pipe sewer shall be haunched.
- d) Where maximum water table is likely to rise above the top of the barrel or wherever the pipe is laid on soft soil the pipe sewers shall be completely encased or surrounded with concrete.

Vitrified clay pipes shall be laid on a bed of 150 mm thick cement concrete (1:3:6) nominal mix by volume.

Cast iron pipes and concrete pipes may be supported on suitable concrete or brick support, where specified. The supports shall be unyielding and strong enough. At least one support shall be located close to ends. Spacing of intermediate supports shall be as decided by the Engineer. Pipes shall be secured to the supports by approved means.

Anchoring of pipes where necessary shall be achieved by suitable concrete encasing designed for the expected thrust.

3.04.05 Entry into structures

For entry of the pipe lines into any building of structure suitable conduits under the structure or sleeves shall be used. The conduits and sleeves shall be such as to allow easy repairs and replacement of the pipes. When openings or chases are required to be made in the structure for entry of pipelines, locations and sizes shall be marked and checked by the Engineer. After laying of the pipeline the openings and chases shall be mended.

3.04.06 Ducts

Where solid, waste and ventilating pipes are accommodated in ducts, access to cleaning areas shall be provided. Connection to drain shall be through a gully with sealed cover to guard against ingress of sewer gas, vermin, or backflow.

3.04.07 Traps and Ventilating Pipes



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Pipes are carrying off the waste from water closets and waste water and overflow water from baths, wash basins, sinks to drains shall be trapped immediately beneath such fixtures. Traps shall have minimum water seal of 50 mm and shall be ventilated whenever such ventilation is necessary to maintain water seal of the trap. Ventilating pipes shall be carried up vertically from the drain to a height of at least 600 mm above the outer covering of the roof of the building or as shown on drawings. All vertical ventilating, anti-siphonage and similar pipe shall be covered on top with a cowl. The cowl shall be made of C. I. unless desired otherwise by the Engineer.

3.04.08 Manhole & Inspection Chambers

At every change of alignment, gradient or diameter there shall be a manhole or inspection chamber. The maximum distance between manholes shall be 30 meter unless specially permitted otherwise. However, for truck route (for pipes above 900 mm dia.) this distance can be increased to 45 M. The distance between manhole or inspection chamber and gully chamber shall not exceed 6 metres unless desired otherwise provision of IS: 4111 (Part-1) shall be followed for construction of a manhole. Manhole shall be constructed so as to be watertight under test. The change in alignment shall be carried out in such a manner as to provide no lodgement for any splashings in case of accidental flashing of the chamber. The channel or drain at the bottom of chamber shall be plastered with 1:2 cement, sand mortar and finished smooth to the grade. The channels and drains shall be shaped and laid to provide smooth flow.

Connecting to existing sewer lines shall be through a manhole.

Unless otherwise specified, 560 mm dia. circular cast iron manhole cover with frame, heavy-duty, conforming to IS: 1726 shall be provided. The covers shall be close fittings so as to prevent gases from coming out.

3.04.09 Cutting of Pipes

Manufacturer's instructions shall be followed for cutting of pipes where necessary. Suitable and approved tools shall be used for the cutting so as to leave surface clean and square to the axis of the pipe.

3.04.10 Jointing

Jointing of pipes shall be so planned as to avoid completely any movement or strain to the joints already made. If any joint is suspected to be damaged it shall be opened out and redone.

All joints between pipes, pipes and fittings and manholes shall be gas-tight when above ground and watertight when underground. Method of jointing



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shall be as per instructions of the pipe and fittings manufacturer and as approved by the Engineer. However, in the absence of any instruction available from the manufacturer the methods as detailed hereunder shall be used.

a) Cast Iron Pipes

Socket and spigot pipes shall be jointed by the cast lead joints. The spigot shall be centred in the socket of the pipe by tightly caulking in sufficient turns of tarred gasket or hemp yarn to have unfilled half the depth of socket. When the gasket or hemp yarn has been caulked tightly a jointing shall be placed round the barrel and tightened against the face of the socket to prevent airlock. Molten lead shall then be poured in to fill the remainder of the socket and caulked with suitable tools right round the joint to make up for shrinkage of the molten metal on cooling and shall be finished 3 mm behind the socket face.

Joints in cast iron pipes with special jointing arrangements like 'Tyton' Joints etc. shall follow the instructions of the manufactures.

In special cases if flanged joints are accepted by the Engineer the joints shall be made leak proof by inserting approved type of rubber gaskets. The bolts shall be secured in stages to avoid uneven strain.

b) Concrete Pipes

Jointing of concrete pipes shall be generally of rigid type. Unless otherwise stated collar type joint shall be provided. IS: 783 shall be followed for general guidance.

The two adjoining pipes shall be butted against each other and adjoined in correct position. The collar shall then be slipped over the joint, covering equally both the pipes. The angular space shall be filled with stiff mixture of cement mortar 1:2 (1 cement : 2 sand) which shall be rammed with caulking tool. After a day's work, any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured for 7 days.

c) Glazed Stoneware Pipes

Tarred gasket or hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly so as not to fill more than 1/4 of the total depth of the socket. The remainder of the socket shall be filled with a stiff mixture of cement mortar 1:1 (1 cement :



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1 sand). A fillet shall be formed round the joint with a trowel, forming an angle of 45 deg. with the barrel of the pipe. The newly made joints shall be protected, until set and shall be cured by covering with damp cloth or other suitable materials.

d) Vitrified clay pipes

The vitrified clay pipe shall be made from refractory clay mixed with crushed pottery and stone and burnt at a high temperature. These shall be hard, compact, and glazed to make them acid resistant and impervious, and shall be obtained from approved manufacturer.

Special care shall be taken in handling these pipes. The pipes shall not be jointed until the earth has been partly refilled over the portion of the pipe between the joint holes. Before laying the second pipe, the socket of the first pipe laid shall be thinly painted all round on the inside with cement slurry (1 part of cement and 2 parts of clean, sharp sand). A ring of rope yarn (closely twisted hemp or jute) dipped in neat cement paste or tar or bitumen, shall be inserted in the socket of pipe and driven home with caulking tools. The rope shall fully encircle the spigot with a slight overlap and shall not occupy more than one-fourth of the total depth of the socket. Where the spigot end of the pipe is made for receiving the gasket, it shall be wrapped with two or three turns of tarred spun, as close to the end as possible, before inserting into the socket. The joint shall then be completely filled with cement mortar (1:1), which shall have very little water. A fillet shall be formed round the joint with trowel, forming an angle of 45 degrees with the outside pipe. Special care shall be taken so that any excess mortar etc. left inside the pipe joints is neatly cleaned off immediately after each joint is made. A semi-circular wooden scrapper or a rubber disc to which a long handle is fixed could be used for this purpose.

e) Lead Pipes

The joints in lead pipes shall be made as wiped solder joint. The minimum and the maximum length of the wiped solder joints shall be 8 cm. and 9 cm. respectively. The solders shall generally consist of two parts of lead and one part of tin.

f) Polyethylene Pipes

The joints shall be thermo welded or bolted as per manufacturer's instructions.

g) Jointing Cast Iron Pipes with Stoneware Pipes

Where any cast iron drain pipe, ventilating pipe or trap is connected with a



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stoneware or semi-vitrified waste pipe, the beaded spigot end of such cast iron drain pipe, waste or ventilating pipe or trap shall be inserted into a socket of such stoneware pipe and the joint made with mortar consisting of one part of cement and one part of clean sand after placing a ratted gasket or hemp yarn soaked in neat cement slurry round the joint and inserted in it by means of a caulking tool.

h) Jointing Stoneware with Cast Iron Pipes

Where any water closet pan or earthware trap connected to such a pan is to be jointed with a cast iron soil pipe, the joint between the stoneware spigot and the cast iron socket shall always be of a flexible nature. Such joint shall be made with a mixture of bitumen and chopped asbestos fibre.

3.04.11 Trenches and other excavations

Width of the trench at the bottom shall be such as to provide 200 mm clearance on either side of the pipe for facility of laying and jointing.

Excavated material shall be stacked sufficiently away from the edge of the trench and the side of the spoil bank shall not be allowed to endanger the stability of the excavation. Spoil may be carted away and used for filling the trench behind the work.

Turf, top soil or other surface material shall be set aside, turf being carefully rolled and stacked for use in reinstatement.

All excavation shall be properly timbered, where necessary.

Efficient arrangements for dewatering during excavation and keeping it dry till backfilling shall be made to the satisfaction of the Engineer. Sumps for dewatering shall be located away from the pipe layout.

Where the excavation proceeds through roads necessary permissions shall be secured by the Contractors from the appropriate authorities.

Special care shall be taken not to damage underground services, cables etc. These when exposed shall be kept adequately supported till the trench is backfilled.

The backfilling shall be done only after the pipeline has been tested and approved by the Engineer. Special care shall be taken under and sides of the pipe during hand packing with selected material. At least 300 mm over the pipe shall also be filled with soft earth or sand. Consolidation shall be done in 150 mm layers. The surface water shall be prevented from getting into the filled up trench. Traffic shall not be inconvenienced by heaping up unduly the



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backfilling material to compensate future settlement. All future settlements shall be made good regularly to minimize inconvenience of traffic where applicable.

3.04.12 Protection

Open end of each pipe shall be protected during installation by suitable covers or plugs so that the ends, threads, sockets, or spigot are not damaged and no foreign material can find its way into the pipeline. Fittings and fixtures liable to be misused or stolen during the construction phase shall be fitted only before testing and handing over.

3.05.00 WATER STORAGE TANKS

Overhead/loft type water storage tank shall be made of PVC. These tanks shall be provided for each toilet block and placed on the roof/loft of the building. Tank shall be installed with proper supports and anchorage for applicable wind and seismic condition. Installation of tank shall be carried out according to the recommendation of IS: 12701. These tanks shall rest preferable on flat surface so as to distribute the load evenly. The tank shall be leakproof and water tight.

The outlet pipe shall be 50 mm above the bottom of the tank and provided preferably with strainers. The wash out or draining pipe shall be connected at the lowest point and flush with bottom of tank.

Tank shall be provided with all fittings for inlet, outlet, overflow pipes and ball valves.

3.06.00 SEPTIC TANK AND EFFLUENT DISPOSAL

3.06.01 Septic tank

Septic tank shall consist of the tank itself with inlet and outlets there from complete with all necessary earthwork and backfilling. The details of septic tank shall be as shown on drawings. This item shall also include ventilating pipe of at least 100 mm dia whose top shall be provided with a suitable mosquito proof wiremesh and cowl. Ventilating pipe shall extend to a height of about 2 meter when the septic tank is at least 15 meter away from the nearest building and to a height of 2 meter above the top of building when it is located closer than 15 meter. Ventilating pipes can be connected to the normal soil ventilating system of the building where allowed.

3.06.02 Effluent Disposal

The effluent from the septic tank shall be disposed by allowing it into an open channel or a body of water if the concerned authority approves or into a soak

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	pit for absorption by soil or shall be allowed to be absorbed by soil through open jointed SW pipes laid in a trench filled with broken bricks. 3.06.03 Soak pit The soak pit shall be complete. It shall consist of a 900 mm dia pit 1000 mm in depth below the invert level of the inlet pipe. The pit shall be lined with stone; brick or concrete blocks set in cement mortar (1:6) and filled with brickbats. Inlet pipe shall be taken down to a depth of 900 mm from the top as an anti-mosquito measure. 3.06.04 Open jointed SW Pipe/dispersion trenches Minimum dia of the SW pipes shall be 150 mm nominal. The trench for laying the pipes shall be a minimum 600 x 600 mm. The joints of the pipes shall be left unsealed. The entire length of the pipe within the trench shall be buried in a 250 mm layer gravel or crushed stone of uniform size. On top of gravel/crushed stone layer is a 150 mm bed of well-graded coarse aggregate. Ordinary soil is used for filling the top of trench. 3.06.05 Commissioning septic tank After the septic tank has been proved watertight and the sewage system is checked the tank shall be filled with water to its outlet level before the sewage is let into the tank. It shall be seeded with well digested sludge obtained from septic tank or sludge digestion tank. In the absence of digested sludge a small quantity of decaying organic matter such as digested cow-dung may be introduced. 3.07.00 Related Works All works, like earthwork, masonry, concrete, steelwork, cutting holes, chases, repairs and rectification associated directly with installation of water supply and sanitation systems shall come under scope of the Contractor unless specifically excluded. These works are not detailed out in this Section. 3.08.00 Regulation The work which is required to be carried out under this section, shall be executed by a licensed Plumber only (engaged by the Contractor) and he shall obtain all necessary sanctions, permissions, certificates etc., from Municipal and/or other Local Authorities and shall abide by all the rules of such Authorities. 4.00.00 TESTING AND ACCEPTANCE CRITERIA	



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4.01.00 Inspection Before installation

All pipes, fittings, and appliance shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes and fittings shall be inspected on site before laying and shall be sounded to disclose cracks. Any defective items shall be clearly marked as rejected and forthwith removed from the site.

4.02.00 Testing of Water Supply pipe line

4.02.01 Testing of Mains After Laying

After laying and jointing, the main shall be slowly and carefully charged with water, so that all air is expelled from the main by providing a 25 mm inlet with a stop-cock, allowed to stand full of water for a few days if time permits, and then tested under pressure. The test pressure shall be 5 Kg/sq.cm or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or in the case of long mains or mains of a large diameter, by a power driven test pump, provided that the pump is not left unattached. In either case due precaution shall be taken to ensure that the required test pressure is not exceeded. Pressure gauges shall be accurate and shall preferably have been recalibrated before the test. The pump having been stopped, the test pressure shall maintain itself without measurable less for at least five minutes. The end of the main shall be closed by fitting a watertight expanding plug and the plug shall be secured by struts to resist the end thrust of the water pressure in the mains.

4.02.02 Testing of Service Pipes and Fittings

The service pipes shall be slowly and carefully charged with water allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working conditions of pressure and flow. When all draw-off taps are closed, the service pipes shall be absolutely watertight. All piping, fittings, and appliances shall be checked for satisfactory support and protection from damage, corrosion, and frost.

4.03.00 Testing of Drain and Sewerage Pipelines

All soil pipes, waste pipes, ventilating pipes and all other pipes, when above ground, shall be gas tight. All sewers and drainpipes laid below ground shall be tested water tight. The method of actual tests shall be decided by the Engineer. All test data shall be recorded and submitted to the Engineer for review and instruction. The Engineer's discretion regarding tolerance shall be final.

General guidance for the tests are given below:



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a) Smoke test

All soil pipes, waste pipes and vent pipes and all other pipes when above ground shall be approved gastight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning oily waste or tarpaper or similar material in the combustion chamber of a smoke machine. Chemical smokes shall not be used.

b) Water test

The pipes shall be subjected to a test pressure of at least 1.5 m head of water at the highest point of the section under tests. The tolerance figure of two litres per centimetre of diameter per kilometre may be allowed during a period of 10 (ten) minutes. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system, with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of the vertical pipe jointed to it so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

Subsidence of test water may be due to one or more of the following cases:

- a) Absorption by pipes and joints
- b) Sweating of pipes or joints
- c) Leakage at joints or from defective pipes
- d) Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the test proper should commence. Any leakage and the defective part of the work shall be cut out and made good.

c) For straightness

- i) By inserting at the high end of the sewer or drain a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball will roll down the invert of the pipe and emerge at the lower end; and
- ii) By means of a mirror at one end of the line and lamp at the other. If the pipeline is straight, the full circle of light may be observed. The mirror



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will also indicate obstruction in the barrel if the pipeline is not straight.

4.04.00 Fittings and Fixtures etc.

All fittings and fixtures shall be connected by water tight joints. No dripping of water shall be acceptable.

4.05.00 Testing Septic Tank

The septic tank shall be tested for water tightness. It shall be filled up with water and allowed to soak for 24 hours. Then, it shall be topped up and allowed to stand again for 24 hours and loss of level recorded. The fall shall not be more than 15 mm in 24 hrs.

5.00.00 I.S. CODES

Important relevant IS Codes for this specification are listed below:

Latest editions shall always be consulted.

IS: 404	:	Lead pipes.
IS: 407	:	Brass tubes for general purposes.
IS: 458	:	Concrete pipes (with or without reinforcement)
IS: 783	:	Code of Practice for laying of concrete pipes.
IS: 1172	:	Code of basic requirements for water supply, drainage and sanitation.
IS: 1200 (Pt.XVI)	:	Laying of water and sewer lines, including appurtenant items.
IS: 1230	:	Cast iron rain water pipes and fittings.
IS: 1239 (Pt.I & III)	:	Specification for Mild Steel Tubes and Mild Steel Tubulars and other wrought steel pipe fittings (10 mm to 15 mm nominal diameter).
IS: 1536	:	Specification for centrifugally cast (Spun) iron pressure pipes for water gas and sewage.
IS: 1537	:	Specification for vertically cast iron pressure pipes for water, gas and sewage.

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	IS: 1592 : Asbestos cement pressure pipes, IS: 1626 : Asbestos cement pressure pipes, gutters and fittings (Spigot and Socket types). IS: 2065 : Code of Practice for Water Supply in buildings. IS: 2501 : Copper tubes for general engineering purposes. IS: 2556 : Specification for vitreous sanitary appliances (vitreous china) Part – I - General requirement IS: 2633 : Method of testing, uniformity of coating on zinc coated articles. IS: 3076 : Low density polyethylene pipes for portable water supplies. IS: 3486 : Specification for Cast iron spigot and socket drain pipes (80 mm to 250 mm nominal diameter). IS: 3589 : Specification for Electrically welded steel pipe for water, gas and sewage (200 mm to 2000 mm nominal diameter). IS: 4827 : Specification for electro plated coatings of nickel and chromium on copper and copper alloy. IS: 4964 : High-density polyethylene pipes for portable water supplies. IS: 12701 : Rotational moulded polyethylene water storage tanks	
6.00.00	RATE AND MEASUREMENT	
6.01.00	RATE	
6.01.01	G.I. Pipes For Water Supply	
	Rate shall include providing and fixing of the pipes including all specials and fittings, such as tees, bands, elbows, clamps, drain heads, cleanouts etc. with cutting, making chases and jointing of pipes, making good the walls.	
6.01.02	Rainwater Down-comers Rate shall include providing and fixing of the pipes including all specials and	

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	fittings, such as tees, bands, elbows, clamps, drain heads, cleanouts etc. The rate also include cost of jointing and making good the opening in structure. 6.01.03 Sanitary Fixtures Rate shall include providing and fixing of sanitary appliances & fixtures and at all elevation, including all accessories and fittings, connections pipes, waste trap and pipes all complete as per description of “Schedule of Items”. Rate shall also include the jointing of waste & traps to drain pipes. 6.01.04 Drainage and Sewer Pipes Rate shall be inclusive of providing, laying and jointing of pipes as specified. Rate also include cost of lead joints or other joint as specified, cost for painting and cutting and making good walls, floors etc. 6.01.05 Floor and Gully Traps Rate of traps is inclusive of all excavation, filling, repair, making good of opening in floor and walls, grating, painting etc. complete as described in “Schedule of Items”. 6.01.06 Manholes, Septic Tank, Soak Pit and Cover Rate of manholes, septic tank, soak pit shall be paid under respective items of work executed like brick work, plastering, concrete, reinforcement steel etc. provided for completion of the structure as per drawing and specifications. Manhole cover shall be paid separately as per description of item. 6.01.07 Water Storage Tank The rate for water storage tank is inclusive of supply and installation of tank with all fittings, inlets, outlets, valves etc. complete. 6.02.00 MEASUREMENTS 6.02.01 Pipe for Water Supply and Drainage For G.I.Pipe of water supply line, rainwater down comers, drainage and sewer pipe, the measurements shall be in running metres and shall be taken along centre line of pipe or specials. The pipe shall be measured separately according to dia. and class of pipe. Fixtures like bibcock, stopcocks, valves etc. shall be measured in numbers.	



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6.02.02

Sanitary Appliances & Fixtures and Allied Works

All sanitary appliances & fixtures like sink, washbasin, WC, shall be measured in numbers for the complete work as described in schedule of items.

Floor and gully traps shall be measured in numbers unless otherwise specified.

Water storage tank shall be measured in numbers for the capacity as specified in “Schedule of Items”.

The item of work executed for completion of manholes, septic tank & soak pit shall be measured in respective items of work like brick work, RCC, plastering etc. CI cover shall be measured in numbers as specified in “Schedule of Items”.



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ROAD AND DRAINAGE



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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Standard Technical Specification For Road and Drainage

1.00.00 Scope

The scope include all works required for the construction of road including construction of embankment, sub-base course, base course, tack coat, bituminous macadam, wearing course, liquid seal coat, shoulder and all incidental items of work specified or not shown but reasonably implied or necessary for the completion of the work etc.

The scope also include all works required for the construction of drainage including construction of road side drains, RCC culverts, pipe culverts, drainage pipes, manholes and all other incidental items necessary for the completion of the work etc.

1.01.00 Works To Be Provided By The Contractor

The works to be provided by the contractor unless specified otherwise shall include but not be limited to the following.

- a) Construction of roads including providing all materials, labour, supervision, services, equipments, tools and plants, transportation etc all required for the completion of the work.
- b) Submission of detailed scheme of all operations required for executing the work (e.g. material handling, placement, services, approaches etc) to the engineer for approval.
- c) Carrying out tests whenever required by the engineer to assess the quality of work and submission of the test results to the engineer after completion of the same etc.

1.02.00 Work To Be Provided By Others

No work under this specification will be provided for by any agency other than the contractor unless specifically mentioned elsewhere in the contract.

1.03.00 Conformity With Designs

The contractor shall carryout the work as per the construction drawings, specification and as directed by the engineer.



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1.04.00 Materials To Be Used

All materials required for the work shall be the best commercial variety and as approved by the engineer.

2.00.00 Codes and Standards

All works under this specification shall conform to the latest revision and/or replacement of the following or any other IRC/IS Codes and Standard Practices unless specified otherwise.

- a) Specification for road and bridge works of Ministry of Shipping & Transport (Road Wing) Published by the IRC
- b) IRC: 19 - Standard specification and code of practice for Water bound Macadam
- c) IRC :SP 11 - Hand Book of Quality Control for Construction of Roads and Runways
- d) IS:456 - Indian Standard Code of Practice for Plain and Reinforced Concrete.
- e) IS:2212 - Code of Practice for Brick work
- f) IS: 783 - Code of Practice for Laying of Concrete Pipes
- g) IS: 1201 - Methods of testing tar and bituminous materials to 1220
- h) IS: 73 - Specification for paving bitumen
- i) IS: 215 - Specification for Road tar
- j) IS: 216 - Coal tar pitch
- k) IS: 217 - Specification for cut-back bitumen
- l) IS: 454 - Specification for cut-back bitumen from waxy crude
- m) IS: 1834 - Specification for hot applied sealing compound for joint in concrete
- n) IS: 1838 - Specification for performed fillers for expansion joints in concrete, non extruding and resilient type



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Part I Bitumen impregnated fibre

Part II CNSL Aldehyde resin and coconut pith

- o) IS : 334 - Glossary of terms relating to bitumen and tar
- p) IS: 1077 - Common burnt clay building bricks
- q) IS : 3117 - Specification for bitumen emulsion roads (anionic type)
- r) IS : 1200 - Method of measurement of building and civil engineering work (Part-17)- Road work including airfield pavements
- s) Other specifications mentioned elsewhere in this specification.

In case any particular aspect of work is not covered specifically by the specification/Indian Standard Code of practices, any other standard practice as may be specified by the engineer shall be followed.

2.01.00

Quality Control

The Contractor shall establish and maintain quality control for all materials, procedures, workmanship and equipments used. All works shall conform to the lines, grades, cross sections and dimensions shown on the drawings, specification and as directed by the engineer. Permitted tolerances for road works are described hereinafter.

a) Horizontal Alignment

Horizontal alignment shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriageway as constructed shall be correct within a tolerance of $\pm 25\text{mm}$ therefrom. The corresponding tolerance for edges of the roadway and lower layers of the pavement shall be $\pm 40\text{mm}$.

b) Longitudinal Profile

The finished levels of the sub-grade and different pavement courses as constructed shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the engineer and shall not exceed the tolerances as mentioned below.

Sub-grade	$\pm 25 \text{ mm}$
Sub-base	$\pm 20 \text{ mm}$
Base course	$\pm 15 \text{ mm}$
Wearing course	$\pm 10 \text{ mm}$



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Tolerance in wearing course shall not be permitted in conjunction with the positive tolerance on base course if the thickness of the wearing course is thereby reduced by more than 6 mm.

c) Surface Regularity of Sub-grade and Pavement Courses

The surface regularity of the completed sub-base, base course and wearing surfaces in the longitudinal and transverse directions shall be within the tolerances indicated in Table - I. The longitudinal profile shall be checked with a 3m long straight edge at the middle of each traffic lane along a line parallel to the centre of the road. The transverse profile shall be checked with a set of three camber boards at intervals of 10m.

TABLE -I

PERMITTED TOLERANCE OF SURFACE REGULARITY FOR PAVEMENT COURSES

Sl. No.	Type of Construction	Longitudinal profile with 3m straight edge					Cross Profile	
		Maximum permissible Undulation (mm)	Maximum number of undulations permitted in any 300m length with undulation exceeding (mm)				Maximum permissible variation from specified profile under camber template (mm)	
			18	12	10	6		
1	2	3	4	5	6	7	8	
1.	Earthen sub-grade	25	30	-	-	-	15	
2.	Granular sub-base	15	-	30	-	-	12	
3.	Water Bound Macadam with oversize metal (40-90 mm size)	15	-	30	-	-	12	
4.	Water Bound Macadam with normal size metal (20-50 mm and 40-63 mm size), Bituminous Penetration Macadam	12	-	-	30	-	8	
5.	Surface dressing** (two coat) over WBM (20-50 mm or 40-63 mm size metal), Bituminous penetration macadam	12	-	-	20	-	8	

6.	Open graded premix carpet, mix seal Surfacing	10	-	-	-	30	6	
7.	Bituminous macadam	10	-	-	-	20***	6	
8.	Semi-dense carpet	10	-	-	-	20***	6	
9.	Asphaltic Concrete	8	-	-	-	10***	4	

Notes:

1. ** For surface dressing in all other cases, the standards of surface evenness will be the same as those for the surface receiving the surface dressing.

2.*** These are for machine laid surfaces. If laid manually due to unavoidable reasons, tolerance upto 50 percent above these values in this column may be permitted at the discretion of the Engineer. However this relaxation does not apply to the values of maximum undulation for longitudinal and cross profiles mentioned in columns 3 and 8 on the table.

3. Surface evenness requirements in respect of both the longitudinal and cross profiles should be simultaneously satisfied.

3.00.00 Execution

3.01.00 Setting Out

Within 15 days of the award of contract, the contractor shall prepare and submit to the Engineer detailed drawings/schemes of embankment filling and excavation works as proposed to be executed by him showing the dimensions as per construction drawings and specification adding his proposals of drainage and dewatering of pits, watering and compacting the embankment fill etc. On receiving the approval from the Engineer with modifications and corrections if any, the contractor shall set out the work from the control points furnished by the Engineer and fix permanent points and markers for ease of future checking. These permanent points and markers will be checked by the Engineer and certified by him after which the contractor shall proceed with the work. It should be noted that this checking by the Engineer prior to the start of the work will in no way absolve the contractor of his responsibility of carrying out the work to true lines and levels as per the approved drawings. If any errors are noticed in the Contractor's work at any stage, the contractor at his own risk and cost shall rectify the same. Profiles of the embankment made with Bamboo, earth or other convenient materials and strings shall be set up at suitable intervals for the guidance of the workmen.

3.02.00 Clearing and Grubbing

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Before commencement of earthwork, the surface area of ground to be occupied shall be cleared of all fences, trees, logs, stumps, bushes, vegetation, rubbish, slush etc. Cutting of trees shall include trees having girth of any size and removing roots upto a depth of 600mm below ground level or 300mm below formation level whichever is deeper. After the removal of roots of trees, the pot holes formed shall be filled with good earth in 250mm layers (loose thickness) and compacted unless otherwise directed by the Engineer. The trees shall be cut into suitable pieces as instructed by the Engineer. Before earthwork is started, all the spoils and unserviceable materials and rubbish shall be burnt or removed from the site to the approved disposal areas as may be specified. Useful materials, saleable timbers, firewood etc shall be the property of the Owner and shall be stacked properly at the work site in a manner as directed by the Engineer.

3.03.00 Filling in Embankment**3.03.01 General**

The material used for constructing the embankment shall be earth, moorum, gravel or a mixture of the above or any other material approved by the Engineer. The material shall be free from lumps and clods, boulders and rock pieces, roots and vegetation, harmful salts and chemicals, organic materials, loose silts, fine sands and expansive clays in order to provide a stable embankment. The filling and compaction operation should be such that the best available materials are saved for the top portion and will result in an acceptable and uniform gradation of material and provide impermeability and stability to the embankment when compacted. The size of the coarse material in the mixture of earth shall ordinarily not exceed 75mm. However the Engineer may at his discretion permit the use of material coarser than the specified if he is satisfied that the same will not present any difficulty as regard to the placement and compaction of the fill material are concerned. Ordinarily, only the materials satisfying the density requirements as given below in Table-II shall be employed for embankment construction.

Table - II

Density Requirements of Embankment Materials

Sl. No.	Type of Work	Maximum laboratory dry density when tested as per IS: 2720 (Part - VII)
1.	Embankment upto 3m height	Not less than 1.44 gm/cc
2.	Embankment exceeding 3m height and embankment of any height subject to long period of inundation	Not less than 1.52 gm/cc
3.	Top 0.5m of the embankment below sub-base and shoulders (where earth shoulders are specified)	Not less than 1.65 gm/cc

Expansive clays exhibiting marked swell and shrinkage properties shall not be used for embankment construction.

The material for embankment construction shall be obtained from approved sources with preference given to the materials available from nearby road excavation or any other excavation under the same contract.

3.03.02 Setting Out

After the site clearance, the work shall be set out true to lines, curves, slopes, grades and sections as shown on the approved drawings or as directed by the Engineer. The contractor shall provide all labour, survey instruments and materials such as strings, pegs, nails, bamboo, stones, lime, mortar, concrete etc required in connection with the setting out of the works and establishment of the bench marks. The limits of the embankment shall be marked by fixing batter pegs on both sides at regular intervals as guides before commencing the earthwork. To ensure the safety, the pegs should normally be fixed about 500mm away from the actual limits of the fill and to be painted in a distinct colour. The centreline of the embankment shall be pegged at regular intervals of 25/30m and at all skews/curves. The actual profile of the embankment shall be made at every third centre line peg with bamboo posts and strings. Preferably prototype profiles developed with wooden planks need to be fixed at every 200m and at the intersection points at curves. The profile shall be about 3m long.



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3.03.03 Stripping and Storing top soil

The construction of the earthen embankment by filling shall conform to the dimensions, slopes and other details shown in the approved drawings. Before commencement of the embankment construction, the surface area of ground to be occupied after clearing and grubbing shall be stripped off to a minimum depth of 150mm or more as directed by the Engineer in order to remove all perishable materials and any soil which may become unstable on saturation or may interfere with the development or proper bonding between the foundation and embankment. It is not necessary to remove all the soil containing fine hair like roots but only the rather heavy mats are to be removed. In localities where most of the available embankment fill materials are not conducive to plant growth or when so directed by the Engineer, the top soil suitable for plant growth existing over the embankment foundation areas shall be stripped to specified depths not exceeding 150mm and stored for covering the embankment slopes where revegetation is desired.

3.03.04 Compacting Original Ground

In all cases, the original ground after stripping shall be compacted by rolling with a minimum six passes of 8-10 tonne roller and as directed by the Engineer.

Where the height of the proposed embankment is less than 0.5m and the original ground does not already have a relative compaction of atleast 95 percent of Standard Proctor density (maximum dry density), the same shall be loosened upto a depth of 0.5m and filled in layers not exceeding 250mm in loose thickness and each layer shall be watered and compacted to 100% maximum dry density of the fill material determined in accordance with IS:2720, Part-VII. However before relaying and compacting the loosened material, the surface below this level shall be suitably compacted as directed by the Engineer with a minimum six passes of 8 - 10 tonne roller.

Where so directed by the Engineer, any unsuitable material occurring in the embankment foundation shall be removed and replaced with approved materials suitably compacted. Embankment work shall not proceed until the foundation soil of the embankment is inspected by the Engineer and approved.

3.03.05 Filling

The embankment material shall be spread uniformly over the entire width of the embankment in layers not exceeding 250mm in loose thickness. Successive layers of embankment shall not be placed until the layer under construction has been thoroughly compacted to the requirements set down hereunder. Moisture content of the fill material shall be checked at the source



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of supply and if found less than that specified for compaction, the same shall be made good either at the source or after spreading the soil in loose thickness for compaction. In the latter case water shall be sprinkled directly from a hose line or from a truck mounted water tank and flooding shall not be permitted under any circumstances. After adding required amount of water, the soil shall be processed by means of harrows, rotary mixers or by any other approved method until the layer is uniformly wet.

If the material delivered to the road bed is too wet, it shall be dried by aeration and exposure to the sun till the moisture content is acceptable for compaction. Should circumstances arise where owing to wet weather, the moisture content cannot be reduced to the required amount by the above procedure, the work on compaction shall be suspended.

Moisture content of each layer shall be checked in accordance with IS:2720, Part-II and unless otherwise specified shall be so maintained making due allowance for evaporation losses that during compaction, the moisture content shall be in the range of 1 percent above to 2 percent below the optimum moisture content as determined in accordance with IS:2720, Part-VII.

Clods or hard lumps of earth shall be broken to have a maximum size of 150mm when being placed in the lower layers of the embankment and a maximum size of 60mm when being placed in the top 0.5m portion of the embankment below sub-base.

Hauling equipment shall be dispersed uniformly over the entire surface of the previously constructed layer to minimise rutting or uneven compaction.

Where the embankment is to be constructed across a low swampy ground that will not support the weight of trucks or other hauling equipments, the lower part of the fill shall be constructed by dumping successive loads in a uniformly distributed layer to a thickness not greater than that necessary to support the hauling equipment while placing subsequent layers.

3.03.06

Compaction

Compaction equipment approved by the Engineer shall only be employed for construction. If directed by the Engineer, the Contractor shall demonstrate the efficiency of the plant he intends to use by carrying out compaction trials. Each layer shall be thoroughly compacted to the density as specified in Table-III. Subsequent layers shall be placed only after the finished layer has been tested and accepted by the Engineer.

Table - III

Compaction Requirements For Embankment

Sl. No.	Type of work/material	Field dry density as a percentage of maximum laboratory dry density as per IS : 2720, Part-VII
1.	Top 0.5m portion of embankment below sub-base and shoulders	Not less than 100
2.	Other portions of embankment	Not less than 95

When density measurements reveal any soft area in the embankment, further compaction shall be carried out as directed by the Engineer. If in spite of that the specified compaction is not achieved, the material in the soft area shall be removed and replaced with approved material and compacted to the density requirements and satisfaction of the Engineer.

3.03.07 Drainage

The surface of the embankment at all times during construction shall be maintained at such a cross fall as will shed water and prevent ponding.

3.03.08 Finishing Operations

Finishing operations shall include the work of shaping and dressing the shoulders, road bed and side slopes to conform the alignment, levels, cross sections and dimensions as shown on the drawings or as directed by the Engineer. Both the upper and lower ends of the side slopes shall be rounded off to improve the appearance and merge the embankment with the adjacent terrain.

3.04.00 Turfing With Sods

3.04.01 General

This work shall consist of furnishing and laying live sod of perennial turf forming grass on embankment slopes, shoulders or other locations as shown on the drawings or as directed by the Engineer. Unless otherwise specified the work shall be taken up following the construction of embankment provided the season is favourable for establishment of the sod.

3.04.02 Materials

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The sod shall consist of dense, well rooted growth of permanent and desirable grasses indigenous to the locality where it is to be used and shall be practically free from weeds and other undesirable matters. At the time the sod is cut, the grass shall have a length of approximately 50mm and the sod shall be free from any debris.

Thickness of the sod shall be as uniform as possible with about 50 to 80mm of soil covering the grass roots depending on the nature of the sod so that practically all the dense root system of the grass are retained in the sod strip. The sods shall be cut in rectangular strips of uniform width not less than 250mm x 300mm in size but not so large so that it is convenient to handle and transport without damage. During wet weather the sod shall be allowed to dry sufficiently to prevent rearing during handling and during dry weather it shall be watered before lifting to ensure its vitality and to prevent dropping of soil during handling.

3.04.03 Placing The Sods

The area to be sodded shall be previously constructed to the required slope and cross section. Soil in the area shall be loosened, freed from all stones larger than 50mm size, sticks, stumps and any other undesirable foreign matters etc and brought to a reasonably granular texture to a depth not less than 25mm for receiving the sod.

Where required, top soil shall be spread over the slopes. Prior to placing the top soil, the slopes shall be roughened and wetted in order to have a satisfactory bond. The depth of top soil (to be spread) shall be 75mm.

Following soil preparation and top soiling (if required), fertilizer and ground limestone when specified shall be spread uniformly. After spreading, the materials shall be incorporated in the soil by discing or other means. The prepared sod bed shall be moistened if not already sufficiently moist and the sod shall be placed thereon within 24 hours after the same has been cut. Each sod strip shall be laid in close contact with each other and shall be lightly tamped with suitable wooden or metal tampers so as to eliminate air pockets and to press it into the underlying soil. At points where water may flow over the sod, the upper edges of the sod strips shall be turned into the soil below the adjacent area and a layer of earth shall be placed over it followed by thorough compaction.

3.04.04 Staking the Sods

Where the side slope is 2 to 1 or steeper and the distance along the slope is more than 2m, the sods shall be staked with pegs or nails spaced approximately 500 to 1000mm along the longitudinal axis of the sod strips.

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	Stakes shall be driven approximately plumb through the sods and to be almost flushed with them. 3.04.05 Top Dressing After the sods have been laid in position, the surface shall be cleaned of any loose sod, excess soil and other foreign materials. Thereafter a thin layer of top soil shall be scattered over the top dressed surface and the area shall be thoroughly moistened by sprinkling water. 3.04.06 Watering and Maintenance The turfing so laid shall be well watered and protected until final acceptance. Watering shall be done in such a way that no erosion or damage to the sodded areas/embankment occur. The Contractor shall erect necessary warning signs and barriers, repair or replace the sods which are failing to show uniform growth of grass or damaged by his operation and shall maintain the sod at his own cost until final acceptance. 3.05.00 Shoulder Construction 3.05.01 Description This work shall consist of constructing shoulder on either side of the pavement in accordance with the requirements of this specification and in conformity with the lines, grades and cross sections shown on the approved drawings and as directed by the Engineer. 3.05.02 Materials Shoulder shall be made of selected earth or granular material as specified conforming to relevant IRC standards. 3.05.03 Construction Operations Except in the case of bituminous pavements, the shoulders shall be constructed in advance to the laying of pavement courses. The compacted thickness of each layer of shoulder shall correspond to the compacted layer of pavement course to be laid adjacent to it. After compaction, the inside edges of shoulders shall be trimmed vertical and the area enclosed between the shoulders shall be cleaned of all spilled materials before proceeding with the construction of the pavement layer.	



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In the case of bituminous pavements, shoulder shall be constructed only after the pavement courses have been laid and compacted.

Regardless of the method of laying, all shoulder construction material shall be placed directly on the shoulder. Any spilled material dragged on to the pavement surface shall be immediately removed without any damage to the pavement and the area so affected shall be thoroughly cleaned. During all stages of shoulder construction, the required crossfall shall be maintained to drain off surface water.

3.06.00 Kerb

3.06.01 Material

Kerb if required for the construction of footpath shall consist of precast concrete blocks with concrete grade of M-20. The blocks shall be of 100mm thick and of suitable length. The depth of blocks unless otherwise mentioned elsewhere shall be 375mm considering 225mm height of footpath above the road level.

3.06.02 Laying

The kerb shall be laid by cutting trenches of 150mm deep. The width of the trench shall be minimum and just sufficient to insert the kerbs. The inside faces of the kerbs shall be in plumb and the gap between the block shall not be more than 10mm. The gap shall be filled with cement mortar as specified.

The kerbs shall be thoroughly packed with a mixture of stone chips (50%) and moorum (50%) at the outside face. The laying and packing shall be done in a proper workmanlike manner acceptable to the Engineer.

3.07.00 Sub-base (Granular Sub-base)

3.07.01 Description

This work shall consist of laying and compacting well graded material on the prepared sub-grade in accordance with the specification. The material shall be laid in one or more layers as shown on the drawings and shall conform to the lines, grades and cross sections shown on the drawings and as directed by the Engineer.

3.07.02 Materials

The materials to be used for the work shall be natural sand, moorum, gravel, crushed stone, crushed slag, crushed concrete, brick metal, laterite, kankar etc or combinations thereof depending upon the grading required. The mixed



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materials shall be free from organic and other deleterious constituents and conform to one of the three grading given in Table - IV below.

**Table - IV
Grading for Granular Sub-base Material**

Sieve designation	Percent by weight passing the sieve		
	Grading 1	Grading 2	Grading 3
80 mm	100	100	100
63 mm	90 - 100	90 - 100	90 - 100
4.75 mm	35 - 70	40 - 90	50 - 100
75 micron	0 - 20	0 - 25	0 - 30
Minimum CBR value for the fraction of material passing 20 mm sieve.	30 %	25%	20%

Note : The materials passing 425micron sieve for all the three gradings when tested according to IS : 2720, Part V shall have liquid limit and plasticity index not more than 25 percent and 6 percent respectively.

3.07.03 Physical Requirements

The fraction of materials passing 20mm sieve shall give a CBR value as specified in Table – IV when tested in accordance with IS : 2720, Part XVI after preparing the samples at maximum dry density and optimum moisture content corresponding to IS : 2720, Part VII and soaking the same in water for 4 days.

3.07.04 Spreading and Compacting



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Immediately prior to laying of sub-base, the sub-grade already finished shall be prepared by removing all vegetations and other extraneous matters, lightly sprinkled with water if necessary and rolled with one pass of 8 - 10 tonne smooth wheeled roller.

The sub-base material shall be spread on the sub-grade with the help of a drag spreader, motor grader or other approved means. The thickness of loose layers shall be so regulated that the maximum thickness of each layer after compaction shall not exceed 150mm.

Moisture content of the loose material shall be checked in accordance with IS : 2720, Part II and shall be suitably adjusted by sprinkling additional water from a hose line, truck mounted water tank or other approved means so that at the time of compaction it shall be from 1 percent above to 2 percent below the optimum moisture content. While adding water, due allowance shall be made for evaporation losses. After water has been added, the material shall be processed by mechanical or other approved means if so directed by the Engineer until the layer is uniformly wet.

Immediately thereafter, rolling shall be done with 8 to 10 tonne smooth wheeled rollers or with any other approved plant. Rolling shall commence from the edges and progress towards the centre longitudinally except on super elevated portions where it shall progress from the lower to the upper edge parallel to the centre line of the pavement. Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. During rolling, the grade and camber shall be checked and any high spots or depressions which become apparent shall be corrected by removing or adding fresh material.

Rolling shall be continued till the density achieved is at least 100% of the maximum dry density of the material determined as per IS : 2720, Part VII. The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction plant and from compaction planes, ridges, cracks or loose materials. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and recompacted.

3.08.00 Water Bound Macadam Sub-base/Base Course

3.08.01 Description

Water bound macadam shall consist of clean crushed aggregates mechanically interlocked by rolling and bonded together with screenings, binding material wherever necessary and water, laid on the prepared sub-grade or sub-base as the case may be and finished in accordance with the specification and in



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conformity with the lines, grades and cross-sections shown on the approved drawings.

3.08.02

Materials

a) Coarse Aggregates - General Requirements

Coarse aggregates shall be either crushed or broken stone. The aggregates shall conform to the physical requirements set forth in Table - V.

Table – V

Physical Requirements of Coarse Aggregates for Water Bound Macadam

Sl.No.	Type of Construction	Test	Test method	Requirements
1.	Sub-base	Los Angeles Abrasion Value * or Aggregate Impact Value	IS : 2386 (Part IV) IS : 2386 (Part IV) or IS : 5640**	50 percent maximum 40 percent maximum
2.	Base	a) Loss Angeles Abrasion value* or Aggregate Impact Value b) Flakiness Index ***	IS : 2386 (Part IV) IS : 2386 (Part IV) or IS : 5640 ** IS : 2386 (Part I)	50 percent maximum 40 percent maximum 15 percent maximum

* Aggregates shall satisfy requirements of either of the two tests.

** Aggregates like brick metal, kankar and laterite which get softened in presence of water shall be tested for impact value under conditions in accordance with IS : 5640.

*** The requirements of Flakiness Index shall be enforced only in case of crushed or broken stone and crushed slag.

b) Crushed or Broken Stone

Crushed or broken stone shall be hard, durable and free from excess flat, elongated, soft and disintegrated particles, dirt and other objectionable matters.

c) Grading Requirements of Coarse Aggregates

The coarse aggregates shall conform to one of the gradings given in Table – VI. However the use of Grading-1 shall be restricted to sub-base courses only.

Table - VI
Grading Requirements of Coarse Aggregates

Grading	Size range	Sieve designation	Percent by weight passing the sieve
1.	90mm to 40 mm	100 mm 80 mm 63 mm 40 mm 20 mm	100 65 - 85 25 - 60 0 - 15 0 - 5
2.	63 mm to 40 mm	80 mm 63 mm 50 mm 40 mm 20 mm	100 90 - 100 35 - 70 0 - 15 0 - 5
3.	50 mm to 20 mm	63 mm 50 mm 40 mm 20 mm 10 mm	100 95 - 100 35 - 70 0 - 10 0 - 5

d) Screenings

Screenings to fill the voids in the coarse aggregate shall generally consist of the same material as the coarse aggregates. However where permitted, predominantly non-plastic material such as moorum or gravel (other than rounded river borne material) may be used for this purpose provided liquid limit and plasticity index of such material is below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 percent.

As far as possible, screenings shall conform to the grading set forth in Table-

VII. Screenings of Type-A in Table-VII shall be used with coarse aggregates of Grading-1 in Table-VI. Screenings of Type-A or B shall be used with coarse aggregates of Grading-2. Screenings of Type-B shall be used with coarse aggregates of Grading-3.

**Table - VII
Grading For Screenings**

Grading classification	Size of screenings	Sieve designation	Percent by weight passing the sieve
A	12.5 mm	12.5 mm	100
		10.0 mm	90 - 100
		4.75 mm	10 - 30
		150 micron	0 - 8
B	10 mm	10 mm	100
		4.75 mm	85 - 100
		150 micron	10 - 30

e) Binding Material

Binding material to be used for water bound macadam construction shall comprise of a suitable material approved by the Engineer having plasticity index value less than 6 as determined in accordance with IS : 2720, Part V. Application of binding material may not be necessary when the screenings used are of crushable type such as moorum or gravel.

3.08.03

Construction Operations

a) The sub-grade/sub-base to receive the water bound macadam coarse shall be prepared to the specified grade and camber and made free of any dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm. Where water bound macadam is to be laid over an existing black topped surface, 50mm x 50mm furrows shall be cut at an angle of 45 degrees to the centre line of the road at 1m intervals in the latter before laying the coarse aggregates.

b) Inverted Choke



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If water bound macadam is to be laid directly over the sub-grade without any other intervening pavement course, a 25mm course of screenings (Grading-B) shall be spread on the prepared sub-grade before application of coarse aggregates is taken up.

c) Spreading Coarse Aggregates

The coarse aggregates shall be spread uniformly over the prepared surface in such quantities that the thickness of each compacted layer is limited to 100mm for Grading-1 and 75 - 100mm for Grading-2 and 3. The spreading shall be done from stockpiles along the side of the roadway or directly from the vehicles. In no case shall the aggregate be dumped in heaps directly on the surface prepared to receive the aggregates nor shall hauling over permitted. The surface of the aggregates spread shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregates as may be required. No segregation of large or fine particles shall be allowed and the coarse aggregates as spread shall be of uniform gradation with no pockets of fine material. The coarse aggregates shall not normally be spread more than 3 days in advance of the subsequent construction operation.

d) Rolling

Immediately following the spreading of the coarse aggregates, rolling shall be started with three wheeled power rollers of 8 to 10 tonne capacity or with tandem or vibratory rollers of approved type. The weight of the roller shall depend upon the type of the aggregate and be indicated by the Engineer.

Except on super elevated portions where the rolling shall proceed from inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First the edge/edges shall be compacted with roller running forward and backward. The roller shall then move inwards parallel to the centre line of the road. Each pass of the roller shall uniformly overlap not less than one half the width of the track made in the preceding pass.

Rolling shall continue until the aggregates are thoroughly keyed and the creeping of aggregates ahead of the roller is no longer visible. During rolling slight sprinkling of water may be done if necessary. Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wavelike motion in the sub-grade or sub-base course.

The rolled surface shall be checked transversely and longitudinally with templates and any irregularities found shall be corrected by loosening the surface, adding or removing necessary amount of aggregates and rerolled until the entire surface conform to the desired camber and grade. In no case shall the use of screenings be permitted to make up the depressions.

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e) Application of Screenings

After the coarse aggregate has been rolled, screenings to completely fill the interstices shall be applied gradually over the surface. These shall not be damp or wet at the time of application. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregates. The screenings shall not be dumped in piles but be spread uniformly in successive thin layers either by the spreading motion of hand shovels or by mechanical spreader or directly from trucks. Trucks operating for spreading the screenings shall be so driven as not to disturb the coarse aggregates.

The screenings shall be applied at a slow and uniform rate (in three or more applications) so as to ensure filling of all voids. This shall be accompanied by dry rolling and brooming with mechanical brooms or hand brooms or with both. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface in such a manner as would prevent filling of voids or prevent the direct bearing of the roller on the coarse aggregate. These operations shall continue until no more screenings can be forced into the voids of the coarse aggregates.

The spreading, rolling and brooming of screenings shall be carried out in only such lengths of road which could be completed within one day's operation.

f) Sprinkling and Grouting

After the screenings have been applied, the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to seep the wet screenings into the voids and to distribute them evenly. The sprinkling, sweeping and rolling operations shall be continued with additional screenings applied as necessary until the coarse aggregates are thoroughly keyed, well bonded and firmly set to its full depth and a grout has been formed of screenings. Care shall be taken to see that the base or sub-grade does not get damaged due to the addition of excess quantity of water during construction.

g) Application of Binding Material

After the application of screenings, the binding material where it is required to be used shall be applied successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water and the resulting slurry shall be swept in with hand brooms or mechanical brooms to fill the voids properly and rolled during which water shall be applied to the wheels of the rollers if necessary to wash down the binding material sticking to them. These operations shall continue until the



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resulting slurry after filling the voids form a wave ahead of the wheels of the moving roller.

h) Setting and Drying

After the final compaction of water bound macadam course, the road shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding material as directed, lightly sprinkled with water if necessary and rolled. No traffic shall be allowed on the road until the macadam is set. The Engineer shall have the discretion to stop hauling traffic from using the complete water bound macadam course if in his opinion it would cause excessive damage to the surface.

3.09.00 Tack Coat

3.09.01 Description

The work shall consist of application of a single coat of low viscosity liquid bituminous material to an existing road surface preparatory to another bituminous construction.

3.09.02 Materials

The binder used for tack coat shall be bitumen of a suitable grade as approved by the Engineer and conforming to IS-73, IS-217 or IS-454 as applicable or any other approved cutback.

3.09.03 Construction Operations

a) Preparation of Base

The surface on which the tack coat is to be applied shall be thoroughly swept and scraped clean of dust and any other extraneous materials before the application of the binder.

b) Application of Binder

Binder shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Engineer and sprayed on the base at the rate specified below. The rate of spread in terms of straight run bitumen shall be 5 kg per 10 square metre area for an untreated water bound macadam surface. The binder shall be supplied uniformly with the aid of sprayers. The tack coat shall be applied just ahead of the oncoming bituminous construction.



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3.10.00 Bituminous Macadam Binder Course

3.10.01 Description

This work shall consist of construction in a single course of 50mm/75mm thickness of compacted crushed aggregates premixed with a bituminous binder laid immediately after mixing on a base prepared previously in accordance with the specification and in conformity with the lines, grades and cross sections shown on the approved drawings.

3.10.02 Materials

a) Binder

The Binder shall be straight run bitumen of a suitable grade as directed by the Engineer complying with IS : 73.

b) Aggregates

The aggregates shall consist of crushed stone, crushed gravel (shingle) or other stones. They shall be clean, strong, durable, fairly cubical in shape and free from any disintegrated pieces, organic and other deleterious matter and adherent coats. The aggregates shall preferably be hydrophobic and of low porosity.

The aggregates shall satisfy the physical requirements set forth in Table - VIII.

Table – VIII

Physical Requirements of Aggregates For Bituminous Macadam

Sl. No.	Test	Test method	Requirements
1.	Los Angeles Abrasion Value *	IS : 2386 (Part IV)	35 percent maximum
2.	Aggregate Impact Value *	IS : 2386 (Part IV)	30 percent maximum
3.	Flakiness Index	IS : 2386 (Part I)	35 percent maximum
4.	Stripping Value	IS : 6241 (Part IV)	25 percent maximum
5.	Water Absorption	IS : 2386 (Part III)	2 percent maximum



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*Aggregates may satisfy requirements of either of the two tests.

The aggregates for bituminous macadam for different thickness shall conform to Grading- A or B as given in Table-IX or X as the case may be.

Table-IX
Aggregates Grading For 75mm Compacted Thickness of Bituminous Macadam

Sieve Designation	Percent by weight passing the sieve	
	Grading A	Grading B
63 mm	100	
50 mm	90 - 100	
40 mm	35 - 65	100
25 mm	20 - 40	70 - 100
20 mm	-	50 - 80
12.5 mm	5 - 20	-
4.75 mm	-	10 - 30
2.36 mm	-	5 - 20
75 micron	0 - 5	0 - 4

Table-X
Aggregates Grading For 50mm Compacted Thickness of Bituminous Macadam

Sieve Designation	Percent by weight passing the sieve	
	Grading A	Grading B
50 mm	100	
40 mm	90 - 100	
25 mm	50 - 80	100
20 mm	-	70 -100



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12.5 mm	10 - 30	-
10 mm	-	35 - 60
4.75 mm	-	15 - 35
2.36 mm	-	5 - 20
75 micron	0 - 5	0 - 4

c) Proportioning of Materials

The binder content for premixing shall be 3.5 and 4.0 percent by weight of the total mix for aggregate Grading-A and B respectively unless directed otherwise by the Engineer. The quantity of aggregates to be used shall be sufficient to yield the specified thickness after compaction.

d) Variation in Proportioning of Materials

The Contractor shall have the responsibility for ensuring proper proportioning of materials and producing a uniform mix. A variation in binder content upto ± 0.3 percent by weight of total mix shall however be permissible for individual specimens taken for quality control tests.

3.10.03

Construction Operations

a) Weather and Seasonal Limitations

Bituminous macadam shall not be laid during rainy weather or when the base course is damp or wet.

b) Preparation of Base

The base on which the bituminous macadam is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross sections as shown on the drawings and as directed by the Engineer. The surface shall be thoroughly swept and scraped clean and free of any dust and foreign matter.

c) Tack Coat

A tack coat shall be applied over the base.

d) Preparation and Transport of Mix

Hot mix plant of adequate capacity shall be used for preparing the mix. The temperature of binder at the time of mixing shall be in the range 150 Deg. - 165 Deg. C and to that of aggregates shall be in the range 125 Deg. - 150 Deg. C provided the temperature difference between the binder and the aggregate at no time exceeds 25 Deg. C. Mixing shall be thorough to ensure that a homogenous mixture is obtained in which all particles of the aggregates are



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coated uniformly. The mixture shall be transported from the mixing plant to the point of use in a suitable vehicle. The vehicle employed for transport shall be clean and be covered over in transit if so directed by the Engineer.

e) Spreading

After mixing, the mix shall be spread immediately by means of a self propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix to the specified lines, grade and cross sections. However in restricted locations and in narrow widths where the available plants cannot operate in the opinion of the Engineer may permit manual laying of the mix. The temperature of mix at the time of laying shall be in the range 110 Deg. - 135 Deg. C.

In multilayer construction, the longitudinal joint in one layer shall offset into the layer below by about 150mm. However, the joint in the topmost layer shall be at the centre line of the pavement.

Longitudinal joints and edges shall be constructed true to the delineating lines parallel to the centre line of the road. All joints shall be cut vertical to the full thickness of the previously laid mix and the surface painted with hot bitumen before placing fresh material.

f) Rolling

After spreading of mix, the rolling shall be done with 8 to 10 tonne power roller or with any other approved plant. Rolling should start as soon as the materials are spread. Rolling shall be done with care to avoid any undulation in the pavement surface.

Rolling on the longitudinal joint shall be done immediately after the paving operation. After this, the rolling shall commence at the edges and progress towards the centre longitudinally except on superelevated portions where it shall progress from the lower to the upper edge parallel to the centre line of the pavement.

The initial or breakdown rolling shall be done as soon as it is possible to roll the mixture without cracking the surface and no mix pick up on the roller wheels. The second or intermediate rolling shall follow the break down rolling as early as possible and be done while the paving mix is still at a temperature that will result in maximum density. The final rolling shall be done while the material is still workable enough for removal of roller marks.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding fresh materials. The rolling shall then be continued till the entire surface has



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been rolled to compaction and there is no crushing of aggregates and till all the roller marks are eliminated. Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. The roller wheels shall be kept damp if necessary to avoid the bituminous material from sticking on the wheels and being picked up. In no case shall fuel/lubricating oil be used for this purpose.

Rolling operation shall be completed in every respect before the temperature of the mix fall below 80 Deg. C.

Rollers shall not stand on the newly laid material as it may lead to undue deformation. The edges along and transverse of the bituminous macadam laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of appropriate binder before the new mix is placed against it.

The bituminous macadam shall be provided with a final surfacing without any delay. If there is to be any delay the course shall be covered by seal coat before allowing any traffic over it.

3.11.00 Open Graded Premix Carpet

3.11.01 Description

This work shall consist of laying and compacting open graded carpet of specified thickness in a single course of suitable small sized aggregates premixed with bituminous binder on a previously prepared base to form wearing course in accordance with the specification.

3.11.02 Materials

a) Binder

The binder shall be bitumen of suitable grade as approved by the Engineer and satisfying the requirements of IS: 73, 217, 454 or any other approved cutback as applicable.

b) Aggregates

The aggregates shall consist of angular fragments of clean, hard, tough and durable rock of uniform quality throughout. They shall be obtained by crushing rock, gravel or river shingle and be free of elongated and flaky pieces, soft and disintegrated materials, vegetable and any other deleterious matter etc. They shall preferably be hydrophobic type. The aggregates shall satisfy the quality requirements set forth in Table-VIII except that the flakiness Index shall be limited to a maximum of 30.

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c) Proportioning of Materials

The materials shall be proportioned as per the quantities given in Table-XI for 20mm thick open graded premix carpet.

Table - XI**Quantity of Materials Required For 10 Sq. M of Road Surface For 20mm Thick Open Graded Premix Carpet**Aggregates for Carpet

i)	Stone Chippings - 12mm size ; passing 20 mm sieve and retained on 10 mm sieve	0.18 Cu.m
ii)	Stone Chippings - 10 mm size; passing 12.5 mm sieve and retained on 6.3 mm sieve	0.09 Cu.m
Total		0. 27 Cu.m

Binder for premixing (quantities in terms of straight run bitumen)

i)	For 0. 18 Cu.m of 12 mm size stone Chippings at 52 Kg per Cu.m	9.5 Kg
ii)	For 0.09 Cu. M of 10mm size stone Chippings at 56 Kg per Cu.m	5.1 Kg



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Total 14.6 Kg

3.11.03

Construction Operation

a) Weather and Seasonal Limitations

Open graded premix carpet shall not be laid during rainy weather or when the base course is damp or wet or when the atmospheric temperature in shade is 16 Deg. C or below.

b) Preparation of Base

The underlying base on which the bituminous carpet is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross section in accordance with the drawing, specification and as directed by the Engineer. The surface shall be well cleaned by removing caked earth and other foreign matters with wire brushes, sweeping with brooms and finally dusting with sacks as necessary.

c) Tack Coat

A tack coat complying with clause 3.09.00 shall be applied over the base preparatory to laying of the carpet. However application of tack coat shall not be necessary when the laying of carpet follows soon after laying the bituminous course.

d) Preparation of Premix

Mixers of approved type shall be employed for mixing the aggregates with the bituminous binder. The binder shall be heated to the temperature appropriate to the grade of bitumen approved by the Engineer in boilers of suitable design avoiding local overheating and ensuring a continuous supply. The aggregates shall be dry and suitably heated to a temperature as directed by the Engineer before these are placed in the mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified. The mixing of binder with chipping shall be continued until the chippings are thoroughly coated with the binder. The mix shall be immediately transported from the mixer to the point of use in suitable vehicles or wheel barrows. The vehicles employed for transport shall be clean and be covered over in transit if so directed.

e) Spreading and Rolling

The premixed material shall be spread on the road surface with rakes to the



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required thickness and camber or distributed evenly with the help of a drag spreader without any undue loss of time. The camber shall be checked by means of camber boards and inequalities evened out. As soon as sufficient length of bituminous material are laid, rolling shall be commenced with 6 to 8 tonne power rollers preferably with smooth wheel tandem type or with any other approved plant. Rolling shall begin at the edges and progress toward the centre longitudinally except on the superelevated portions where it shall progress from the lower to upper edge parallel to the centre line of the pavement.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding premixed materials. Rolling shall then be continued until the entire surface has been rolled to compaction and all the roller marks have been eliminated. In each pass of the roller, preceding track shall be overlapped uniformly by at least 1/3 width. The roller wheels shall be kept damp to prevent the premix from adhering to the wheels and being picked up. In no case shall fuel/lubricating oil be used for this purpose. Rollers shall not stand on newly laid material as it may lead to undue deformations.

The edges along and transverse of the carpet laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of approved binder before the new mix is placed against it.

f) Seal Coat

A seal coat conforming to clause 3.12.00 shall be applied to the surface immediately after laying the carpet. No traffic shall be allowed on the road till the seal coat has been placed.

3.12.00 Seal Coat

3.12.01 Description

This work shall consist of application of a seal coat as specified for sealing the voids in the bituminous surface laid to the specified levels, grade and camber.

Type-A : Liquid seal coat comprising of an application of a layer of bituminous binder followed by a cover of stone chippings.

Type-B : Premixed seal coat comprising of a thin application of fine aggregate premixed with bituminous binder.

3.12.02 Materials



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a) Binder

The binder shall be bitumen of suitable grade as directed by the Engineer and conforming to the requirements of IS : 73, 217 or 454 as applicable or any other approved cutback.

The quantity of binder to be adopted in terms of straight run bitumen shall be 9.8 Kg and 6.8 Kg per 10 square metre area for Type-A and Type-B seal coat respectively.

b) Stone Chippings for Type A Seal Coat

The stone chippings shall consist of angular fragments of clean, hard, tough and durable rock of uniform quality throughout. They shall be free of elongated or flaky pieces, soft or disintegrated stone, vegetable or other deleterious matters etc. Stone chippings shall be of 6mm size defined as 100 percent passing through 10mm sieve and retained on 2.36mm sieve. The quantity used for spreading shall be 0.09 cu.m per 10 sq.m area. The chippings shall satisfy the quality requirements spelled out in Table- VIII except that the upper limit for flakiness Index shall be 30.

c) Fine Aggregate for Type B Seal Coat

The fine aggregate shall be sand or fine grit and shall consist of clean, hard, durable, uncoated dry particles and shall be free from dust, soft or flaky material, organic matter or other deleterious substances. The aggregate shall pass 1.7 mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06 cubic metre per 10 square metre area.

3.12.03

Construction Operations

a) Preparation of Base

The seal coat shall be applied immediately after laying the bituminous course which is required to be sealed. Before application of seal coat, the surface shall be cleaned free of any dust or other extraneous matters.

b) Construction of Type-A Seal Coat

The binder shall be heated in boilers of suitable design to the temperature appropriate to the grade of bitumen approved by the Engineer and sprayed on the dry surface in a uniform manner preferably with the help of mechanical sprayers. Excessive deposits of binder caused by stopping or starting of the



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sprayer or through leakage or due to any other reason shall be suitably corrected before the stone chippings are spread.

Immediately after the application of binder, stone chippings in a dry and clean state shall be spread uniformly on the surface preferably by means of a mechanical grittier or otherwise manually so as to cover the surface completely. If necessary the surface shall be broomed to ensure uniform spread of chippings. Immediately after the application of the cover material, the entire surface shall be rolled with a 8 - 10 tonne smooth wheeled roller. Rolling shall commence from the edges and progress towards the centre except in superelevated portions where it shall proceed from the inner edge to the outer. Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. While rolling is in progress additional chippings shall be spread by hand in whatever quantities required to make up the irregularities. Rolling shall continue until all aggregate particles are firmly bedded in the binder and present an uniform closed surface.

c) Construction of Type-B Seal Coat

Mixers of approved type shall be employed for mixing the aggregates with the bituminous binder. The binder shall be heated in boilers of suitable design to the temperature appropriate to the grade of bitumen approved by the Engineer. Also the aggregates shall be dry and suitably heated to a temperature as directed by the Engineer before the same are placed in the mixer. Mixing of binder with aggregates to the specified proportions shall be continued till the latter is thoroughly coated with the former. The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed. As soon as sufficient length has been covered with the premixed material, the surface shall be rolled with 6 - 8 tonne smooth wheeled power rollers. Rolling shall be continued till the premixed material completely seals the voids in the bituminous course and a smooth uniform surface is obtained.

3.12.04 Opening to Traffic

In case of Type-B Seal coat, traffic may be allowed soon after the final rolling when the premixed materials are cooled down to the surrounding temperature. However in case of Type- A seal coat, the traffic shall not be permitted until the following day.

3.13.00 Repair of Existing Water Bound Macadam Surfaces

Pot holes or patches and ruts in the water bound macadam base or surface course which is to be surface treated shall be repaired by removing all loose materials by cutting in rectangular patches and replacing with suitable materials. The repair shall be done as under.



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Pot holes, patches and ruts shall be drained of any water and cut to regular shape with vertical sides and then be filled either with i) coarse aggregates and screenings conforming to the specification for water bound macadam and compacted with rollers or other approved rammer etc or with ii) premixed material conforming to the specification for open graded premix carpet and compacted with rollers or other approved means after painting the sides and bottom of the holes with a thin application of bitumen or a combination of both as directed by the Engineer.

3.14.00 Road Side Drains

3.14.01 Drains

The road side drains shall be made in sizes and slopes as shown on the approved drawings. The sides and bottom shall be neatly dressed after excavation. Proper connections shall be made to the culverts outside the plant area as per the drawings and instructions of the Engineer.

The excavated spoils other than that required for backfilling shall be transported and filled in low areas within the plant area or in embankments as instructed by the Engineer. The lining for drains shall be as per the drawings. Lining of drains may be of bricks or cement concrete blocks of specified grade as shown on the approved drawing or as directed by the Engineer. If shown on approved drawing, drains shall be of R.C.C. construction with necessary slopes.

3.15.00 Culverts

Excavation in trenches for foundation of culverts and wing walls shall be done with side slopes as per the drawings and instructions of the Engineer after clearing the site etc. As described in the "Specification for Earthwork in Excavation and Backfilling", backfilling in layers with watering and compaction shall be done after the construction of foundations. The construction of culverts shall be done true to the lines and levels as shown on the drawings. The specification for Masonry and/or Plain and Reinforced Cement concrete shall be followed as applicable.

3.16.00 Pipe Culverts and Drainage Pipes

3.16.01 Materials

The drainage pipes shall be made of R.C.C and shall be either class NP-2 or NP-3 as shown on the approved drawings. Pipe culverts shall be made of reinforced concrete pipe and shall be of class NP4 or RDSO class for railways as shown in the drawing. All pipes shall meet the requirements of IS : 458 and

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shall be procured from approved manufacturers with collars as per manufacturer's specification. The tenderer shall specifically mention the particular manufacturer's product he proposes to use.

Cement shall be ordinary Portland Cement as per IS:269. Coarse Aggregates shall be as per IS:383. Maximum size shall not exceed one third the thickness of the pipe or 20 mm whichever is smaller. Fine aggregates for concrete shall be as per IS:383.

3.16.02**Laying of Pipes**

Laying of concrete pipes shall correspond to IS:783 and as per the specification given below.

a) The foundation bed for pipe shall be excavated true to lines and grades shown on the drawings and as directed by the Engineer. When trenching is involved, its width on either side of the pipe shall not be less than 150mm and not more than one third the diameter of pipe unless otherwise instructed/permitted by the Engineer. The sides of the trench shall be as nearly vertical as possible. Side slope, shoring, bailing out water etc as required shall be done by the Contractor.

Side slips if there be any shall be removed by the Contractor. After laying of the pipes are completed, backfilling of the trenches shall be done as per "Specification for Earthwork in Excavation and Backfilling" to the satisfaction of the Engineer. The surplus spoils shall be transported and filled in low areas within the plant area as instructed by the Engineer.

When bedrock or boulder stratum is encountered during excavation, the excavation shall be taken down to at least 200mm below the bottom of the pipe with prior permission of the Engineer and all rock/boulders in the area shall be removed and space filled with approved earth free from stone or fragmented materials, shaped to the requirements and thoroughly compacted to provide adequate support for the pipe.

Filling of trench shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressures do not occur and shall be done as per the "Specification for Earthwork in Excavation and Backfilling". When two or more pipes are to be laid adjacent to each other, they shall be separated by a distance equal to at least half the diameter of the pipe subject to a minimum of 450 mm. Laying of pipes shall start from the outlet and proceed towards inlet. All pipes and fittings shall be gradually lowered into the trench or placed on the supports by approved means taking due care to avoid any damage. Under no circumstances the pipes shall be dropped into the trench or on supports from heights.

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b) Pipe bedding shall be first class projection bedding for positive projecting pipes as per IS : 783 having a projection ratio not greater than 0.70. The pipe shall be carefully laid on bedding made up of fine granular materials in an earth foundation; the bedding shall be carefully shaped to fit the lower part of the pipe exterior for at least ten percent of its overall height and in which the fill material is thoroughly compacted in layers not exceeding 150mm in depth around the pipe for the remainder of the pipe laid in trench.

When indicated on the drawings or directed by the Engineer, the pipe shall be bedded on a cradle constructed of concrete having a mix not leaner than M-15. The shape and dimension of the cradle shall be as indicated on the drawing or as directed by the Engineer. The pipe shall be laid on the concrete bedding before the concrete is set.

c) The drop walls shall be made with first class brickwork in 1:4 cement mortar.

d) The pipe culverts shall be made with proper care with respect to the invert of the pipe, gradient if any etc as specified on the drawings and as instructed by the Engineer.

e) Where R.C.C pipes are encased in concrete at road crossings or at other places the pipes need be suitably supported avoiding reinforcements of concrete blocks, joints properly done before concreting is taken up. Concreting of total height of block may be done in a single operation or may be done upto some height for pipes to be properly laid in position and the balance height of the block shall be concreted subsequently.

f) The R.C.C. pipes shall be joined with cement mortar. Cement mortar shall consist of 1 part of cement and 2 part of clean sand with only enough water for workability. Procedure of jointing shall be as per IS : 783.

3.16.03**Relation With Water Supply Pipeline**

Unless specifically cleared by the Engineer, under no circumstances shall the drainage pipes be allowed to come close to water supply pipelines.

3.17.00**Manholes and Inspection Chambers**

The maximum distance between the manholes shall be 30m unless specifically permitted otherwise. In addition, at every change of alignment, gradient or diameter there shall be a manhole or inspection chamber. The distance between the manhole or inspection chamber and gully chamber shall not exceed 6 meters unless permitted otherwise. Manhole shall be constructed so as to be water tight under test. The channel or drain at the bottom of chamber shall be plastered with 1:2 cement sand mortar and finished smooth to the grade. The channels and drains shall be shaped and laid to provide a smooth



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flow. Connection to the existing pipelines shall be through a manhole. Manholes shall be provided with standard covers usually of C.I. or as directed by the Engineer. The cover shall be closely fitted so as to prevent gases from coming out.

4.00.00 Testing and Acceptance Criteria

All testing as mentioned in the specification and as mentioned in Clause No. 900 of the “Specification for Roads and Bridge Works, 1983” published by IRC on behalf of Ministry of Shipping and Transport (Roads Wing) shall be carried out by the Contractor as per the direction of the Engineer.

5.00.00 MEASUREMENT

Method of measurement shall be as per the latest version of IS:1200, Part-17 and as directed by the Engineer.



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(PART I)**

SUB-SECTION – D 17

FABRICATION OF STRUCTURAL STEEL WORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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C O N T E N T

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SUB-SECTION – D XVII FABRICATION OF STRUCTURAL STEEL WORK 1.00.00 SCOPE This specification covers supply, fabrication, testing, painting and delivery to site of structural steelwork including supply of all consumable stores and rivets, bolts, nuts, washers, electrodes and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the contract. 2.00.00 GENERAL 2.01.00 Work to be provided for by the Contractor The work to be provided for by the Contractor, unless otherwise specified elsewhere in the contract, shall include, but not be limited to the following a) Preparation of complete detailed fabrication drawings and erection marking drawings required for all the structures covered under the scope of the contract based on the approved design drawings. As decided by the Engineer, some or all of these detailed drawings will have to be submitted for approval. b) To submit revised design with calculations and detailed fabrication drawings in case any substitution of the designed sections are to be made. c) To submit design calculations for joints and. connections developed by the contractor along with detailed fabrication drawings. d) Furnish all materials, labour, tools and plant and all consumables required for fabrication and supply, all necessary rivets, bolts, nuts, washers, tie rods and welding electrodes for field connections, e) Furnish shop painting of all fabricated steelwork as per requirements of this Specification. f) Suitably mark, bundle, and pack for transport all fabricated materials. g) Prepare and furnish detailed Bill of Materials, Drawing Office Dispatch lists, Rivet and Bolt List and any other list of bought out items required in connection with the fabrication and erection of the structural steelwork. h) Insure, load and transport all fabricated steelwork field connection materials to site.		

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	i) Maintain a fully equipped workshop at site for fabrication, modification and repairs of steelwork at site as may be required to complete the works in accordance with the Contract. 2.02.00 Work by others No work under this specification will be provided for by any agency other than the contractor, unless specifically mentioned otherwise elsewhere in the contract. 2.03.00 Codes and standards All work under this specification shall, unless otherwise specified in the contract, conform to the requirements of the latest revision and/or replacements of the following or any other relevant Indian Standard specifications and codes of practice. In case any particular aspect of the work is not specifically covered by any Indian Standard specification, any other standard practice, as may be specified by the Engineer shall be followed: IS : 226 - Structural steel (Standard Quality) IS : 800 - Code of Practice for general construction in steel. IS : 806 - Code of practice for use of steel tubes in general building construction. IS : 808 - Rolled steel beams, channels, and angle sections IS : 813 - Scheme of symbols for welding IS : 814 - Covered electrodes for metal arc welding of structural steel IS : 815 - Classification and coding of covered electrodes for metal arc welding of structural steels. IS : 816 - Code of practice for use of metal arc welding for general construction in mild steel IS : 817 - Code of practice for training and testing metal arc welders IS : 818 - Code of practice for safety and health requirements in electric and gas welding and cutting operations IS : 822 - Code of practice for inspection of welds IS : 919 - Recommendations for limits and fits for Engineering	

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IS : 961 - Structural Steel (High Tensile) IS : 1148 - Rivet bars for structural purposes IS : 1149 - High tensile rivet bars for structural purposes IS : 1161 - Steel Tubes for structural purposes IS : 1200 - Method of measurement of steelwork and ironwork (Part 8) IS : 1239 - Mild Steel Tubes IS : 1363 - Black hexagon bolts, nuts and lock nuts (dia. 6 to 30 mm) and black hexagon screws (dia 6 to 24 mm) IS : 1364 - Precision and semi-precision hexagon bolts, screws, nuts and locknuts (dia, range 6 to 39 mm) IS : 1367 - Technical supply conditions for threaded fasteners IS : 1442 - Covered electrodes for the metal arc welding of high tensile structural steel IS : 1608 - Method for tensile testing of steel products other than sheet strip, wire and tube IS : 1730 - Dimensions for steel plate, sheet, and strip for structural and general engineering purposes. IS : 1731 - Dimensions for steel flats for structural and general engineering purposes IS : 1852 - Rolling and cutting tolerances for hot-rolled steel products IS : 1977 - Structural steel (ordinary quality) St-42-0 IS : 2062 - Steel for General Structural Purposes IS : 2074 - Ready mixed paint, red oxide Zinc chromate priming IS : 2595 - Code of Practice for Radiographic Testing IS : 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and Steel IS : 2633 - Method for testing uniformity of coating on Zinc Coated Articles					

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	IS : 3757 - High strength structural bolts IS : 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel and other allied products IS : 7205 - Safety Code for Erection of Structural Steelwork IS : 7215 - Tolerances for fabrication of steel structures IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels. IS : 9595 - Recommendations for metal arc welding of carbon and carbon manganese steels. 2.04.00 Conformity with Designs The contractor shall design all connections, supply and fabricate all steelwork and furnish all connection materials in accordance with the approved drawings and/or as instructed by the Engineer keeping in view the maximum Utilization of the available sizes and sections of steel materials. The methods of painting, marking, packing and delivery of all fabricated materials shall be in accordance with the provisions of the contract and/or as approved by the Engineer. Provision of all relevant Indian Standard Specifications and Codes of Practice shall be followed unless otherwise specified in the contract. 2.05.00 Materials to be used 2.05.01 General All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section. The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes,	

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	the manufacturer shall furnish instructions giving recommended voltage and amperage (Polarity in case of D.C. supply) for which the electrodes are suitable. 2.05.02 Steel All steel materials to be used in construction within the purview of this specification shall comply with any of the following Indian Standard Specifications as may be applicable: a) IS : 2062 - Steel for general structural purposes b) IS : 961 - Structural steel High Tensile c) IS : 1977 - Structural steel (Ordinary quality) St-42-0 In case of imported steel materials being used, these shall conform to specifications equivalent to any of the above as may be applicable. 2.05.03 Rivet Steel All rivet steel used in construction within the purview of this Specification shall comply with one of the following Indian Standard Specifications as may be applicable: a) IS : 1148 - Rivet Bars for structural purpose b) IS : 1149 - High tensile rivet bars for structural purposes. Where high tensile steel is specified for rivets, steps shall be taken to ensure that the rivets are so manufactured that they can be driven and heads formed satisfactorily without the physical properties of steel being impaired. 2.05.04 Electrodes All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable a) IS : 814 - Covered electrodes for metal arc welding of structural steel b) IS : 815 - Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel	

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	c) IS : 1442 - Covered electrodes for the metal arc welding of high tensile structural steel d) IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels				
2.05.05	Bolts and Nuts All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners. Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable. a) Mild Steel All mild steel for bolts and nuts when tested in accordance with the following Indian Standard Specification shall have a tensile strength of not less than 44 Kg/mm ² and a minimum elongation of 23 per cent on a gauge length of 5.6 _/A, where "A" is the cross sectional area of the test specimen i) IS: 1367: Technical supply conditions for threaded fasteners ii) IS: 1608: Method for tensile testing of steel products other than sheet, strip, wire and tube b) High Tensile Steel The material used for the manufacture of high tensile steel bolts and nuts shall have the mechanical properties appropriate to the particular class of steel as set out in IS: 1367 or as approved by the Engineer.				
2.05.06	Washers Washers shall be made of steel conforming to any of the following Indian Standard Specifications as may be applicable under the provisions of the Contract: a) IS : 2062 - Steel for general structural purposes b) IS : 961 - Structural Steel (High Tensile Quality) c) IS : 1977 - Structural steel (Ordinary Quality) St-42-0				

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	d) IS : 6649 - Hardened washers 2.05.07 Paints Paints to be used for shop coat of fabricated steel under the purview of this contract shall conform to the Indian Standard Specification IS: 2074 - Ready mixed Paint, Red oxide Zinc Chromate Priming. 2.06.00 Coal Bin 2.06.01 Shape of bins shall be circular, polygonal, square, or rectangular in plan. Bottom hopper portion may have be conical-cum-hyperbolic or any other profile shape as shown in the drawing. Bin shall be termed as bunkers or silos according to their shape and plane of rupture of coal. 2.06.02 For general requirements, fabrication and construction details IS: 9178 (Pt.I & 11) shall be followed as general guidance. The bins shall be fabricated and erected in segments. 2.06.03 The Coal bins shall be made of mild steel plates joined together with full strength butt weld and provided with stiffeners at regular interval. Stiffeners shall be provided on the external face and it may be welded with external face. 2.06.04 Bending of plates and rolled sections to the required shape for fabrication shall be done by plate bending machine or cold bending process Without resorting to heating, hammering, angle smithy and black smithy process. 2.06.05 Poking hole (manual or pneumatic) and striking plate shall be provided to facilitate coal flow. Poking holes shall have circular MS pipe and cover cap as detailed in the drawing. 2.07.00 New Erection Marks 2.07.01 Additional structures involving new erection marks may be required to be added at any stage of work. 2.07.02 All such new erection marks shall be detailed and included in marking schemes and fabrication carded out thereafter. 2.07.03 All such new erection marks shall be considered under item of original fabrication work. As a result of additional structures becoming necessary if the work is delayed beyond the time schedule stipulated, the Engineer shall give suitable extension of time provided he is satisfied about the reasonableness of the delay involved. However, no claim for extra payments or revision of rates due to delay shall be entertained.	



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2.08.00	ELECTRO FORGED STEEL GRATINGS	
2.08.01	Factory made fabricated electro forged gratings unit with steel conforming to IS: 2062 shall be supplied, fabricated, transported, erected and aligned in floorings, platforms, drain and trench covers, walkways, passages, staircases with edge binding strips and anti skid nosing in treads etc.	
2.08.02	All grating units shall be rectangular in pattern and electro forged. The size and the spacing of the bearing bars and cross bars shall be as detailed in fabrication drawings. The contractor shall submit the grating design for different spans and load intensities along with fabrication drawings. The depth of the grating unit shall be 40 mm, unless specified otherwise.	
2.08.03	The gratings shall be made up in panel units designed to coincide with the span of the structural steel framing or openings as indicated in the design/scope drawings. Maximum possible standardization of the grating panel sizes shall be tried and designed.	
2.08.04	The grating unit shall be accurately fabricated and finished, free from wraps, twists, or any defects that would impair their strength, serviceability, and appearance.	
2.08.05	Grating work shall include cut outs and clearance opening for all columns, pipes, ducts, conduits or any other installation penetrating through the grating work. Such cut outs and clearances shall be treated as specified in subsequent clauses.	
2.08.06	The gratings shall be notched, trimmed and neatly finished around flanges and webs of the columns, moment connections, cap plates, and such other components of the steel structures encountered during the placement of the gratings. In all such cases, the trimming shall be done to follow the profile of the components encountered. After trimming, the binding strip shall be provided on the grating to suit the profile so obtained.	
2.08.07	Opening in gratings for pipes or ducts that are 150mm in size or diameter or larger shall be provided with steel bar toe plates of not less than 5mm thickness and appropriate width, set flush with the bottom of the bearing bars.	
2.08.08	Penetrations in gratings that are more than 50mm but less than 150mm in size or diameter shall be welded with plates of size shown in the detailed drawings set flush with the bottom of the grating panel.	
2.08.09	Unless otherwise indicated on the drawings, grating units at all penetrations shall be made up in split section, accurately fitted and neatly finished to provide for proper assembly and erection at the job site.	

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	2.08.10 Grating units shall be provided with all necessary clips, bolts, nuts and lock washers required for proper assembly and rigid installation and fastening to abutting units supporting structural steel framing members. 2.08.11 The gratings shall be of reputed make and manufacturer, as approved by Engineer. The unit rate quoted by him for this item shall be inclusive of transport of gratings to the project site, all taxes, duties etc. He shall also provide all facilities and access to the Engineer or his representative to carry out inspection during all stages of manufacturing of gratings. 2.08.12 Maximum deviation in linear dimension from the approved dimension shall not exceed 12mm. 2.08.13 All fabricated grating section and accessories shall be blast cleaned to near white metal surface (Sa 2½) followed by either of the following two: (a) Two coats of red lead primer and two coats of black enamel finish paint. (b) Hot dipped galvanization at 610 gm/sq.m. in the shop prior to erection at site, as the approved drawing. 2.08.14 Prior to finishing all surfaces shall be cleaned, free from rust, mill scale, grease, oil, or any other foreign matter by blast cleaning. BS: 4232 shall be followed for blast cleaning. 2.08.15 Primer can be applied by spray guns or by brushes, however the finish paint shall necessarily be applied by means of spray guns. The applied coatings shall be uniform, free from voids and streaks; drilled or punched holes shall be touched up prior to erection or assembly. 2.09.00 GALVANIZATION OF GRATINGS 2.09.01 Purity of Zinc to be used-for galvanizing shall be 99.5% as per IS: 2 15 2.09.02 After the shop work is complete, the structural material shall be punched with erection mark and be hot double dip galvanized. Before galvanizing the steel section shall be thoroughly blast cleaned to near white metal surface (Sa 2½). 2.09.03 The weight of the zinc coating shall be at least 610 gm/m² - unless noted otherwise. 2.09.04 The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be cleaned and smooth and shall be free from defects like discoloured	

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	patches, bare spots, unevenness of coating, spelter that is loosely attached to the steel, blistered surface, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection. 2.09.05 There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633. 2.09.06 When the steel section is removed from the galvanizing kettle, excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose. 2.09.07 Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specifications or lack of quality control in any manner in the galvanizing plant, shall render the entire, production in the relevant shift liable to rejection. 2.09.08 All structural steel shall be treated with sodium dichromate or an approved equivalent solution after galvanizing; so as to prevent white storage stains. 2.09.09 If the galvanizing of any member is damaged, the Engineer shall be shown of the extent of damage, if so directed the galvanizing may have to be redone in the similar manner as stated above at no extra cost to the Owner. 2.10.00 STAINLESS STEEL HOPPERS (As per BOQ item) 2.10.01 Material In case SS Hopper is to be fabricated & erected as per BOQ item with SS415M, following specification shall be followed. Stainless steel hopper of grade SS 415M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. SS 415M having the following chemical composition shall be used. <table> <tr> <th>Material</th><th>%</th><th>Remarks</th></tr> <tr> <td>Carbon</td><td>10.03%</td><td>Max.</td></tr> <tr> <td>Silicon</td><td>1.60%</td><td>Max.</td></tr> <tr> <td>Manganese</td><td>0.80% to 1.50%</td><td></td></tr> <tr> <td>Phosphorous</td><td>0.03%</td><td>Max.</td></tr> <tr> <td>Sulphur</td><td>0.03%</td><td>Max.</td></tr> </table>	Material	%	Remarks	Carbon	10.03%	Max.	Silicon	1.60%	Max.	Manganese	0.80% to 1.50%		Phosphorous	0.03%	Max.	Sulphur	0.03%	Max.	
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<table><tr><td>Chromium</td><td>10.80% to 12.50%</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Nickel</td><td>1.50%</td><td></td><td></td><td>Max.</td><td></td><td></td></tr><tr><td>Titanium</td><td>0.75%</td><td></td><td></td><td>Max.</td><td></td><td></td></tr><tr><td>Nitrogen</td><td>0.03%</td><td></td><td></td><td>Max.</td><td></td><td></td></tr></table> The mechanical properties shall be as follows: <table><tr><td>Description</td><td>Value</td><td>Remarks</td></tr><tr><td>Hardness Rock Well B Scale</td><td>90</td><td>Max.</td></tr><tr><td>Tensile Strength</td><td>450 MPa</td><td>Min.</td></tr><tr><td>Yield Strength</td><td>300 MPa</td><td>Min.</td></tr><tr><td>Elongation</td><td>25%</td><td>Min.</td></tr></table>							Chromium	10.80% to 12.50%						Nickel	1.50%			Max.			Titanium	0.75%			Max.			Nitrogen	0.03%			Max.			Description	Value	Remarks	Hardness Rock Well B Scale	90	Max.	Tensile Strength	450 MPa	Min.	Yield Strength	300 MPa	Min.	Elongation	25%	Min.
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Elongation	25%	Min.																																															
2.10.02		Fabrication The fabrication, erection, alignment and welding shall be carried out as per the accepted practice and in accordance with relevant I.S. and international specification as well as stipulations contained herein. Fabrication drawings shall be prepared by the contractor on the basis of the design / scope drawings furnished by Engineer. The fabrication and erection works shall be done as per the approved fabrication drawings.																																															
2.10.03		Fabrication Drawings a) Fabrication drawing shall give the cutting plan for each hopper plate. Such, cutting plan shall be based on the size of the Stainless Steel plate available at store. In order to reduce the wastage and ensure the maximum utilization of stainless steel plate, the cutting plan shall take in the consideration of the reverse curvature and place the various elements of hopper plate in opposite fashion to reduce the end wastage. Similarly the hopper plate element having different radii shall be placed one inside the other, to optimize the stainless steel plate use. Such optimization may also required adjustment in the size of the each element of hopper plate and also additional weld joints. b) The bill of material of hopper plate shall indicate the inner surface area of the hopper, weight of the hopper based on the inner surface area, weight of each of the cut plate of hopper fabrication, weight of cut and scrap pieces																																															

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	generated. Contractor shall return to the Owner's store all unutilized (surplus) stainless steel plates and all waste and cut pieces generated. Non return of any part of the surplus/waste steel pieces to the Owner's store will call for the penal recovery at three (03) times the maximum procurement rate for the weight of stainless steel pieces not returned to the store. c) In case the contractor does the cutting of the stainless steel without approved cutting plan then all the wastage (i.e. the difference between the weight of stainless steel plate cuts and the actual finished weight considered for the measurement for payment) shall be subjected to the penal recovery at the rate mentioned above. 2.10.04 Cuffing Cutting may be affected by shearing, or by using plasma. The cut edges of all plates shall be perfectly straight and uniform through out. Cutting shall be done as per the cutting plan shown in the fabrication drawing. Should the Engineer find it necessary, the edges shall be ground smooth afterwards by contractor within the unit rates quoted by him. All the edge s shall be ground smooth before they are welded. 2.10.05 Jointing Welding shall join stainless steel. All weld joints (along the inclined plane) shall be staggered. Any common welding process can weld stainless steel viz. MIG, metal arc or plasma using the covered compatible electrodes as per IS: 5206 or by inert gas arc welding as per IS: 2811. Shielding gas shall be Argon + Hydrogen mixture or Argon + Oxygen mixture. However, Argon + Oxygen mixture shall be preferred. Carbon-di-oxide mixture shall be avoided. 308L and 315L electrodes/fillers shall be used for the welding of Stainless Steel to Stainless Steel and Stainless Steel to Mild Steel respectively. However, the welding process and the type of the electrodes to be used for welding shall be as per welding procedure, as approved by the Engineer. On the basis of the welding procedure, the Contractor shall conduct qualification test. 2.10.06 Bending The stainless steel plates shall be subjected to cold forming and bending in order to get the desired shape and profile. 2.10.07 Welding sequence The type of electrodes, welding sequence, preheat and interpass temperature and post weld heat treatment shall be as approved by the Engineer.	

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	placed on this layer while it is still workable and the bearing is levelled. The bearing should not be displaced as the beam is lowered into position. When the mortar and adhesive are fully set and the beam slightly above the top of the bearing. The upper surface of the bearing shall then be coated with sufficient thickness of epoxy resin mortar so that when the beam is lowered on to the temporary supports it comes into full contact with the mortar and some is squeezed out. The surplus shall be troweled off and after the mortar is fully set the temporary supports removed. 2.12.00 Storage of material 2.12.01 General All materials shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged, shall be removed from the contractor's yard immediately, failing which, the Engineer shall be at liberty to get the material removed and the cost incurred thereof shall be realised from the Contractor. The Contractor shall maintain upto date accounts in respect of receipt, use, and balance of all sizes and sections of steel and other materials. In case the fabrication is carried out in contractor's fabrication shop outside the plant site where other fabrication works are also carried out, all materials meant for use in this contract shall be stacked separately with easily identifiable marks. 2.12.02 Steel The steel to be used in fabrication and the resulting cut-pieces shall be stored in separate stacks off the ground section wise and lengthwise so that they can be easily inspected, measured, and accounted for at any time. If required by the Engineer, the materials may have to be stored under cover and suitably painted for protection against weather. 2.12.03 Electrodes The electrodes for electric arc welding shall be stored in properly designed racks, separating different types of electrodes in distinctly marked compartments. The electrodes shall be kept in a dry and warm condition if necessary by resorting to heating. 2.12.04 Bolts, Nuts and Washers Bolts, nuts and washers and other fastening materials shall be stored on racks off the ground with a coating of suitable protective oil. These shall be stored in separate gunny bags or compartments according to diameter, length, and quality.	

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2.12.05	Paints Paints shall be stored under cover in air tight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened. 2.13.00 Quality Control The Contractor shall establish and maintain quality control procedures for different items of work and materials to the extent he deems necessary to ensure that all work is performed in accordance with this specification. In addition to the Contractor's quality control procedures, materials and workmanship at all times shall be subjected to inspection by the Engineer or Engineer's representative. As far as possible, all inspection by the Engineer or Engineer's representative shall be made at the Contractor's fabrication shop whether located at Site or elsewhere. The Contractor shall co-operate with the Engineer or Engineer's representative in permitting access for inspection to all places where work is being done and in providing free of cost all necessary help in respect of tools and plants, instrument, labour and materials required to carry out the inspection. The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor. Materials or workmanship not in reasonable conformance with the provisions of this Specification may be rejected at any time during the progress of the work. The quality control procedure shall cover but not be limited to the following items of work a) Steel: Quality manufacturer's test certificates, test reports of representative samples of materials from unidentified stocks if permitted to be used. b) Rivets, Bolts, : Manufacturer's certificate, dimension checks, Nuts & Washers material testing. c) Electrodes : Manufacturer's certificate, thickness and quality of flux coating. d) Welders : Qualifying Tests e) Welding sets : Performance Tests f) Welds : Inspection, X-ray, Ultrasonic tests g) Paints : Manufacturer's certificate, physical inspection	

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	reports h) Galvanizing : Tests in accordance with IS 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS : 4759 - Specification for Hot-Dip Zinc coatings on Structural Steel and other allied products. 2.14.00 Standard dimensions, forms and weights The dimensions, forms, weights and tolerances of all rolled shapes rivets, bolts, nuts, studs, washers etc. and other members used in the fabrication of any structure shall, wherever applicable, conform to the requirements of the latest relevant Indian Standards, wherever they exist, or, in the absence of Indian Standards, to other equivalent standards. 2.15.00 Fabrication Drawings The contractor shall within thirty (30) days after the award of the Contract submit to the Engineer the Schedule of Fabrication and erection of structural Steelworks, for approval. Within one week after receipt of approval on design of any steel structure (part or full) based on the approved design. As decided by the Engineer, six (6) copies each of some or all of the detailed fabrication drawings will have to be submitted for approval. The sequence of preparation of fabrication drawings shall match with the approved fabrication and erection schedule. The above-mentioned approval for fabrication drawings will be accorded only towards the general conformity with the design requirements as well as specifications. The approval of drawing however shall not relieve the contractor of his sole responsibility in carrying out the work correctly and fulfilling the complete requirements of contract documents. The fabrication drawings shall include but not limited to the following: a) Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections. b) Dimensional drawings of base plates, foundation bolts location etc. c) Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings. d) Complete Bill of Materials and detailed drawings of all sections as also their billing weights.	

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	e) Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof. These drawings shall give all the necessary information for the fabrication, erection, and painting of the steelwork in accordance with the provisions of this Specification. Fabrication drawings shall be made in accordance with the best modern practice and with due regard to sequence, speed and economy in fabrication and erection. Fabrication drawings shall give complete information necessary for fabrication of the various components of the steelwork, including the location, type, size, and extent of welds. These shall also clearly distinguish between shop and field rivets, bolts, and welds and specify the class of bolts and nuts. The drawings shall be drawn to a scale large enough to convey all the necessary information adequately. Notes on the fabrication drawings shall indicate those joints or groups of joints in which it is particularly important that the welding sequence and technique of welding shall be carefully controlled to minimize the locked up stresses and distortion. Welding symbols used shall be in accordance with the requirements of the Indian Standard Specification. IS: 813 - Scheme of symbols for Welding, and shall be consistent throughout. Weld lengths called for on the drawings shall mean the net effective length. The Contractor shall be responsible for and shall carry out at his cost any alterations of the work due to any discrepancies, errors or omissions on the drawings or other particulars supplied by him, whether such drawings or other particulars have been duly approved or not in accordance with the Contract. 3.00.00 WORKMANSHIP 3.01.00 Fabrication 3.01.01 General All workmanship shall be equal to the best practice in modern structural shops, and shall conform to the provisions of the Indian Standard IS: 800 - Code of Practice for general construction in steel and other relevant Indian Standards or equivalent. 3.01.02 Straightening Material Rolled materials before being laid off or worked, must be clean, free from sharp kinks, bends or twists and straight within the tolerances allowed by the Indian Standard Specification on IS: 1552 - Specification for rolling and cutting tolerance for hot-rolled steel products. If straightening is necessary, it may be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 600°C.	

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3.01.03	Cutting Shearing, cropping, or sawing shall affect cutting. Use of a mechanically controlled gas-cutting torch may be permitted for mild steel only. Gas cutting of high tensile steel may also be permitted provided special care is taken to leave sufficient metal to be removed by machining, so that all metal that has been hardened by flame is removed. Gas cutting without a mechanically controlled torch may be permitted if special care is taken and done under expert hand, subject to the approval of the Engineer. To determine the effective size of members cut by gas, 3 mm shall be deducted from each cut edge. Gas cut edges, which will be subjected to substantial stress or which are to have weld metal deposited on them, shall be reasonably free from gouges, occasional notches or gouges not more than 4 mm deep will be permitted. Gouges greater than 4 mm that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch free to a radius of at least 12 mm. Shearing, cropping and gas cutting shall be clean, reasonably square and free from any distortion.	
3.01.04	Planning of edges	
	Planning or finishing of sheared or cropped edges of plates or shapes or of edges gas-cut with a mechanically controlled torch shall not be required, unless specifically required by design and called for on the drawings, included in a stipulation for edge preparation for welding or as may be required after the inspection of the cut surface. Surface cut with hand-flame shall generally be ground, unless specifically instructed otherwise by the Engineer.	
3.01.05	Clearances	
	The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 2 mm at each end. The erection clearance at ends of beams web shall be not more than 3 mm at each end, but where for practical reasons greater clearance is necessary, suitably designed cheatings shall be provided.	
3.02.00	Riveted and bolted construction	
3.02.01	Holes	
	Holes through more than one thickness of material for members, such as compound stanchions and girder flanges, shall be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, if the thickness of the material is not greater than the nominal diameter of rivet or bolt plus 3 mm subject to a maximum thickness of 16 mm	

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	provided that the holes are punched 3 mm less in diameter than the required size and reamed after assembly to the full diameter. Holes for rivets or black bolts shall be not more than 1.5 mm or 2.0 mm (depending on whether the diameter of the rivet or bolt is less or more than or equal to 25 mm) larger in diameter than the nominal diameter of the rivet or black bolt passing through them. Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to a tolerance grade of BS as specified in IS: 919. Parts to be connected shall be firmly held together by tacking welds or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all thickness in one operation shall be drilled to a smaller size and reamed out after assembly. Holes for rivets or bolts shall not be formed by gas cutting process. 3.02.02 Assembly All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting to enlarge unmatching holes shall not generally be permitted. In case drifting is permitted to a slight extent during assembly, it shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the rivets or bolts shall be reamed. Poor matching of holes shall be cause for rejection .The component parts shall be so assembled that they are neither twisted not otherwise damaged, and shall be so prepared that the specified cambers, if any, are maintained. Rivets shall ordinarily be hot driven, in which case their finished heads shall be approximately hemispherical in shape and shall be of uniform size throughout the work for rivets of the same size full, neatly finished and concentric with he holes. Rivets shall be heated uniformly to a temperature not exceeding 1 125°C they shall not be driven after their temperature has fallen below 540°C. Rivets shall be driven by power riveters, of either compression or manually operated type, employing pneumatic, hydraulic or electric power. Hand driven rivets shall not be allowed unless in exceptional cases specifically approved by the Engineer. After driving, rivets shall be tight, shall completely fill the holes and their heads shall be in full contact with the surface. In case of countersunk rivets, the countersinking shall be fully filled by the rivet, any proudness of the countersunk head being dressed off flush, if required. Riveted members shall have all parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single	

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	riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole. All loose, burnt, or otherwise defective rivets shall be cut out and replaced and special care shall be taken to inspect all single riveted connections. Special care shall also be taken in heating and driving long rivets. The Contractor shall prove the quality of riveting by cutting some rivets chosen at random by the Engineer. No extra payment will be made to the Contractor for such cutting and replacing. Riveting work, for any particular section or group, will be considered satisfactory when at least 90% of the corresponding cut rivets is found to be sound. If the ratio is below 75%, all the rivets in the particular section or group shall be cut, removed and replaced and tested again at the Contractor's expense. For cases between 75% and 90% the engineer shall have the option to instruct cutting and replacing any number of further rivets at the Contractor's cost as he deems necessary. Bolted construction shall be permitted only in case of field connections if called for on the Drawings and is subjected to the limitation of particular connections as may be specified. In special cases, however, shop bolt connections may be allowed if shown on drawing or directed by the Engineer. Washers shall be tapered or otherwise suitably shaped, where necessary, to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least one thread. In all cases the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. In addition to the normal washer one spring washer or lock nut shall be provided for each bolt for connections subjected to vibrating forces or otherwise as may be specified on the Drawings. 3.03.00 Welded Construction 3.03.01 General Welding shall be in accordance with relevant Indian Standards and as supplemented in the Specification. Welding shall be done by experienced and good welders who have been qualified by tests in accordance with IS: 817. 3.03.02 Preparation of material Surface to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material except that mill scale, which withstands vigorous wire brushing, may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch.	

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	ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract. To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards. 3.03.12 Temperature No welding shall normally be done on parent material at a temperature below (-) 5°C. However, if welding is to undertaken at low temperature, adequate precautions as recommended in relevant Indian Standard shall be taken. When the parent material is less than 40 mm thick and the temperature is between (-) 5°C and 0°C, the surface around the joint to a distance of 100 mm or 4 times the thickness of the material, whichever is greater, shall be preheated till it is hand warm. When the parent material is more than 40 mm thick, the temperature of the area mentioned above shall be in no case be less than 20°C. All requirements regarding preheating of the parent material shall be in accordance with the relevant Indian Standard. 3.03.13 Peening Where required, intermediate layers of multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool, peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peening. 3.03.14 Equipment These shall be capable of producing proper current so that the operator may produce satisfactory welds. The welding machine shall be of a type and capacity as recommended by the manufacturers of electrodes or as may be approved by the engineer. 3.04.00 Finish Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-butt over the whole section with a clearance not exceeding 0.1 mm locally at any place. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc; after welding/riveting together, should be accurately machined so that the parts connected butt over the entire surfaces of contact. Care should be taken that those connecting angles of channels are fixed with such accuracy that they are not reduced in thickness by machining by more	

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	than 1.0 mm. 3.05.00 Slab bases and caps Bases and caps fabricated out of steel slabs, except when cut material with true surface, shall be accurately machined over the bearing surface and shall be in effective contact with the end of the stanchion. A bearing face, which is to be grouted direct to a foundation, need not be machined if such face is true and parallel to the upper face. To facilitate grouting, holes shall be provided, where necessary, in stanchion bases for the escape of air. 3. 12.00 Lacing bars The ends of lacing bars shall be neat and free from burns. 3. 13.00 Separators Rolled section or built-up steel separators or diaphragms shall be required for all double beams except where encased in concrete, in which case, pipe separators shall be used. 3.14.00 Bearing Plates Provision shall be made for all necessary steel bearing plates to take up reaction of beams and columns and the required stiffeners and gussets whether or not specified in Drawings. 3.15.00 Floor Grating All grating units shall be rectangular in pattern and of pressure locked assembly. The size and spacing of bearing bars and cross bars shall be as approved in detailed drawings. Alternatively diamond pattern grating if approved may be used. The grating shall be made in panel units designed to span as indicated in structural steel framing drawing or as directed by the Engineer. The grating units shall be finished free from warps, twists, or any other defects. Grating work shall include cutouts and clearance openings for all columns, pipes, ducts, conduits etc. The gratings shall be notched, trimmed, and neatly finished around components of the steel structures encountered.	

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	Binding strip shall be provided on the grating to suit the profile. Openings in gratings shall be provided with steel bar toe plates of not less than 5 mm thickness and 100 mm width. Unless otherwise indicated on drawings, all penetrations of grating units shall be made up in split section, accurately fitted, and neatly finished. Grating units shall be provided with all necessary clips, bolts, lock washers etc. for proper assembly and installation on supporting steel members. Maximum deviation in linear dimension shall not exceed 12 mm. 3.10.00 Chequered Plates Minimum thickness of chequered plate floorings, covers etc. shall be 6 mm O/P. Chequered plate shall be accurately cut to the required sizes and shapes and the cut edges properly ground. Stiffeners shall be provided wherever required from design consideration. 3.11.00 Architectural Clearances Bearing plates and stiffener connections shall not be permitted to encroach on the designed architectural clearances. 3.11.00 Shop connections a) All shop connections shall be otherwise riveted or welded as specified on the Drawings. b) Heads of rivets on surfaces carrying brick walls shall be flattened to 10 mm thick projection. c) Certain connections, specified to be shop connections, may be changed to field connections if desired by the Engineer for convenience of erection and the contractor will have to make the desired changes at no extra cost to the exchequer. 3.13.00 Castings Steel castings shall be annealed. 3.14.00 Shop erection The steelwork shall be temporarily shop-erected complete or as directed by the Engineer so that accuracy of fit may be checked before dispatch. The parts shall be shop-erected with a sufficient number of parallel drifts to bring and keep the parts in place. In case of parts drilled or punched using steel jigs to make all similar parts interchangeable, the steelwork shall be shop erected in	



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3.15.00 3.15.01	Shop painting General Unless otherwise specified, steelwork, which will be concealed by interior building finish, need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned, in accordance with the following paragraph, by brush, spray, roller coating, flow-coating or dipping as may be approved by the Engineer. After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing or by other methods of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by the solvent. Steelwork specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt and other foreign material by trough sweeping with a fibre brush. 3.15.02 Inaccessible parts Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint, Positively of different colours to prove application of two coats before assembly. This does not apply to the interior of sealed hollow sections. 3.15.03 Contact surfaces Contact surface shall be cleaned in accordance with sub-clause 3.13.1 before assembly. 3.15.04 Finished surfaces Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection. 3.15.05 Surfaces adjacent to field welds Unless otherwise provided for, surfaces within 50 of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.	

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	not to injure the skin on galvanized surfaces during transport, handling, and erection. Damages, if occur, shall be made good in accordance or as directed by the Engineer. 4.00.00 INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY 4.01.00 Inspection Unless specified otherwise, inspection to all, work shall be made by the or Engineer's representative at the place of manufacture prior to delivery. The Engineer or his representative shall have free access at all reasonable times to those parts of the manufacturer's works which are concerned with the fabrication of the steelwork under this Contract and he shall be afforded all reasonable facilities for satisfying himself that the fabrication is being done in accordance with the provisions of this Specification. The Contractor shall provide free of charge, such labour, materials, electricity, fuel, water, stores, tools and plant, apparatus and instruments as may be required by the Engineer to carry out inspection and/or tests in accordance with the Contract. The Contractor shall guarantee compliance with the provisions of this Specification. 4.02.00 Testing and Acceptance Criteria 4.02.01 General The Contractor shall carry out sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own Cost. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test. 4.02.02 Steel All steel supplied by, the Contractor shall conform, to the relevant Indian Standards. Except otherwise mentioned in the contract, only tested quality steel having mill test reports shall be used. In case unidentified steel materials are permitted to be used by the Engineer, random samples of materials will be taken from each unidentified lot of 50 M.T or less of any particular section for tests to conform to relevant Indian Standards. Cost of all tests shall be born by the contractor. All material shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance.	

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4.02.02	Welding a) The weld surface shall be cleaned with steel wire brush to remove spatter metal, slag etc. and 100% of welds shall be inspected visually for size, length of weldment and external defects. Weld gauges shall be used for checking weld sizes. The surface shall be clean with regular beads and free from slags, cracks, blow-holes etc. b) Non-destructive examination shall be carried out to determine soundness of weldments as follows: i) 10% at random on fillet-joints. ii) 100% on all butt-joints. c) Should the ND tests indicate defects like improper root penetration, extensive blowholes, slag intrusion etc., such welds shall be back gauged, joints prepared again and rewelded. All defects shall be rectified by the Contractor at no extra costs. d) All electrodes shall be procured from approved reputed manufacturers with test certificates. The correct grade and size of electrode, which has not deteriorated in storage, shall be used. The inspection and testing of welding shall be performed in accordance with the provisions of the relevant Indian Standards or other equivalents. For every 50 tones of welded fabrication, the Engineer may ask for 1(one) test-destructive or non-destructive including X -ray, ultrasonic test or similar, the cost of which shall be borne by the Contractor.	
4.02.04	Rivets, bolts, nuts and washers All rivets, bolts, nuts, and washers shall be procured from M/s. Guest Keen William Ltd. or equivalent and shall confirm to the relevant Indian Standards. If desired by the Engineer, representative samples of these materials may have to be tested in an approved laboratory and in accordance with the procedures described in relevant Indian Standards. Cost of all such testing shall have to be borne by the Contractor. In addition to testing the rivets by hammer, 2% (two per cent) of the rivets done shall have to be cut off by chisels to ascertain the fit, quality of material and workmanship. The removal of the cut rivets and re-installing new rivets shall be done by the Contractor at his own cost.	
4.02.05	Shop painting All paints and primers shall be of standard quality and procured from approved	

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	manufacturers and shall conform to the provisions of the relevant Indian Standards. 4.02. 12 Galvanizing All galvanizing shall be uniform and of standard quality when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and 15: 4759 - specification for Hot-Dip Zinc Coatings on Structural Steel & other allied products. 4.03.00 Tolerance The tolerances on the dimensions of individual rolled steel components shall be as specified in IS: 1852 - specification for rolling and Cutting Tolerances for Hot-rolled Steel Products. The tolerances on straightness, length etc. of various fabricated components (such as beams and girders, columns, crane gantry girder etc.) of the steel structures shall be as specified in IS: 721 - Tolerances for Fabrication of Steel Structures. 4.04.00 Acceptance Should any structure or part of a structure be found not to comply with any of the provisions of this specification, the same shall be liable to rejection. No Structure or part of the structure once rejected, shall be offered again for test, except in cases where the Engineer considers the defects rectifiable. The Engineer may, at his discretion, check some of the tests at an appropriate laboratory at the contractors cost. When all tests to be performed in the Contractor's shop under the terms of this contract have been successfully carried out, the steelwork will be accepted forthwith and the Engineer will issue acceptance certificate, upon receipt of which, the items will be shop painted, packed and dispatched. No item to be delivered unless an acceptance certificate for the same has been issued. The satisfactory completion of these tests or the issue of the certificates shall not bind the Owner to accept the work, should it, on further tests before or after erection, be found not in compliance with the Contract. 4.05.00 Delivery of materials 4.05.01 General The Contractor will deliver the fabricated structural steel materials to site with all necessary field connection materials in such sequence as will permit the most efficient and economical performance of the erection work. The Owner may prescribe or control the sequence of delivery of materials, at his own	



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discretion.

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4.05.02	Marking Each separate piece of fabricated steelwork shall be distinctly marked on all surfaces before delivery in accordance with the markings shown on approved erection drawings and shall bear such other marks as will further facilitate identification and erection. 4.05.03 Shipping Shipping shall be strictly in accordance with the sequence stipulated in the agreed Programme. Contractor shall dispatch the materials to the e worksite securely protecting and packing the materials to avoid loss or damage during transport by rail, road or water. All parts shall be adequately braced to prevent damage in transit. Each bundle, bale or package delivered under this contract shall be marked on as many sides as possible and such distinct marking (all previous irrelevant markings being carefully obliterated) shall show the following: a) Name and address of the consignee b) Name and address of the consignor c) Gross weight of the package in tonnes and its dimensions d) Identification marks and/or number of the package e) Custom registration number, if required All markings shall be carried out with such materials as would ensure quick drying and indelibility. Each component or part or piece of material when shipped, shall be indelibly marked and/or tagged with reference to assembly drawings and corresponding piece numbers. Each packing case shall contain in duplicate in English a packing list pasted on to the inside of the cover in a water-proof envelope, quoting especially - a) Name of the Contractor b) Number and date of the Contract c) Name of the office placing the contract d) Nomenclature of stores	

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	e) A schedule of parts or pieces, giving the parts or piece number with reference to assembly drawings and the quantity of each. The shipping dimensions of each packing shall not exceed the maximum dimensions permissible for transport over the Indian Railways/Roads. After delivery of the materials at site, all packing materials shall automatically become the property of the Owner. Notwithstanding anything stated hereinbefore, any loss or damage resulting from inadequate packing shall be made good by the Contractor at no additional cost to the Owner. When facilities exist, all shipments shall be covered by approved Insurance Policy for transit at the cost of the Contractor. The contractor shall ship the complete materials or part on board a vessel belonging to an agency approved by the Owner or on rail and/or road transport as directed. The Contractor shall take all reasonable steps to ensure correct appraisal of freight rates, weights and volumes and in no case will the Owner be liable to pay any warehouse, wharfage, demurrage and other charges. If, however, the Owner has to make payment of any of the above-mentioned charges, the amount paid will be deducted from the bills of the Contractor. Necessary advise regarding the shipment with relevant details shall reach the Engineer at least a week in advance. 5.00.00 INFORMATION TO BE SUBMITTED 5.01.00 With Tender The following information is required to be submitted with the Tender: a) Progress Schedule The Contractor shall quote in his Tender a detailed schedule of progress of work and total time of completion, itemizing the time required for each of the following aspects of work. i) Preparation and approval of fabrication drawing ii) Procurement of Materials iii) Fabrication and shipping of all anchor bolts iv) Fabrication and shipping of main steelwork.	

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	v) Fabrication and shipping of steelwork for bunkers, tanks and/or silos as applicable. vi) Fabrication and shipping of all other remaining steelwork including miscellaneous steelwork. vii) Final date of completion of all shipments. b) Shop Location of the Tenderer's fabrication workshop giving details of equipment, manpower, the total capacity, and the capacity that will be available exclusively for this contract shall be submitted. 5.02.00 After Award After award of the Contract the successful Tenderer is to submit the following: a) Complete fabrication drawings, material lists, cutting lists, rive and bolt lists, field welding schedules based on the approved design drawings prepared by him in accordance with the approved schedule. b) Monthly Progress Report with necessary photographs in six (6) copies to reach the Engineer on or before the 7th day o. each month, giving the up-to-date status of preparation of detailed shop drawings, bill of materials, procurement of materials, actual fabrication done, shipping and all other relevant information. c) Detailed monthly material reconciliation statements relevant to the Work done and reported in the Progress Report, giving the stock at hand of raw steel, work in progress, finished materials. d) Results of any test as and when conducted and as require by the engineer. e) Manufacturer's mill test report in respect of steel materials, rivets, bolts, nuts, and electrodes as may be applicable. 6.00.00 RATES AND MEASUREMENT 6.01.00 Rates 6.01.01 The items of work in the Schedule of items describe the work in brief. The various items of the Schedule of items shall be read in conjunction with these specifications including amendments and additions, general conditions of	

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	contract, special conditions of contracts, and other tender documents, if any. For each item of Schedule of Items, the bidder's rates shall include the activities covered in the description of the item as well as all necessary operations described in the Specifications. 6.01.02 The bidder's rates shall include cost of all minor details which are obviously and fairly intended and which may not have been included in the description in these documents but are essential for the satisfactory completion of the work. Rates shall also include for taking all safety measures. 6.01.03 The bidder's -rates for all items of schedule of items shall include complete cost towards plant, equipment, erection and dismantling of scaffolding, men, materials and consumables, skilled and unskilled labour, levies, taxes, royalties, duties, transport, storage, repair/rectification/maintenance until handing over, contingencies, overhead and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work. 6.01.04 No claims shall be entertained, if the details shown on the 'Released for Construction' drawings differ from those shown on the bid/tender drawings. 6.01.05 Rates shall be inclusive of all leads and lifts/elevation. 6.01.06 The bidder's rates for Structural Steel shall include for fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, erection scheme, alignment, welding, including preheating and post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus/waste steel materials including cut pieces/waste steel, provision of additional butt/weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work. The rates for fabrication are inclusive of all tests on welds and material and no extra shall be payable for quality tests specified for fabrication of structure in shop or at site. Separate BOQ items for test on welds like radiography or Ultrasonic, DPT, magnetic particle tests are kept for tests on material/fabrication not covered under regular fabrication item of BOQ. 6.01.07 The bidder's rates for foundation bolts assembly shall include fabrication, threading, heat treatment, erection, installation, and alignment of complete bolt	

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	assembly with nuts, locknuts, anchor plates, stiffener plates, protective tape, etc. This shall also include the cost of all materials not issued by the Owner. Material issued by Owner will be specified in GCC. 6.01.08 The bidders rates for application of inorganic primer shall include surface preparation to near white metal surface by blast cleaning, abrasives, touch up painting, suitable enclosure to avoid contamination and the necessary statutory approval from the factory inspector/pollution control board etc. regarding the method of blast cleaning and abrasives used, and getting approval of the specialized agency supplying the primer specified. 6.01.09 The bidder's rates for application of finish painting system shall include surface preparation, application of intermediate (under) coat, finish coat and final finish coat, and getting approval of the specialized agency supplying the finish paint. 6.01.10 The bidder's rates for electro-forged gratings (if specified) shall include supply, fabrication, transportation to the site, erection and alignment of factory made electro-forged gratings, all taxes, duties thereon etc. The rates shall also include preparation of grating design for different spans and load intensifies, preparation of design and fabrication drawings, edge preparation, blast cleaning followed by finish paint. 6.01.11 The bidder's rates for galvanization of factory made electro-forged gratings (if specified) shall include the application of hot dipped galvanization as finish over the fabricated gratings and the treatment to be given for prevention of white storage stains, as per the technical Aspiration. 6.01.12 The bidder's rates for permanent mild steel bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types of Structural Steel works, as per the technical specification. 6.01.13 The bidder's rates for high strength structural bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types, of Structural Steel works, as per the technical specification. 6.01.14 The bidder's rates for dismantling, additions to, alterations in and/or modifications shall be inclusive of all operations such as lowering of material, carriage etc., as mentioned in the technical specification. Unutilised steel pieces cut/removed shall be returned to the project stores free of charge. Non-return of unutilized steel pieces to the Owner's store would be considered as wastage and recovery would be affected as per the provision of contract for structural steel consumption. This shall not include the weight of temporarily dismantled/supported members, connected member. The bidder should prepare an optimised cutting plan as per fabrication	

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	drawing to utilise the steel material upto maximum extent and minimise the wastage/scrap. Quantity of wastage/scrap of material should be limited to the percentage mentioned elsewhere in the conditions of tender/contract specifications. 6.01.15 The bidder's rates for re-erection of erection marks after additions to, alterations in and/or modifications shall be inclusive of all operations mentioned in technical specification for the calculated weight of the rectified/modified erection mark rejected at site. This shall not include the weight of temporarily dismantled/supported members, connected member. All the operations mentioned above for restoring such members shall be carried out at no extra cost. The work of erection of any erection mark which has not been dismantled but have been modified/rectified before erection shall not be paid under this item but shall be paid under relevant item of fabrication and erection of steel work of Schedule of items for the modified weight. 6.01.16 The bidder's rates for PTFE shall include design, supply, transportation of the complete assembly with guides and dust protection cover and installation of bearings in position drilling, bolting, erecting aligning etc. along with any taxes, duties thereon etc. 6.01.17 The bidder's rates for Stainless Steel hopper (if specified) shall include fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, all other operations mentioned in the technical specification. The rates shall also include for erection scheme, alignment, making cutting plan, cutting, jointing, bending, rolling, grinding, drilling, bolting, assembly, edge preparation, welding including pre-heating, post-heating, testing of welders, inspection of welds, inspection and testing, protection against damage in transit, stability of structures, installation of temporary structures etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus / waste steel materials including cut pieces/waste steel, provision of additional butt / weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work. 6.01.18 The bidders rates for preformed flexible open ended bellow strap of neoprene (if specified) shall include supply and transportation, installation in position, drilling, bolting, aligning etc. complete along with any taxes, duties thereon etc. 6.01.19 The bidder's rates for Stainless Steel Hand Rail (if specified) shall include complete Hand Rail including, materials, fabrication, grinding & finishing, stainless steel beading, stainless steel cleats, stainless steel fasteners, neoprene gaskets, preparation of shop drawing but excluding the cost of glazing. The Owner shall supply no material for this item of work.	

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	6.02.00 MODE OF MEASUREMENT 6.02.01 The measurement for the item of foundation bolts assembly including that of nuts; locknuts shall be based on the calculated weight of steel installed in Metric Tonne, corrected to second place of decimal. The weight of the foundation bolt shall be calculated in the same way as that done for the item of fabrication, erection, alignment of structural steel. The weight of the nut / locknut shall be taken as per actual weight supplied by the contractor and accepted by the Engineer. 6.02.02 The measurement for the item of fabrication, erection, alignment, welding, etc. of structural steel work shall be based on the approved weight of steel nearest to a Kg, by applying the unit weight as adopted at the time of issue of structural steel on the measurements worked out as given below. 6.02.03 For ISMB, ISMC, ISA, flats, round bars, square bars and pipes, length shall be taken as per distance between planes normal to the axis of the member passing through the extreme points of the section. 6.02.04 Gussets plates in trusses, and bracings, brackets plates, stiffeners, and skew cuts if any in plates for butt welds, the area shall be assumed as the minimum circumscribed rectangle. However deduction for any notch/skew cut shall be made as mentioned in clause no-6.02.06. 6.02.05 For bunker wall plates, the minimum-circumscribing rectangle of the individual plate/pieces out of which these wall plates are assembled by butt-welding, shall be measured. Care shall be taken to ensure maximum utilization of cut-pieces generated by providing extra butt joints (for which no extra payment shall be made). 6.02.06 For all other plates, where the area of any notch/skew cut in the plate is less than 0.05 sq.m. the area of the plate shall be assumed as that of the minimum circumscribing rectangle for the purpose of measurement and calculation of area for the purpose of payment. However, if the area of any notch/skew cuts in a plate is more than 0.05 sq.m, the area of notch/skew cut shall be deducted from assumed minimum circumscribing rectangular area for the purpose of payment. 6.02.07 No deduction shall be made for the hole in the members, if the area of individual hole is less than 0.05 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.05 sq.m. 6.02.08 All cut-pieces and scrap generated due to cutting of holes, skew-cuts of plates, gussets, brackets, stiffeners, etc. shall be stacked separately and handed over to the project stores without being considered for material accounting as the	



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**SECTION - D
(PART I)**

SUB-SECTION – D 18

ERECTION OF STRUCTURAL STEELWORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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SUB-SECTION – D 18 ERECTION OF STRUCTURAL STEELWORK 1.00.00 SCOPE This specification covers the erection of structural steelwork including receiving and taking delivery of fabricated structural steel materials arriving at site, installing the same in position, painting and grouting the stanchion bases all complete as per Drawings, this Specification and other provision of the Contract. 2.00.00 GENERAL 2.01.00 Work to be provided for by the Contractor, unless otherwise specified in the Contract, shall include but not be limited to the following: a) The Contractor shall provide all construction and transport equipment, tools, tackle, consumables, materials, labour, and supervision required for erection of the structural steelwork. b) Receiving, unloading, checking, and moving to storage yard at Site including prompt attendance to all insurance matters as necessary for all fabricated steel materials arriving at Site. The Contractor shall pay all demurrage and/or wharfage charges etc. on account of default on his part. c) Transportation of all fabricated structural steel materials from Site storage yard, handling, rigging, assembling, riveting, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location according to approved erection drawings and/or as directed by the Engineer. If necessary suitable temporary approach roads to be built for transportation of fabricated steel structures. d) Checking center lines, levels of all foundation blocks including checking line, level, position and plumb of all bolts and pockets. Any defect observed in the foundation shall be rectified with Engineer's approval. The Contractor shall fully satisfy himself regarding the correctness of the foundations before installing the fabricated steel structures on the foundation blocks. e) Aligning, plumbing, leveling, riveting, bolting, welding and securely fixing the fabricated steel structures including floor gratings, chequered plates etc. in accordance with the Drawings or as directed by the Engineer. f) Painting of the erected steel structures.		

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	g) All minor modifications of the fabricated steel structures as directed by the Engineer including but not limited to the following: i) Removal of bends, kinks, twists etc. for parts damaged during transport and handling. ii) Cutting, chipping, filling, grinding, etc. if required for preparation and finishing of site connections. iii) Reaming of holes for use of higher size rivet or bolt if required. iv) Refabrication of parts damaged beyond repair during transport and handling or refabrication of parts, which are incorrectly fabricated. v) Fabrication of parts omitted during fabrication by error, or subsequently found necessary. vi) Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication. vii) Carry out tests in accordance with this specification. 2.02.00 Work by Others No work under this Specification will be provided for by any agency other than the Contractor unless specifically mentioned elsewhere in the contract. 2.03.00 Codes and Standards All work under this Specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specification and codes of Practice of equivalent: IS: 800 - Code of practice for general construction in steel. IS: 456 - Code of practice for main or reinforced concrete. 2.04.00 Conformity with Designs The Contractor will erect the entire fabricated steel structure, align all the members, complete all field connections and grout the foundations all as per the provisions of this specification and the sequence and the design criteria laid down by the Engineer. All work shall conform to the provisions of this specification and /or instructions of the engineer. The testing and acceptance of the erected structures shall be in accordance with the provisions of this Specifications and/or the instructions o the Engineer.	

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2.05.00	Material	
2.05.01	General All fabricated steel structures and connection materials shall be supplied by the Contractor to the site. The Contractor shall take delivery from railway wagons or trucks at site, and unload the materials and perform all formalities like checking of materials and attend to insurance matters in accordance with Sub-Clause 2.01.00 and as specified hereinbefore.	
2.05.02	Materials to conform to Indian standards All materials required to be supplied by the Contractor under this contract shall conform to the relevant Indian Standard specifications.	
2.06.00	Storage of Materials	
2.06.01	General All material shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for use in the works. Any material which has been deteriorated or damaged beyond repairs and has become unfit for use shall be removed immediately from the site, failing which, the engineer shall be at liberty to get the materials removed by agency and the cost incurred thereof shall be realised from the Contractor's dues.	
2.06.02	Yard The Contractor will have to establish a suitable yard in an approved location at site for storing the fabricated steel structures and other raw steel materials such as structural sections and plates as required. The yard shall have facilities like drainage, lighting, and suitable access for large cranes, trailers, and other heavy equipments. The yard shall be fenced all around with security arrangement and shall be of sufficiently large area to permit systematic storage of the fabricated steel structures without overcrowding and with suitable access for cranes, trailers and other equipment for use in erection work in proper sequence in accordance with the approved Programme of work. The Tenderer must visit the site prior to submission of his tender to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc. all of which shall be carried out by the Contractor at his own cost as directed by the Engineer.	

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2.06.03

Covered Store

All field connection materials, paints, cement etc. shall be stored on well designed racks and platforms off the ground in a properly covered store building to be built at the cost of the Contractor.

2.07.00

Quality Control

The contractor shall establish and maintain quality control procedures for different items of work and materials as may be directed by the Engineer to assure compliance with the provisions of the Contract and shall submit the records of the same to the Engineer. The quality control operation shall include but not be limited to the Following items of work :

- i) Erection: Lines, levels, grades, plumbs, joint characteristics including tightness of bolts.
- ii) Grouting: Cleaning and roughness of foundation, quality of materials used for grouting, admixtures, consistency, and strength of grout.
- iii) Painting: Preparation of surface for painting, quality of primers and paints, thinners, application and uniformity of coats.

2.08.00

Taking Delivery

The Contractor shall take delivery of fabricated structural steel and necessary connection materials from railhead/trucks as may be necessary and as directed by the Engineer. He shall check, unload; transport the materials to his stores for proper storing at his own cost. The Contractor shall submit claims to insurance or other authorities and pursue the same in case of loss or damage during transit and handling and all loss thereof shall be borne by him.

The Contractor shall also take all precautions against damage of the materials in his custody after taking delivery and till the same are erected in place and accepted. The Contractor shall salvage, collect, and deliver all the packing materials to the Owner free of charge.

3.00.00

WORKMANSHIP

3.01.00

Erection

3.01.01

Plant and Equipment

The suitability and adequacy of all erection tools and plant and equipment proposed to be used shall be thoroughly verified. They shall be efficient, dependable, in good working condition and shall have the approval of the

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3.01.02 Method and sequence of erection

The method and sequence of erection shall have the prior approval of the Engineer. The Contractor shall arrange for most economical method and sequence available to him consistent with the drawings and specifications and other relevant stipulations of the contract.

3.01.03 Temporary Bracing

Unless adequate bracing is included as a part of the permanent framing, the erector during erection shall install, free of cost to the Owner, temporary guys and bracings where needed to secure the framing against loads such as wind or seismic forces comparable in intensity to that for which the structure has been designed, acting upon exposed framing as well as loads due to erection equipment and erection operations.

If additional temporary guys are required to resist wind or seismic forces acting upon components of the finished structure installed by others during the course of the erection of the steel framing, arrangement for their installation by the erector shall be made free of cost to the Owner.

The requirement of temporary bracings and guys shall cease when the structural steel is once located, plumbed, levelled, aligned, and grouted within the tolerances permitted under the specification and guyed and braced to the satisfaction of the Engineer.

The temporary guys, braces, false work, and cribbing shall not be the property of the Owner and they may be removed immediately upon completion of the steel erection.

3.01.04 Temporary Floors for Buildings

It shall be the responsibility of the Contractor to provide free of cost planking and to cover such floors during the work in progress as may be required by any Act of Parliament and/or bylaws of state, Municipal or other local authorities.

3.01.05 Setting Out

Positioning and levelling of all steelwork, plumbing of stanchions and placing of every part of the structure with accuracy shall be in accordance with the approved Drawings and to the satisfaction of the Engineer. For heavy columns,



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etc. the Contractor shall set proper screed bars to maintain proper level. No extra payment shall be made for this.

Each tier of column shall be plumbed and maintained in a true vertical position subject to the limits of tolerance under this Specification.

No permanent field connections by riveting, bolting or shall be carried out until proper alignment and plumbing has been attained.

3.01.06

Field Riveting

All rivets shall be heated and driven with pneumatic tools. Hand passing or "throwing" of rivets are desirable. Any other method of conveying hot rivets from the furnace to the driving point must be approved by the engineer. No-cold rivets shall be driven. All other requirements of riveting including quality and acceptance criteria shall be in accordance with the relevant portions of the Specification for Fabrication of Structural Steelwork of the Project.

3.01.07

Field Bolting

All relevant Portions in respect of bolted construction of the Specification for Fabrication of Structural Steelwork applicable to the Project shall also be applicable for field bolting in addition to the following:

Bolts shall be inserted in such a way so that they may remain in position under gravity even before fixing the nut. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces, including those adjacent to the washers shall be free of scales except tight mill scales. They shall be free of dirt, loose scales, burns, and other, defects that would prevent solid seating of the parts. Contact surfaces within friction type joints shall be free of oil, paint, lacquer, or galvanizing.

All high tensile bolts shall be tightened to provide, when all fasteners in the joint are tight, the required minimum bolt tension by any of the following methods.

a) Turn-of-nut Method

When the turn-of-nut method is used to provide the bolt tension, there shall first be enough bolts brought to a "snug tight" condition to ensure that the parts of the Joint are brought into good contact with each other. 'Snug tight' is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in any remaining



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holes in the connection and brought to snug tightness. All bolts in the joint shall then be tightened additionally by the applicable amount of nut rotation specified in Table-I with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation there shall be no rotation of the part not turned by the wrench.

TABLE-I

Bolts length not exceeding 8 times dia or 200 mm	Bolt length exceeding 8 times dia or 200 mm	Remarks
1/2 turn	2/3 turn	Nut rotation is relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation-30° over or under.

Bolts may be installed without hardened washers when tightening is done by the turn -of-nut -method. However, normal washers shall be used.

Bolts tightened by the turn-of-nut method may have the outer face of the match-marked with the protruding bolt point before final tightening, thus affording the inspector visual means of noting the actual nut rotation. Such marks can be made by the wrench operator by suitable means after the bolts have been brought up snug tight.

b) Torque Wrench Tightening

When torque wrenches are used to provide the bolt tensions, the bolts shall be tightened to the torques specified in TABLE-II (See Note below the Table). Nuts shall be in tightening motion when torque is measured. When using torque wrenches to install several bolts in a single joint, the wrench shall be returned to touch up bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the required tension.

TABLE-II

Nominal Bolt Diameter (mm) (Kg.M) of IS:1367	Torque to be applied for bolt class 8.8
20	59.94



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81.63

24

103.73

Note: The above torque values are approximate for providing tensions of 14.7 T for 20 mm dia.; and 21.2 T for 24 mm dia. bolts under moderately lubricated condition. The torque wrench shall be calibrated at least once daily to find out the actual torque required to produce the above required tension in the bolt by placing it in a tension indicating device. These torques shall be applied for tightening the bolts on that day with the particular wrench.

In either of the above two methods, if required, for bolt entering and wrench operation clearances, tightening may be done by turning the bolt while the nut is prevented from rotating.

Impact wrenches if used shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds. Holes for turned bolts to be inserted in the field shall be reamed in the field. All drilling and reaming for turned bolts shall be done only after the parts to be connected are assembled. Tolerances applicable in the fit of the bolts shall be in accordance with relevant Indian Standard Specifications. All other requirements regarding assembly and bolt tightening shall be in accordance with this sub clause.

3.01.08

Field Welding

All field assembly and welding shall be carried out in accordance with the requirements of the specification for fabrication work applicable to the project, excepting such provisions therein which manifestly apply to shop conditions only. Where the fabricated structural steel members have been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints.

3.01.09

Holes, Cutting and Fitting

No cutting of sections, flanges, webs, cleats, rivets, bolts, welds etc. shall be done unless specifically approved and /or instructed by the Engineer.

The erector shall not cut, drill, or otherwise alter the work of other trades, unless such work is clearly specified in the Contract or directed by the Engineer. Wherever such work is obtain specified the Contractor shall obtain complete information as to size, location and number of alterations prior to carrying out any work. The Contractor shall not be entitled for any payment on account of any such work.



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3.02.00

Drifting

Correction of minor misfits and reasonable amount of reaming and cutting of excess stock from rivets will be considered as permissible. For this, light drifting may be used to draw holes together and drills shall be used to enlarge holes as necessary to make connections. Reaming, that weakens the member or makes it impossible to fill the holes properly or to adjust accurately after reaming, shall not be allowed.

Any error in shop work which prevents the proper assembling and fitting of parts by moderate use of drift pins and reamers shall immediately be called to the attention of the Engineer and approval of the method of correction obtained. The use of gas cutting torches at erection site is prohibited.

3.03.00

Grouting of stanchion bases and bearings of beams and girders on stone, brick or concrete (Plain or reinforced)

Grouting shall be carried out with Ordinary Cement grout as described below:

The mix shall be one (1) part cement and one (1) part sand and just enough water to make it workable. The positions to be grouted shall be cleaned thoroughly with compressed air jet and wetted with water and any accumulated water shall be removed. These shall be placed under expert supervision, taking care to avoid air locks. Edges shall be finished properly. If the thickness of grout is 25 mm or more, two (2) parts of 6 mm down graded stone chips may be added to the above noted cement-sand grout mix, if required, by the Engineer or shown on the drawings.

No grouting shall be carried out until a sufficient number of bottom lengths of stanchions have been properly lined, leveled, and plumbed and sufficient floor beams are tied in position.

Whatever method of grouting is employed, the operation shall not be carried out until the steelwork has been finally levelled and plumbed, the stanchion bases being supported meanwhile by steel wedges, and immediately before grouting, the space under steel shall be thoroughly cleaned.

If required by the Engineer, certain admixtures like aluminium powder, “ironite” or equivalent, may be required to be added to the grout to enhance certain desirable properties of the grout. Approved non-shrink pre-mixed grout having required flowability and compressive strength may also be used with Engineer's approval.

3.04.00

Painting after Erection

Field painting shall only be done after the structure is erected, levelled,



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plumbed, aligned and grouted in its final position, tested and accepted by the Engineer. Normally, final painting shall be done only after the floor slabs are concreted and masonry walls are built. However, touch up painting, making good any damaged shop painting and completing any unfinished portion of the shop coat shall be carried out by the Contractor free of cost to the Owner. The materials and specification for such painting in the field shall be in accordance with the requirements of the specification for fabrication of structural steelwork applicable for the project.

Painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surfaces to be painted. Before painting of steel, which is delivered unpainted, is commenced, all surfaces to be painted shall be dried and thoroughly cleaned from all loose scale and rust.

All field rivets, bolts, welds, and abrasions to the shop coat shall be spot painted with the same paint used for the shop coat. Where specified, surfaces, which will be in contact after site assembling, shall receive a coat of paint (in addition to the shop coat, if any) and shall be brought together while the paint is still wet.

Surface, which will be inaccessible after field assembly shall receive the full, specified protective treatment before Bolts and fabricated steel members who are galvanized or otherwise treated and steel members to be encased shall not be painted.

The final painting shall be of tow coats of Synthetics Enamel painting or Aluminium paint of approved manufacture as per the approved “Schedule of Painting”. The shades shall also be as per the approved schedule. Synthetic enamel paint shall conform to IS: 2932.

3.05.00 Final cleaning up

Upon completion of erection and before final acceptance of the work by the Engineer, the contractor shall remove free of cost all false work, rubbish and all Temporary Works resulting in connection with the performance of his work.

4.00.00 TESTING AND ACCEPTANCE CRITERIA

4.01.00 General

Loading tests shall be carried out on erected structures, if required by the Engineer, to check adequacy of fabrication and/or erection. Any structure or a part thereof found to be unsuitable for acceptance as a result of the test shall have to be dismantled and replaced with suitable member as per the Contract and no payment towards the cost of the dismantled portion and any connected



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work shall be made to the contractor. In course of dismantling, if any damage is done to any other parts of the structure or to any fixtures, the same shall be made good free of cost by the Contractor, to the satisfaction of the Engineer. The Cost of the tests specified hereinafter shall be borne by the Owner; but if the structure fails to pass the tests, the cost of the tests shall be recovered from the Contractor. Any extra claim due to loss of time, idle labour, etc. arising out of these testing operations shall not be entertained, however, only reasonable and appropriate time extensions will be allowed.

The structure or structural member under consideration shall be loaded with its actual dead load for as long a time as possible before testing and the tests shall be conducted as indicated in the following sub-clauses 4.01.01, 4.01.02 and 4.01.03. The method of testing and application of loading shall be as approved by the Engineer.

4.01.01 Stiffness Test

In this test, the structure or member shall be subjected, addition to its actual dead load, to a test load equal to 1.5 times the specified superimposed load, and this loading shall be maintained for 24 hours. The maximum deflection attained during the test shall be within the permissible limit. If, after removal of the test load, the member or structure does not show a recovery of at least 80 per cent of the maximum strain or deflection shown during 24 hours under load, the test shall be repeated. The structure or member shall be considered to have sufficient stiffness, provided that the recovery after this second test is not less than 90 per cent of the maximum increase in strain or deflection recorded during the second test.

4.01.02 Strength Test

The structure or structural member under consideration shall be subjected, in addition to its actual dead load, to a test load equal to the sum of the dead load and twice the specified superimposed load, and this load shall be maintained for 24 hours.

In the case of wind load, a load corresponding to twice the specified wind load shall be applied and maintained for 24 hours, either with or without the vertical test load for more severe condition in the member under consideration or the structure as a whole. Complete tests under both conditions may be necessary to verify the strength of the structure. The structure shall be deemed to have adequate strength if, during the test, no part fails and if on the removal of the test load, the structure shows a recovery of at least 20 per cent of the maximum deflection or strain recorded during the 24 hours under load.

4.01.03 Structure of same design



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Where several structures are built to the same design and it is considered unnecessary to test all of them, one structure, as a prototype, shall be fully tested, as described in previous Sub-clauses, but in addition, during the first application of the test load, particular note shall be taken of the strain or deflection when the test load 1.5 times the specified superimposed load has been maintained for 24 hours. This information is required as a basis of comparison in any check test carried out on samples of the structure.

When a structure of the same type is selected for a check test, it shall be subjected, in addition to its actual dead load, to a superimposed test load, equal to 1.5 time the specified live load, in a manner and to an extent prescribed by the Engineer. This load shall be maintained for 24 hours, during which time, the maximum deflection shall be recorded. The check test shall be considered satisfactory, provided that the maximum strain or deflection recorded in the check test does not exceed by more than 20% of the maximum strain or deflection recorded at similar load in the test on the prototype.

4.01.04

Repair for subsequent test and use after strength tests

An actual structure which has passed the "Strength Test" as specified in Sub-clause 4.1.2 hereinbefore and is subsequently to be erected for use, shall be considered satisfactory for use after it has been strengthened by replacing any distorted members and has subsequently satisfied the 'Stiffness Test' as specified in Sub-clause 4.01.01 hereinbefore.

4.02.00

Tolerances

Some variation is to be expected in the finished dimensions of structural steel frames. Unless otherwise specified, such variations are deemed to be within the limits of good practice when they are not in excess of the cumulative effect of detailed erection clearances, fabricating tolerances for the finished parts and the rolling tolerances for the profile dimensions permitted under the Specifications for fabrication of structural steel work applicable to this Project and as specified below: The specified tolerance is mainly for welded erection. In case of bolted erection, no tolerance is desired so that all prefabricated bolt holes are matched on erection.

I. For Buildings Containing Cranes

Component	Description	Variation Allowed
1.	2.	3.
Main columns	a) shifting of column axis	

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	at foundation level with respect to building line i) In longitudinal direction ii) In lateral direction b) Deviation of both major column axis from vertical between foundation and other member connection levels: i) For a column upto and including 10M height ii) For a column greater than 10M but less than 40M height c) For adjacent pairs of columns across the width of the building prior to placing of truss d) For any individual column deviation of any bearing or resting level from levels shown on drawings. e) For adjacent pairs of columns either across the width of building or longitudinally level difference allowed between bearing or seating Trusses least. Trusses	i) ± 3.0 mm ii) ± 3.0 mm i) ± 3.5 mm from true vertical ii) ± 3.5 mm from true vertical for any 10 M length measured between connection levels, but not more than ± 7 mm per 30m length. ± 9.0 mm on true span. ± 3.0 mm 3.0 mm 1/1500 of the span or greater than 10mm whichever is the 1/250 of depth of truss or 20 mm

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	span from vertical plane running through center of supports. Crane Cirders a) Difference in levels of crane rail measured between adjacent columns. b) Deviation to crane rail-gauge c) Relative shifting of ends of adjacent crane rail in plan and elevation after thermite welding. d) Deviation of crane rail axis from centre line of web. Setting of Expansion gaps	which ever is the - least. 2.0 mm. ± 3.0 mm 1.0 mm. ± 3.5 mm At the time of setting of the expansion gaps, due regard shall be taken of the ambient temperature above or below 30°C. The coefficient of expansion or contraction shall be taken as 0.000012 per °C per unit length.
	iv) For Building without Cranes	
	The maximum tolerances for line and level of the steel work shall be ±3.0 mm on any part of the structure. The structure shall not be Out of Plumb more than 3.5 mm on each lox section of height and not more than 7.0 mm per 30 m section.	
	These tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes state otherwise.	
4.03.00	Acceptance	
	Structures and members have passed the tests and conform to all requirements specified in the foregoing Sub-clause 4.01.00, 4.01.01, 4.01.02, 4.01.03 and 4.01.04 and other applicable provisions of this specification and are within the limits of tolerances specified in Sub-clause 4.02.00 and/or otherwise approved by the Engineer shall be treated as approved and accepted for the purpose of fulfillment of the provisions of this contract.	

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5.00.00	INFORMATION TO BE SUBMITTED	
5.01.00	Before Tender	
5.01.01	Tentative Programme	
	The Tenderer shall submit a tentative programme based on the information available in the Tender Document and visit to site indicating the structure-wise erection schedule proposed to be maintained by the Contractor to complete the job in time in accordance with the Contract.	
5.01.02	Constructional Plant and Equipment, Tools, Temporary works & manpower	
	A detailed list Of all constructional plant and equipment like cranes, derricks, winches, welding sets, erection tools etc. along with their make, model, present condition and location available with the Tenderer which he will be able to employ on the job to maintain the progress of work in accordance with the Contract shall be submitted along with the Tender. The total number of each category of experienced personnel like fitters, welders, riggers etc. that he will be able to employ on the job shall also be indicated.	
5.01.03	Erection Yard	
	A site plan showing the layout and location of the erection yard proposed to be established by the tenderer shall also be attached with the tender indicating the storage space for fabricated steel materials, site-fabrication and repair shop, covered stores, offices, locations of erection equipments and other facilities. The Engineer shall have the right to modify the arrangement and location of the proposed yard to suit site conditions and the Contractor shall comply with the same without any claim whatsoever.	
5.02.00	After award of the Contract	
	After award of the contract, the Contractor shall submit the following:	
5.02.01	Detailed Programme	
	The Contractor shall submit a detailed erection programme within a month of the award of the Contract for completion of the work in time in accordance with the Contract. This will show the target programme, with details of erection proposed to be carried out in each fortnight, details of major equipment required, and an assessment of required strength of various categories of workers in a proforma approved by the Engineer.	
5.02.02	Fortnightly Progress Report	

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The Contractor shall submit fortnightly progress reports in triplicate to the Engineer showing along with necessary photographs, 125 mm x 90 mm size, and all details of actual achievements against the target programme specified in Sub-clause 5.02.01 above. Any shortfall in the achievement in a particular fortnight must be made up within the next fortnight. Along with this report, the Contractor shall also furnish details of fabricated materials in hand at site and the strength of his workers.



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Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
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ROOF DECKING

1.00.00 Scope

This section of the specification covers the supply, fabrication and erection of profiled light gauge Metal Decks (coated and painted) as roof decking to the main plant building and any other area as indicated in the drawings.

2.00.00 Material

2.01.01 Roof of main plant TG and Deareator bay and bunker building consists of permanently colour coated (on exposed face) galvanized MS trough metal sheet decking plate of approved colour over roof purlins for cast-in-situ roof slab as per IS: 14246 and conform to class 3. Thickness of deck plate shall be minimum 0.8mm and minimum trough depth of 44 mm and centre to centre of the valley shall be 130mm with minimum yield strength of 250 Mpa. Silicon modified polyester paint shall be used for permanent coating over galvanized surface with minimum rate of galvanization 150 gm/sqm. DFT of permanent colour coating shall be 20 microns. It shall serve as permanent shuttering for cast-in-situ roof slab. It should have adequate strength to support weight of green concrete and imposed load during construction. The thickness of the deck plate shall however be designed suitably according to the spacing of roof purlins.

3.00.00 INSTALLATION

The Contractor shall furnish all labour, equipment and materials as required for the design, fabrication, coating, erection and fixing of the decking over purlins, painting and for the complete performance of the work in accordance with the construction drawings and as described herein.

The description, which follows, gives a general indication of the nature and extent of the work but is not necessarily exhaustive and does not purport to cover all the details/operations which will be necessary in order to carry out the work.

3.01.00 Detailed Design of Roof Decking

The Contractor, in conjunction with the manufacturer, shall be responsible for the detailing of the profiled decking, fittings and fixtures and shall submit with his tender particulars of the proposed manufacturer and of the particular product proposed for use. The detailing is to be based on typical details furnished by the Engineer. The Contractor shall submit to the Engineer, two copies of the general arrangement and detailed working drawings for the proposed design, together with all calculations necessary to verify the adequacy and completeness of the design & detailing of decking sheets,

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	fixtures, flashings and trims. After approval he shall supply further eight copies. The Engineer will verify the correct interpretation of his requirements but may not necessarily check the design and details, and the Contractor shall be entirely responsible for the accuracy of the drawings and the correctness of the design and the suitability of the details. Manufacture of roof decking sheets shall not commence until the necessary approval of the Engineer has been obtained. 3.02.00 Erection & Fixing 3.02.01 Sequence of Manufacture/Erection Cutting Schedules, delivery to site and stacking arrangements in store shall ensure that sheets are erected in a sequence which follows that for the manufacture. The decking sheets shall be erected using an arrangement of sheets and joints to conform with the requirements of this specification. Decking erection for each elevation or feature shall commence at one end only and proceed towards the other end, in order to ensure tight fitting laps. 3.02.02 Position and Location of Laps Side and end laps of roof decking sheets shall be located and positioned in such a manner as to provide the maximum weather protection taking into account the direction of the prevailing wind. The lines formed by horizontal laps and fixing shall where possible, be continuous and coincide with the edges of large openings in the roof. 3.02.03 Alignment of Sheets and Fixings All roof decking sheets shall be fixed plumb and level with all fixings evenly spaced and accurately lined. All dirt and grease shall be removed from the surfaces of the sheets as the work proceeds. 3.02.04 Site Cutting Approval must be obtained before the roof decking sheets are cut at site. Generally cutting of sheets to length will not be permitted, only special cutting and trimming for small openings shall allowed. Where possible, site cut edges shall be concealed at laps. 3.02.05 Damaged Sheets Distorted, blemished or water stained sheets and any other fittings shall not be used.	

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3.02.06 Laps

End laps and side laps to roof decking sheets shall be sufficiently large to ensure that the decking complies with the weather tightness and other requirements of this specification. The length of each decking sheet shall be adjusted so that the end laps shall bear on the purlins. In no case end laps shall not be less than 150 mm and side laps shall not be less than 53 mm.

3.02.07 End Lap Fixings

End lap fixings shall be located at least 25 mm from the end of each sheet.

3.02.08 Side Lap Fixings

The spacing of side lap fixings shall ensure compliance with this specification regarding tightness. The spacing of these fixing screws shall not exceed 500mm. The fixing shall be located in the bottom flat of the corrugation.

3.02.09 Holes

Holes in MS decking sheets shall be punched. In case holes are drilled holes, it is to be ensured that the holes do not go oversize due to the small thickness of the sheeting. All drilling swarf shall be removed from the surfaces of decking, supporting steel work, purlins etc.

3.02.10 Location and Spacing of Fixings

Fixings shall be accurately located in position in the centre of the corrugations to ensure that the heads of bolts, nuts and washers bear squarely down on the surface of the sheeting and are not located at the edge or on the joints in supporting purlins.

3.02.11 Fixings

The tenderer shall submit with his tender details of the proposed method for securing the roofing sheets to the metal purlins. The roof decking sheets are to be fixed to the roof purlins with hex washer head white zinc plated heat treated carbon steel self drilling / self tapping screws of minimum thread diameter of 5.6mm. These self drilling screws shall be drilled through the roofing sheets and purlins supporting the roofing sheets. These purlins shall be suitably spaced as per the requirement of roofing sheets and the roofing sheets shall not sag more than span/250 for the loads likely to be imposed during concreting and in future. The self-drilling screws are to be spaced at a maximum distance of 390mm centre to centre along the length of the purlins and top chord of truss. The screws are to be located preferably in the valley only and shall be

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	installed in accordance with the manufacturer's recommendations using tools approved by the manufacturer which do not damage the coating of the decking sheets. 3.03.00 Protection during Construction Precautions shall be taken during the erection of the roof decking to ensure that partially erected decking are protected during inclement weather and damage at all times. 3.04.00 Damage Any damage to coating & primer during transportation is to redone with the similar type of coating as per the manufacturer's specification at no extra cost to the Owner. 4.00.00 Acceptance Criteria The installation shall present a neat appearance and shall be checked for water tightness. The following shall be checked : a) Side and end laps b) Absence of damage in the sheeting. c) Conformity of fixings with the approved design. 5.00.00 IS Codes All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed. IS : 513 - Specification for cold rolled carbon steel sheets. IS : 3618 - Specification for phosphate treatment of iron and steel for protection against corrosion. IS : 4431 - Specification for carbon & carbon manganese free cutting steel. IS : 1573 - Electroplated Coatings of zinc on iron and steel.	



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6.00.0 RATES AND MEASUREMENTS

6.01.00 Rates

Rates shall be unit rate for complete item described in the Schedule of Items and shall include all wastage.

6.02.00 Method of Measurement

Roofing shall be measured for net area of the work done. Profiled sheeting (coated & painted) shall be measured in plan area of sheets and not girthed. No deduction shall be made for openings measuring up to 0.1 sq.m. in area. No extra shall be paid for extra labour in cutting and for wastage etc. in making opening and cutting to size.

No payments shall be made for laps.



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TECHNICAL SPECIFICATION FOR FALSE FLOORING

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FALSE FLOORING

1.00.00 General

This section of the specification covers the supply, fabrication and installation of false flooring system having PVC top finish particle board, GI supporting system, painting etc. as per schedule of items in the main plant building and any other area as indicated in the drawings.

The scope of contractor covers supply of all materials, fabrication & installation works required to be carried out for completion of false flooring in the area specified in the drawings.

2.00.00 MATERIAL

2.01.00 Supporting structure

Supporting pedestals shall be made of steel and will be of height as required. Supporting pedestal shall be truly vertical and located at distances to conform with size of floor panels and shall be equipped with locking devices to prevent disturbances of finished elevation. Base of pedestal shall have integral load dispersion plate of size 100x100x8mm to transmit the load evenly to the base floor. Adjustment of pedestal shall be provided by threaded vertical rod of 25mm diameter and elevating nut. The pedestal head shall provide positive interlocking of the steel grid channels supporting system and shall prevent lateral shifting.

The grid channels shall be made of galvanised steel of 40mm x 40mm x 3.15mm thick and shall be placed at 610mm centre to centre both ways to support floor panels in uniform levelled elevations. Nominal height of the false flooring system shall be 600 mm unless otherwise indicated. Pedestal head shall be equipped with conducting grounding pad if so desired by the Engineer

2.02.00 Floor Panels

The floor panels shall be made of fire resistant particle board, phenol formaldehyde bonded. Size of each panel shall be 610mm x 610mm with all panel edges finished to a tolerance of ± 0.2 mm. Floor panel shall have 2mm thick non-static PVC on top, 2mm thick hard PVC strip lipping on four edges and 26 G aluminium sheet fixed with araldite at bottom. Minimum thickness of the panel shall be 35mm, unless otherwise noted. All panels shall be completely interchangeable and easily removable with a suction lift tool. Panels shall be square within a tolerance of ± 0.25 mm on the diagonal. The floor panels shall be cut, wherever required for providing suitable outlets for



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cables and edges shall be lipped with hard PVC sheets.

2.02.01 Strength

Each 610mm x 610 mm floor panel must be capable of withstanding the designed service load. The ultimate strength shall provide a safety factor of 3. The false flooring shall be capable of carrying a axial load of 800 kg and uniform load of 2000 kg/sq.m with maximum deflection of 1/350. If required by the Engineer, the samples shall be accepted only after carrying out load tests. The Engineer may relax the test requirements with concentrated load in case cabinets are not handled with castor fitting arrangement.

One additional pedestal shall be provided under floor stringer along front panel area of each control board for taking possible additional load that may occur from time to time.

2.02.02 Surface finish

All removable panels shall have the top surface finished with 2 mm thick flexible PVC flooring conforming to IS:3462 and shall be fixed to the surface with compatible high-creep resistant adhesive. The PVC floor tile shall be in single piece for each floor panel. Under side of panels shall also be painted with suitable epoxy or oil based paint.

2.02.03 Damaged Floor Panels

Distorted, blemished or stained floor panels shall not be used.

2.03.00 Skirting

Skirting shall be 150 mm high and 2 mm thick, completely matching with false flooring surface finish materials and shall be fixed to the wall surface as per manufacturer's installation instructions.

3.00.00 INSTALLATION

3.01.00 Base

The system shall be placed over a base of RCC floor slab and beams. Any grouting etc. that is necessary to fix the supporting structure shall be done.

The concrete sub floor shall be sealed with two coats of polyurethane paint to prevent moisture from coming in contact with cables and to minimise dust problem.

The floor panels and channels shall be completely interchangeable and remain in position without screwing or bolting under working/imposed loadings.



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Any damage to the sub floor during installation of the false flooring system shall be made good by the contractor without any extra cost to the Owner. All steel surfaces are to be protected by two coats of polyurethane paint over a compatible primer and any damage to the paint during installation shall be made good. In case the loads exerted by the weight of machines are above the stated characteristics of floor finish material, the floor shall be protected by overlaying hard board during installation of machine or equipment.

All installation work of the false flooring system shall be supervised by the manufacturer's authorised representative.

3.03.00 Painting

After fixing the false flooring supporting system the sub floor shall be given a coat of polyurethane paint.

3.04.00 Protection during Construction

All precautions shall be taken during the erection of the false flooring to ensure that partially erected flooring are protected and shall not be damaged before handing over to owner.

3.05.00 Damage

Any damage of coating to supporting system caused during transportation is to be redone with the similar type of coating as per the manufacturer's specification at no extra cost to the Owner.

4.00.00 ACCEPTANCE CRITERIA

The false flooring system shall only be accepted after completion of following checks :

- a. Level
- b. Alignment of joints
- c. Thickness of joints
- d. Surface finish
- e. Colour and texture
- f. Details of edges, junctions etc.
- g. Performance



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h. Criteria specified for strength.

5.00.00

IS CODES

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

IS:5318 Laying of flexible sheet and flooring.

IS:3462 Flexible PVC flooring

IS:3087 Wood particle boards (medium density) for general purposes.

6.00.0

RATES AND MEASUREMENTS

6.01.00

Rates

Rates shall be unit rate for complete item described in the Schedule of Items and shall include, but not limited to, supply & installation of floor panels, supporting systems, paintings etc.

6.02.00

Method of Measurement

False flooring shall be measured in Sq.M for net area of the work done. No deduction shall be made for openings measuring up to 0.4 sq.m. in area. No extra shall be paid for extra labour in cutting and for wastage etc. in making opening and cutting to size.



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BORED CAST-IN-SITU RCC PILES

SPECIFICATION NO. PE-TS-999-600-C021



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



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**TECHNICAL SPECIFICATION FOR INSTALLATION OF BORED
CAST-IN-SITU PILES**

1.00.00 SCOPE

This specification covers the installation of bored cast-in-situ reinforced concrete vertical piles of specified load carrying capacity and diameter for various structures. This specification also covers carrying out initial and routine load tests on piles to assess their vertical, horizontal and pull out load carrying capacities.

2.00.00 GENERAL REQUIREMENTS

2.01.00 This specification along with specific requirements under Annexure-A covers the technical requirements for piling work.

2.02.00 The work shall include supplying and providing necessary materials, mobilization of all necessary equipments (Annexure-B), providing necessary engineering supervision through qualified and technical personnel, skilled and unskilled labour, etc. as required to carryout the complete piling work, and submission of records as per schedule.

2.03.00 The Contractor shall carryout all works as mentioned in Scope above. All works shall be executed to the satisfaction of the Engineer.

2.04.00 Pile capacities in vertical compression, horizontal, pullout loads for various pile diameters are given in Annexure-A.

2.05.00 The Contractor shall confirm and guarantee the "Safe Load" capacities by conducting both initial and working load test on piles as mentioned in the specific requirements.

2.06.00 The Contractor shall submit along with tender documents his tender design of piles based on soil data furnished by the Owner along with this specification. The ultimate load capacity of a pile may be estimated using suitable static formula and the minimum factor of safety shall be 2.5. However, safe load carrying capacity shall be conformed and guaranteed by conducting initial and routine load tests.

2.07.00 In case of initial or routine load test piles, if the Contractor fails to establish the safe load capacity as per his design, the Owner has the right to either derate the pile capacity on prorata basis or insist the Contractor to modify the pile design, to achieve the desired safe load capacity at no extra cost to the Owner.

2.08.00 Derating is acceptable up to 90 percent. In such case, additional piles shall be installed as per the design requirements.

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	2.09.00 The Owner shall decide whether to derate or modify the design based on the design considerations such as providing additional piles in the designed pile cap, provision for extending the pile cap size, etc. 2.10.00 In case the Owner decides to modify the design instead of derating the pile, the contractor shall carry out the same and install separate test piles and test the same to guarantee the safe load at no extra cost to the Owner. However no extra shall be charged for the additional test piles as well as testing of these piles as per agreed contract conditions. 2.11.00 In case of working piles, if the pile does not meet the guaranteed capacity or rejected due to any other reason, the Contractor shall install extra piles at no extra cost to the Owner. Further, the extra cost, due to the increase in the pile cap size if any, on account of extra piles, shall be borne by the Contractor. 2.12.00 It is essential that all equipment and instruments are properly calibrated both at commencement and immediately after the completion of tests so that they represent true values. Certificates to this effect from an approved institution shall be furnished to the Engineer. If the Engineer so desires the Contractor shall arrange for having the instruments tested at an approved laboratory at no extra cost to the Owner and the test report shall be submitted to the Engineer. If the Engineer desires to witness such tests Contractor shall arrange to conduct the test in his presence. 2.13.00 The Contractor shall make his own arrangements for locating the coordinates and position of piles as per drawings supplied to him and for determining the Reduced Levels (RL) of these locations with respect to the benchmark indicated by the Engineer. Two established reference lines in mutually perpendicular direction shall be indicated to the Contractor. The Contractor shall provide at site all the required survey instruments to the satisfaction of the Engineer so that the work can be carried out accurately according to specifications and drawings. 2.14.00 The contractor shall assure the quality of piling work including cleaning of pile bore, quality of concrete, integrity of piles, etc. 2.15.00 AVAILABLE SUB-SOIL DATA An abstract of the sub soil data is furnished in the tender document. However, the detailed soil investigation report shall be made available for reference of the bidder, if so required, at the office of the Owner. The soil data furnished is in good faith and only for the guidance of the Bidder, to arrive at design parameters and construction methods.	



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3.00.00 MATERIALS

3.01.00 General

All materials viz cement, steel, aggregates, water, etc. which are to be used for pile construction shall conform to relevant IS codes for properties, storage and handling of common building materials. However, aggregates more than 20 mm size shall not be used.

3.02.00 CONCRETE

Concrete shall be manufactured either by central batching plant or Ready Mix concrete. However, for initial test piles suitable method as approved by the Engineer may be used. Concrete shall conform to IS: 10262 & IS: 456.

3.02.01 Technical Specification for Cement Concrete (Plain and Reinforced) works along with IS: 2911 Part I/Sec 2 shall be followed for concrete works of piles. Use of plasticiser to control the water cement ratio shall be permitted on specific approval from the Engineer. Water cement ratio shall not be greater than 0.5.

3.02.02 Grade and minimum cement content
Minimum grade of concrete shall be as per Annexure-A conforming to IS: 456. Minimum cement content of 400 Kg/M³ of concrete shall be used for M-20 grade concrete.

3.02.03 Slump of concrete
The slump of concrete shall vary between 150 to 180 mm.

3.03.00 REINFORCEMENT

3.03.01 Longitudinal reinforcement in pile shall be high strength deformed steel bars conforming to IS: 1786 unless specified otherwise. Lateral reinforcement in pile shall be of mild steel conforming to IS: 432 Part-1 or HYSD bars as per IS: 1786.

3.03.02 The longitudinal reinforcement shall be provided considering the combination of vertical (compression and tension) and horizontal loads. However, the minimum longitudinal reinforcement shall be 0.4 percent of the sectional area calculated on the basis of nominal pile diameter. Minimum six numbers of bars shall be provided for longitudinal reinforcement. The diameter of longitudinal reinforcement bars shall not be less than 12mm. The stipulated minimum reinforcement shall be provided for the full length of pile.

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3.03.03	The longitudinal reinforcement shall project 50 times its diameter above cut off level unless otherwise indicated.		
3.03.04	The laterals shall be tied to the longitudinal reinforcement to maintain its shape and spacing. The laterals may in the form of links or spirals. The minimum diameter of the links or spirals shall be 6 mm and the spacing of the links or spiral shall not be less than 150 mm and in no case more than 250 mm.		
3.03.05	Reinforcement cage shall be sufficiently rigid to withstand handling and installation without any deformation and damage. As far as possible number of joints (laps) in longitudinal reinforcement shall be minimum. In case the reinforcement cage is made up of more than one segment, these shall preferably be assembled before lowering into casing tube/pilebore by providing necessary laps as per IS: 456.		
3.03.06	The minimum clear distance between the two adjacent main reinforcement bars shall normally be 100 mm for the full depth of cage.		
3.03.07	The laps in the reinforcement shall be such that the full strength of the bar is effective across the joint and the reinforcement cage is of sound construction.		
3.03.08	Laps shall be staggered as far as practicable and not more than 50% bars shall be lapped at a 'particular section. Lap joints shall be staggered by at least 1.3 times the lapped length (Centre to Centre).		
3.03.09	Proper cover and central placement of the reinforcement cage in the pile bore shall be ensured by use of suitable concrete spacers or rollers, cast specifically for the purpose.		
3.03.10	Minimum clear cover to the longitudinal reinforcement shall be 50 mm, unless otherwise mentioned.		
3.03.11	Bundling of bars is not permitted.		
4.00.00	PILE INSTALLATION Installation of piles shall be carried out as per pile layout drawings, installation criteria, and the direction of the Engineer.		
4.01.00	Equipment and Accessories		
4.01.01	The equipment and accessories for installation of bored cast-in-situ piles shall be selected giving due consideration to the sub soil conditions, ground water conditions and the method of casting, etc. These shall be of standard type and shall have the approval of the Engineer.		

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4.01.02	List and details of equipment and accessories proposed to be used for the job shall be submitted along with the bid.				
4.01.03	The capacity of the rig shall be adequate so as to reach the specified founding level.				
4.01.04	Provision shall be kept for chiselling within the pilebore, as specified elsewhere in this specification. Chiselling shall be carried out only with the approval of Engineer.				
4.02.00	Installation Criteria				
4.02.01	For determining the founding level of piles in soil as specified elsewhere, the Contractor shall have to perform Standard penetration test (SPT) as per IS: 2131 in a separate bore hole. The SPT shall be conducted at 1.0 m interval between the depths covering 5 metres each above and below the specified founding level. The bore shall be 100 mm diameter and method of boring shall conform to IS: 1892.				
4.02.02	For determining founding level of piles in rock, as specified elsewhere socketing horizon shall be established by the Contractor by collecting rock cores of Nx size in a separate borehole, and testing the same for uniaxial compressive strength (UCS). Cores shall be collected by double tube core barrel attached with diamond bit. Coring shall be done upto a depth as indicated in the "specific requirements." Coring in rock shall conform to IS: 6926.				
4.02.03	In case it is not possible to test the cores so obtained for uniaxial compressive strength, cores shall be tested for point load strength index and correlated to obtain uniaxial compressive strength.				
4.02.04	Number of boreholes for carrying out SPT in soil or uniaxial compressive strength in rock, shall vary from one in 100 to 150 piles or pile group of 150 Sqm depending on the site condition and as decided by the Engineer. However, at the location of initial load test piles, one such borehole shall be done.				
4.02.05	A protocol between contractor and BHEL site shall be maintained regarding the strata at founding level. SPT value and UCS from the nearest borehole shall be indicated therein.				
4.02.06	The founding level of the pile shall be decided based on the criteria elaborated in the specific requirements under Annexure-A. Concreting shall not be done until the above conditions for founding level are satisfied.				
4.02.07	Approval of founding level by the Engineer shall in no way absolve the Contractor of his responsibility to guarantee the Safe load capacity of the piles as indicated in this document.				



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4.03.00 Control of position and alignment

4.03.01 Piles shall be installed as accurately vertical as possible. The permissible limits for deviation with respect to position and (inclination) alignment shall conform to IS: 2911 Part I/Sec. 2, which is reproduced below for ready reference.

- a) The maximum deviation of vertical piles shall not exceed 1.5 per cent in alignment.
- b) Piles shall not deviate more than 75 mm or D/4 whichever is less (75mm or D/10 whichever is more in case of piles having diameter more then 750mm) from their designed position at the working level.

4.04.00 Boring

4.04.01 Boring operations shall be done by rotary or percussion type drilling rigs using reverse mud circulation (RMC) method. Rotary hydraulic pulley shall be preferred.

4.04.02 The Contractor shall satisfy himself about the suitability of the method to be adopted for site. If DMC (direct mud circulation) or RMC is used Bentonite slurry shall be pumped through drill rods by means of high-pressure pumps. The cutting tool shall have suitable ports for the bentonite slurry to flow out at high pressure. If on mobilisation, the Contractor fails to make a proper bore for any reason, the Contractor has to switchover to other boring methods as approved by the Engineer at no extra cost to the Owner.

4.04.03 Working level shall be above the cut off level. After the initial boring of about 1.0m a temporary guide casing of suitable length shall be lowered in the pile bore. The diameter of guide casing shall be of such diameter, so as to give the necessary finished diameter of the concrete pile. The centre line of guide casing shall be checked before continuing further boring. Guide casing shall be minimum of 1.0m length. Additional length of casing may be used depending on the condition of the strata, ground water level etc.

4.04.04 Use of drilling mud (bentonite slurry) for stabilizing the sides of the pile bore is necessary wherever subsoil is likely to collapse in the pile bore. Drilling mud to be used shall meet the requirement as given in Annexure-C.

4.04.05 The bentonite slurry and the cuttings, which are carried to the surface by the rising flow of the slurry, shall pass through settling tanks of adequate size to remove the sand and spoils from the slurry before the slurry is recirculated to the

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	boring. The bentonite slurry mixing and recirculation plant shall be suitably designed and installed. 4.04.06 The bentonite slurry shall be maintained at 1.5m above the ground water level during boring operations and till the pile is concreted. When DMC or RMC method is used the bentonite slurry shall be under constant circulation till start of concreting. 4.04.07 The size of cutting tools shall not be less than the diameter of the pile by more than 75mm. However, the pile bore shall be of the specified size. 4.05.00 Chiselling 4.05.01 Chiselling may be resorted to with the permission of the Engineer below the socketing horizon. The chiselling tool or bit shall be of adequate size and weight so as to reach the desired depth. 4.06.00 Cleaning of Pile bore 4.06.01 On completion of the pile bore upto the required depth, the bottom of the hole shall be cleaned very carefully before concreting work is taken up. Cleaning shall ensure that the pile bore is completely free from sludge/bored materials, debris of rock/boulder etc. Necessary checks shall be made as given in clause 5.0 to confirm the thorough cleaning of the pile bore. 4.06.02 Pile bore shall be cleaned by fresh drilling mud through tremie pipe after placing reinforcement and just before start of concreting. 4.06.03 Pile bore spoil along with used drilling mud shall be disposed off from site as directed by the Engineer. 4.06.04 Pile bore bottom shall be thoroughly cleaned to make it free from sludge or any foreign matter before and after placing the reinforcement cage. 4.07.00 Adjacent Structures 4.07.01 When working near existing structures care shall be taken to avoid any damage to such structures. 4.08.00 Concreting 4.08.01 The Contractor shall carry out concrete mix design in accordance with IS: 10262 and submit mix design calculations and get them approved from the Engineer well in advance for installation of piles. Adequate number of tests on cubes, etc. shall be carried out as mentioned in clause 5.0 to ensure concrete of the	

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	minimum specified strength in accordance with IS: 456 at requisite workability (slump). 4.08.02 Concreting shall not be done until the Engineer is satisfied that the bearing strata (soil/rock) met with at the termination level of pile. 4.08.03 The time interval between the completion of boring and placing of concrete shall not exceed 6 hrs. In case the time interval exceeds 6 hrs the pilebore shall be abandoned. However, the Engineer may allow concreting provided the Contractor extends the pile bore by 0.5 m beyond the proposed depth, and clean the pilebore. The entire cost of all operation and materials for this extra length shall be borne by the Contractor. 4.08.04 Proper placement of the reinforcement cage to its full length shall be ensured before concreting. 4.08.05 Concreting shall be done by tremie method as specified by IS: 2911 (Part I /Sec.2). The level of drilling mud shall be maintained sufficiently above the ground water level. 4.08.06 The concreting operations shall not be taken up when the specific gravity of bottom slurry is more than 1.2 and sand content more than 7%. The drilling mud sample shall be collected from the bottom of pilebore as mentioned in clause 5. 4.08.07 Consistency of the drilling mud suspension shall be controlled throughout the concreting operations in order to keep the bore stabilized as well as to prevent concrete getting mixed up with the thicker suspension of the mud. 4.08.08 It shall be ensured that volume of concrete poured is at least equal to the theoretically computed volume of pile shaft being cast. 4.08.09 The temporary guide casing shall be withdrawn cautiously, after concreting is done upto the required level. While withdrawing the casing concrete shall not be disturbed. 4.09.00 Cut off level (COL) 4.09.01 Cut off level of piles shall be as indicated in drawings released for construction or as indicated by the Engineer. 4.09.02 The top of concrete in pile shall be brought above the COL to remove all laitance and weak concrete and to ensure good concrete at COL for proper embedment in to pile cap. 4.09.03 When the pile cut off level is less than 1.0 metre below the working level, concrete shall be cast to the piling platform level to permit overflow of	

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	concrete for visual inspection. In case COL of pile is more than 1.0 metre below working level then concrete shall be cast to a minimum of one metre above COL.	
4.10.00	Sequence of Piling	
4.10.01	Each pile shall be identified with a reference number.	
4.10.02	The convenience of installation may be taken into account while scheduling the sequence of piling in a group. This scheduling shall avoid piles being bored close to other recently constructed piles.	
4.11.00	Building up of Piles	
4.11.01	If any pile, already cast as per construction drawing, requires any extra casting due to any change in cut off level or the cast pile top level is less than the specified level or for any other reason, then the pile shall be built-up by using atleast one grade higher concrete than that used for concreting of the same pile, ensuring proper continuity with the existing concrete and to the satisfaction of the Engineer. Necessary reinforcement as per design requirement and suitable shuttering shall be provided before casting the concrete. Surrounding soil shall also be built up to the required level by proper compaction to ensure lateral capacity of the pile.	
4.12.00	Breaking off of Piles	
4.12.01	If any pile already cast, requires breaking due to lowering in cut off level or for any other reason, then the same shall be carried out, not before seven days of casting without affecting the quality of existing pile such as loosening, cracking etc. and to the satisfaction of the Engineer.	
4.13.00	Preparation of Pile head	
4.13.01	The soil surrounding the piles shall be excavated upto the bottom of the lean concrete below the pile cap, with provision for working space, sufficient enough to place shuttering, reinforcement, concreting and any other related operations.	
4.13.02	The exposed part of concrete above the COL shall be removed/chipped off and made to a uniform level at COL, but not before seven days of casting of pile.	
4.13.03	The projected reinforcement above COL shall be properly cleaned and bent to the required shape and level to be anchored into the pile cap.	
4.13.04	The pile top shall be embedded into the pile cap by 50mm or clear cover to reinforcement, whichever is higher.	

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4.13.05	All loose material, like debris due to chipping/breaking of pile head to the desired level, shall be removed and disposed off as directed by the Engineer.	
4.14.00	Rejection and Replacement of Defective Piles	
4.14.01	The Engineer reserves the right to reject any pile which in his opinion is defective on account of load capacity, structural integrity, position, alignment, concrete quality etc. Piles that are defective shall be pulled out or left in place as judged convenient by the Engineer, without affecting the performance of adjacent piles. The Contractor shall install additional piles to substitute the defective piles as per the directions of the Engineer, at no extra cost to the Owner.	
4.15.00	Recording of Piling Data	
4.15.01	The Contractor shall record all the information during installation of piles. Typical data sheet for recording pile data shall be as shown in Appendix D of IS: 2911 Part I/Sec.2. The pile data shall also include all the details as in Annexure-D. On completion of each pile installation, pile record in triplicate shall be submitted to Engineer within two days of completion of concreting of the pile.	
5.00.00	SAMPLING, TESTING AND QUALITY ASSURANCE	
5.01.00	Facilities required for sampling and testing of materials, concrete, etc. in field and in laboratory should be provided by the Contractor. The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and this Specification. Where no specific testing procedure is mentioned the tests shall be carried out as per the prevalent accepted engineering practice and as per the directions of the Engineer. Tests shall be done in the presence of the Engineer or his authorized representative. In case the Engineer requires additional tests, the Contractor shall arrange to get these tests done and submit to the Engineer the test results in triplicate within three days after completion of any test.	
5.02.00	The Contractor shall maintain records of all inspection and testing, which shall be made available to the Engineer. The Engineer at his discretion may waive some of the stipulations for small and unimportant concreting operations and other works.	
5.03.00	Materials found unsuitable for acceptance shall be removed and replaced by the Contractor. The work done by this unsuitable material shall be redone as per specification requirements & and to the satisfaction of the Engineer at no extra cost to the Owner.	
5.04.00	Quality Assurance Programme	

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	a) The Contractor shall submit and finalize a detailed Field Quality Assurance Programme within 30 days from the date of award of the contract, according to the requirements of this specification. This shall include setting up of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of field quality plan, etc. On finalized field quality plan, the Owner shall identify, customer hold points, beyond which work shall not proceed without written approval from the Engineer. The testing apparatus/equipment installed in the field laboratory shall be calibrated/ corrected by the qualified persons as frequently as possible to give accurate testing results. b) Frequency of sampling and testing, etc. and Acceptance Criteria are given in Table - 1. The testing shall be done at field laboratory or any other laboratory approved by the Engineer. However, the testing frequencies set forth are the desirable minimum and the Engineer shall have the full authority to call for tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications. The materials shall be tested to meet all the specified requirements before acceptance at manufacturers premises or at independent government approved laboratory. Tests indicated in the table are for cross checking at site the conformity of the materials to some of the specifications. 5.05.00 Testing of Concrete 5.05.01 Concrete and other materials shall be tested for quality, strength and other properties. Details of testing shall be as specified under technical specification for Cement concrete (Plain and Reinforced). 5.05.02 One sample consisting of six test cubes shall be made from the concrete used in each test pile, three to be tested after 7 days and three after 28 days. 5.05.03 For working piles, minimum one sample consisting of six test cubes shall be made from the concrete for the first ten piles, three to be tested after 7 days and three after 28 days. Thereafter, minimum one sample consisting of three test cubes for every 10 piles shall be tested for the 7-days & 28-days cube strength. 5.05.04 In preparation of test cubes or specimens vibrators shall not be used. 5.05.05 Concrete shall be tested for slump at every 1-hour interval during concreting of piles. 5.05.06 The frequency of sampling and testing of concrete and materials shall be done as per technical specification for cement concrete (Plain & Reinforced). 5.05.07 The acceptance criteria shall be as mentioned in Table-1. 5.06.00 Testing for position and alignment	

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5.06.01	Each pile shall be checked for its position with respect to specified location. Each pile bore shall be checked for its alignment.	
5.06.02	Permissible limits for deviation shall be as specified under clause no. 4.03.	
5.07.00	Properties of Drilling mud	
5.07.01	Properties of drilling mud shall be checked as per requirement under Annexure C. Prior to the commencement of piling work and thereafter minimum once in a week or as found necessary by the Engineer, one sample consisting of 3 specimens shall be tested. Acceptance criteria applicable are as specified else where with 5% variation. This relaxation is not applicable for properties of drilling mud before concreting.	
5.07.02	Density of the drilling mud shall be checked in each pile before concreting.	
5.08.00	Check for Pile bore	
5.08.01	On completion of boring and cleaning the bottom of each pilebore shall be checked from the sample collected from near the bottom of pile bore or by any other methods as approved by the Engineer, to ensure that it is free from pilebore spoil/debris and any other loose material, before concreting. Concreting shall be done only after the approval of the Engineer.	
5.08.02	For sampling of drilling mud from the pilebore the following method or any other suitable method shall be adopted. a) A solid cone shall be lowered by a string to the bottom of pilebore. A sampler tube closed at top with a central hole (hollow cylinder) is lowered over the cone, and then a top cover shall be lowered over the cylinder. Care shall be taken for proper fittings of assembly to minimize the leakage while lifting the cone assembly to the ground surface. The slurry collected in the sampler tube shall be tested for density and sand content. b) Use of borehole camera for checking the pile bore spoil and strata is acceptable on approval of the Engineer.	
5.09.00	Pile Integrity test	
5.09.01	Low strain integrity test shall be conducted on 50% of the jobs piles and on all test piles or as directed by Engineer. The system shall have the computer readout facility and report on the findings of this shall be furnished to the Owner. This test shall be used to identify the job piles for routine load test.	

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	Piles shall be trimmed to cut off level or sound concrete level. No pile cap blindage work should be undertaken prior to this test. The cast in-situ piles should not be tested before 14 days of casting. 5.09.02 The test shall be undertaken by persons trained and experienced and capable of interpreting the results with specific regard to piling. This test is limited to testing the integrity of the shaft and is not intended to replace the use of static load testing. 5.09.03 Low Strain Integrity Test Methodology: - In this test, a low stress wave is set up in the pile shaft and is also known as Sonic Integrity or Sonic Echo test. - A small metal/hard rubber hammer is used to produce a light blow on top of the pile. The shock wave travelling down the length of the pile is reflected back from the toe of the pile and recorded through a suitable transducer/ accelerometer in a computer for subsequent analysis. - The primary shockwave, which travels down the length of the shaft, is reflected from the toe by the change in density between the concrete and sub strata. However, if the pile has any imperfections or discontinuities within its length these will set up secondary reflections, which will be added to the return signal. - By analysis of the captured signal and knowledge of the conditions of the ground, age of concrete, etc. a picture of the locations of pile shaft defects can be built up. The observed signals are amplified into digital display as velocity versus length records providing information on structural integrity of piles. - The stress wave velocity and approximate pile lengths are provided as input for the integrity testing. The stress wave velocity is dependent on the Young's Modulus and mass density of pile concrete. - More than one recording of signals shall be done until repeatability of signals is achieved on the same pile. - The tests shall be conducted at 3-6 locations to cover the entire cross section of the pile. 6.00.00 PILE TESTING Pile load test shall be carried out as per IS:2911 Part-4 (latest edition) or as directed by Engineer.	



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6.01.00 INITIAL LOAD TEST

Initial load test shall be carried out on separately cast piles for confirmation of estimated pile capacities and to fix a more accurate driving criteria viz. set/bow, total number of blows and approximate depth etc. of founding level. At least 2 nos. of tests shall be conducted for each mode (vertical compression, pull out and lateral). The maximum test load shall be as mentioned in bill of quantities.

6.02.00 ROUTINE LOAD TEST

Routine load tests shall be carried out on job (working) piles for 0.5% of total no. of piles (for each mode and type). Maximum test load shall be 1.5 times the design safe load capacity. Piles showing unsatisfactory results as per load test results shall be treated as defective piles. Defective piles shall be removed or left in place and replaced by additional piles as directed by Engineer at no extra cost to the owner. Any additional cost towards design implications, if any, due to above shall be born by the contractor.

7.00.00 CODES AND STANDARDS

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

- IS: 432 - Specification for mild steel and medium tensile steel bars (Part 1 & 11) and hard drawn steel wire for concrete reinforcement.
- IS: 456 - Code of practice for plain and reinforced concrete.
- IS: 1200 - Measurement of Building and Civil Engineering works (Part 23) Piling.
- IS: 1786 - Code of practice for twisted steel high strength deformed bars for concrete reinforcement.
- IS: 1892 - Code of practice for Subsurface Investigation for foundation.
- IS: 2131 - Method of Standard Penetration Test for Soils
- IS: 2911 - Code of practice for design and construction of pile foundations - Bored cast-in-situ concrete piles.
- IS: 2911 - Code of practice for design and construction of pile

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	Part IV foundation - Load test on piles. IS: 6926 - Code of practice for Diamond core Drilling for Site Investigation for River Valley Projects. IS: 10262 - Recommended guidelines for concrete mix design.	
8.00.00	RATES AND MEASUREMENTS The clauses below shall apply for item rate contracts only. They shall not be applicable to turnkey/lump sum Contracts.	
8.01.00	Rates	
8.01.01	The items of work in the schedule of items, describe the work in brief. The various items in schedule of items shall be read in conjunction with the corresponding sections in the Technical Specifications, including amendments, and additions, if any. For each item in schedule of items, the unit rate shall include for the activities covered in the description of the item as well as for all necessary operations described in the specification and specific requirements.	
8.01.02	The unit rates shall include for minor details which are obviously and fairly intended, and which may not have been included in the description in these documents, but are essential for the satisfactory completion of the work. Unit rates shall also include for all safety measures as required by codal provisions, local regulations, acts, bye-laws, etc. and for execution of work to the satisfaction of the Engineer.	
8.01.03	The quoted rate for each item shall be inclusive of mobilization of all plant, equipment, scaffolding, labour, materials, skilled and unskilled labour, and demobilization after completion of work, supervision, establishing the level and coordinates at each work.	
8.01.04	The quoted rate for piling for a particular diameter and capacity of pile shall remain valid for the actual lengths provided /to be provided irrespective of the minimum length specified elsewhere in this specification.	
8.01.05	The quoted rate for piling as per description of item works shall be inclusive of providing all plant equipment, labour, materials, skilled and unskilled labour, making observations, establishing the ground level and coordinates at each location of pile by carrying levels from one established bench mark and distances from one set of grid lines furnished by the owner.	

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8.01.06	The quoted rate for piling shall be inclusive of bailing out all the pile bore spoil from the pilebore, keeping the borehole free from bored material/debris etc. and disposing the bored/chiselled material along with the drilling mud upto 2 Km. beyond plant boundary or as directed by Engineer, flushing the pile bore by fresh bentonite before concreting, collection of samples from bottom of pilebore, transporting to laboratory, testing and reporting of results.	
8.01.07	The quoted rate for piling shall include shifting of plant and equipment from one pile location to another pile locations, providing temporary casing pipe and removal of the same after completing, concreting, supply of necessary materials, equipment and manpower, cost of boring by approved method as specified, circulation of bentonite slurry and cleaning of borehole free from sludge, as specified, etc.	
8.01.08	The quoted rate for piling shall also include chiselling, if any, required for socketing the pile in rock.	
8.01.09	The quoted rate for the piling shall include concreting by termite method, length of pile above COL, withdrawal of guide casing, cost for preparation of pile head and disposal of debris etc., resulting from breaking off of pile upto COL, upto a distance of 2 Km from the plant boundary or as directed by Engineer.	
8.01.10	The quoted rate for piling shall also include providing reinforcement and its cleaning, straightening, cutting, bending, binding with annealed wire, welding, tackwelding, providing concrete cover blocks, spacers, placing the reinforcement cage in pile casing/bore and other cost of tools and plants, materials, labours, carting the steel from store to piling site and return of unused steel to the Owners storage point, etc.	
8.02.11	Plasticiser/Admixture when used as directed by the Engineer shall be included in piling rates.	
8.01.12	The quoted rate for piling shall include for all quality assurance requirements, but not limited to providing for technical inspection, transportation of samples to laboratory, testing samples, maintaining and submitting all test records, etc.	
8.01.13	The quoted rate for boring in separate borehole shall be inclusive of performing of SPT at regular intervals as specified and collecting rock cores from boreholes, upto the depth as specified shall be inclusive of transporting to laboratory, testing and reporting of the results.	
8.01.14	Unit rate for low integrity test shall be inclusive of mobilization of the entire set of equipment, computer readout, printer, and equipment which may not have been included in the description but are essential for the satisfactory completion of the work as per internationally accepted practice. The rate quoted shall be inclusive of repeatability of test, preparation of pile top surface etc.	



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8.02.00 Measurement

8.02.01 Piling length shall be measurement by linear measurement from pile cut-off level to the tip of pile in meters upto second place of decimal separately for each diameter and capacity of pile. The length of pile to be cast above cut off level, as per specification, and as approved by Engineer, shall be considered for cement reconciliation only. Theoretical diameter of piles shall be considered for reconciliation of cement consumption. No extra payment shall be made for the length from existing ground to cut-off level.

8.02.02 Reinforcement steel shall be measured for reconciliation purpose only and the measurement shall be done for providing and placing reinforcement in piles, by weight in tones, up to third place of decimal in the following manner:

- i) The weight shall be arrived at by multiplying the actual length measured alongwith standard hooks, rings or spirals, spacers, cranks, bends, authorized laps, etc. by sectional weight. These shall be submitted with supporting documents giving the schedule of bars with sketches. The sectional weight to be adopted shall be IS code's sectional weight. Nothing extra shall be payable to the contractor on account of difference in weight, if any, due to different methods adopted for issue and measurement.
- ii) Standard hooks, cranks, bend, authorized laps, supports, hangers and chairs which are covered in approved bar bending schedule shall be measured in tones.
- iii) Dowels, neither shown on the drawings nor instructed by the Engineer, but required for construction facilities shall not be measured.

8.02.03 Breaking off of piles, due to subsequent change in design cut off level, shall be measured separately. This shall be measured in cubic metres upto second place of decimal. This will be payable only when the pile is cast and on the basis of written instruction of the Engineer for lowering of COL.

8.02.04 Measurements for the item of boring in a separate borehole shall be measured in metres from ground level upto the depth as specified, upto second place of decimal. Item of work of boring in soil and coring in rock shall be measured separately for the actual length of boring in soil and coring in rock.

8.02.05 The item for pile integrity test shall be measured in terms of no. of piles tested.



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ANNEXURE-A

Specific Requirements for Bored Cast-in-situ RCC Piles

A1.0 Minimum cement concrete grade M-25

Minimum cement content 400 Kg/M³

A1.1 Safe load

Diameter of Pile

Diameter of Pile (mm)	Vertical/ Compression (MT)	Horizontal/ Lateral (MX)	Pul lout/Tension (MT)
*	*	*	*
*	*	*	*

A2. Installation criteria

The installed pile(s) shall satisfy the following criteria.

A2.1 In Soil/weathered Rock

- Minimum length of the pile shall be _____* m below COL.
- The pile shall be terminated after penetrating through the strata having SPT penetration less than ____* cm for ____* blows, for a minimum length of _____* times the diameter of the pile.

A2.2 In Rock

- Piles shall be installed and socketed into the rocks for a length (socketing length) equal to _____* times the pile diameter subject to a minimum of _____* meter below the socketing horizon.
- Socketing horizon shall consist of rock strata having minimum uniaxial compressive strength of _____* kg/sq.cm.

A3. Average cut-off level for tender design and initial load test can be assumed as _____* m below ground level.

A4. A protocol shall be signed between BHEL site and contractor regarding,

Strata at the founding depth



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Installation criteria

Socketing depth

Density of bentonite before concreting

Slump of concrete.

Time interval between end of boring and start of concreting,

* Values shall be indicated separately depending upon subsoil strata of the site.



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ANNEXURE-B

List of Equipments

Sl.No	Description	Capacity No.
1.	Piling Rigs	
2.	Chisel	3 T min 6 T max
3.	High pressure Mud Pumps	10 HP min 25 HP max
4.	Bentonite mixing plants	
5.	Concrete batching plant	
6.	Soil testing equipments	

Note:

1. The no. and capacity of the piling equipment varies for each work.
2. Additional equipments shall be mobilized if required as per the directions of the Engineer to match the work schedule at no extra cost to the Owner.



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ANNEXURE-C

Bentonite suspension used for piling work shall satisfy the following requirements

- a) Liquid limit of bentonite when tested in accordance with IS: 2720(Part V) shall be more than 300 percent and less than 450 percent.
- b) Sand content of the bentonite powder shall not be greater than 7 percent.
- c) Bentonite solution should be made by mixing it with fresh water using pump for circulation. The density of the freshly prepared bentonite suspension shall be between 1.034 and 1.10 gm/ml depending upon the pile dimensions and type of soil in which the pile is to be installed. However, the density of bentonite suspension after mixing with deleterious materials in the pilebore may be upto 1.25 gm/ml.
- d) The Marsh viscosity when tested by a Marsh cone shall be between 30 to 60 seconds.
- e) The differential free swell shall be more than 540 percent.
- f) The pH value of the bentonite suspension shall be between 9 and 11.5.



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ANNEXURE-D

PILE DATA

1. Reference No. Location (Co-ordinates) _____ area.
2. Sequence of Piling
3. Pile diameter & Type
4. Working level (Platform level)
5. Cut off level (COL)
6. Actual length below COL
7. Pile termination level
8. Top of finished concrete level
9. Date and time of start and completion of boring.
10. Depth of Ground water table in the vicinity.
11. Type of soil at pile tip
12. Method of boring operation
13. Details of drilling mud as used:
 - i) Freshly supplied mud
 - Liquid limit -
 - Sand content -
 - Density -
 - Marsh viscosity -
 - Swelling index -
 - pH value -
 - ii) Contaminated mud
 - Density -
 - Sand content -



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14. SPT* N values in soil (from the nearest bore hole).
+UCS** value in rock (from the nearest bore hole).

* Standard penetration Test

** Unconfined compression strength

15. Chiseling if any, from..... m to m

16. Date and time of start and completion of concreting.

17. Method of placing concrete

18. Concrete quantity

Actual

Theoretical

19. Ref. Number of test cubes

20. Grade and slump of concrete

21. Results of test cubes

22. Reinforcement details:

Main Reinforcement

No. _____

Dia. _____

Depth _____

Stirrups: Type

No. _____

Dia. _____

Spacing _____

23. Any other information regarding obstructions, delay and other interruption to the sequence of work.

TABLE -1

FREQUENCY OF SAMPLING AND TESTING

SI. No	Type of material work	Nature of Test/ characteristics	Method of Test & frequency	No. of test	Acceptance Criteria
1.	Pilebore size a) diameter b) length		Physical measurement	each pile	as per specification
2.	Founding level	to establish socketing horizon/ and or founding level & upto depth 5m below founding level.	in separate borehole meant for the purpose a) SPT in soils/ weathered rock b) Core & UCS value of rock	1 borehole for 100-150 piles or group of 150 Sqm	Annexure - B
3.	Bentonite (Mud) properties. a) Basic properties of bentonite before use. b) Contaminated mud from pile bore bottom before concreting	Liquid Limit, Marsh Viscosity, Specific gravity, sand content, swelling index, pH value. Density, sand content	in lab in lab	As per Cl. 5.7 Each Pile	As per Annexure C As per annexure C
4.	Position and Alignment	-	Physical or any Approved method	Each Pile	As per Cl. 4.3
5.	Cleaning of pilebore	-	As per Cl. 5.8	Each Pile	Pilebore be free from bored material cuttings debris/sludge
6.	Reinforcement (R/F) Spacing of longitudinal R/F cover laps binding of laterals		Physical inspection and measurement	each cage	As per approved design
7.	Concrete a) Workability b) Cubes	Slump cone test Compressive Strength test	Each pile As per spec.	As per Cl. 5.5 As per Cl. 5.5	As per specification. As per IS: 456
8.	Materials like aggregate, sand etc.	As per technical specification for concrete and relevant IS codes			
9.	Pile head		Physical	each pile	



TITLE:

**TECHNICAL SPECIFICATION FOR
SITE LEVELLING & GRADING
WORKS**

SPECIFICATION NO. PE-TS-999-600-C022

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SITE LEVELLING & GRADING WORKS

SPECIFICATION NO. PE-TS-999-600-C022



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**TECHNICAL SPECIFICATION FOR
SITE LEVELLING & GRADING
WORKS**

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2.00.00	SCOPE	3
3.00.00	MATERIALS	4
4.00.00	QUALITY CONTROL	6
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6.00.00	RATES AND MEASUREMENTS	15



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**GENERAL TECHNICAL SPECIFICATION
FOR
SITE LEVELLING AND GRADING**

1.00 GENERAL

This specification cover the works to be carried out for “**Site Levelling and Grading Works including Slope Protection**” etc for the entire plant and associated areas. The specified formation level(s) shall be achieved either by excavation or by raising with controlled fill with excavated/borrowed earth as the case may be.

2.00 SCOPE

2.01 The scope include all works involved in levelling the site to the lines, grades, cross sections and dimensions as shown on the approved drawings and/or as directed by the engineer including site clearance, setting out, earth work in excavation, stacking, loading, transportation, unloading, dewatering, drainage, filling, watering, compaction, turfing on slopes (if required), lighting, disposal of residual/surplus earth etc. It also include supplying and providing all labour, materials, supervision, services, equipments, tools and plants, testing and all incidental items of work not shown or specified but reasonably implied or necessary for the completion of the work etc.

2.02 All tools and plants, equipments and machineries to be used in this work shall be of standard quality and manufactured by reputed concerns conforming to Indian Standard (IS) codes or equivalent thereof.

2.03 Work to be provided by the Contractor

The works to be provided by the contractor unless specified otherwise shall include but not be limited to the following.

a) Supplying and providing all labour, supervision, services including as required under statutory labour regulations, materials, equipments, tools and plants, approaches, transportation etc required for the completion of the work.

b) Preparation and submission of detailed scheme of all operations required for executing the work (material handling, placement, services, approaches etc) to the engineer for approval.

c) Carrying out sampling and testing on fill materials/fills to assess the quality/moisture content/degree of compaction and submission of the test results whenever required by the engineer.

d) Design, construction and maintenance of Magazine of proper capacity for storage of explosives for blasting work and removal of the same after completion of the work etc.

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2.04 Work to be provided by others

No work under this specification will be provided for by any agency other than the contractor unless specifically mentioned elsewhere in the contract.

2.05 Codes and Standards

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) codes unless specified otherwise.

IS: 1200 Methods of measurement of building and civil engineering works,
Part-1: Earthwork

IS: 2720 Method of test for soils (Relevant parts)

IS: 3764 Excavation work- Code of safety

IS: 4081 Safety code for blasting and related drilling operations

IS: 4701 Code of practice for earthwork on canals

IS: 6922 Criteria for safety and design of structures subject to underground
Blasts

In case of conflict between this specification and those (IS codes) referred to herein, the former shall prevail. In case any particular aspect of work is not covered specifically by the specification or/and by the IS codes, any other standard practice as may be specified by the engineer shall be followed.

2.06 Conformity with Designs

The contractor shall carry out the work as per the approved drawings, specification and as directed by the engineer.

3.00 MATERIALS

All materials required for the work shall be of best variety and approved by the engineer.

3.01 Materials for Excavation

For the purpose of identifying the various strata met during the course of excavation, the following classification is to be followed.



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a) Soil

It include all type of soil including laterite, moorum etc with/without any percentage of kankars which can be excavated by normal means such as shovel, pick axe, crow bar, spade etc and those which do not fall under **clause 3.01 (b) and (c) etc.**

b) Soft Rock

It include the rocks (including weathered rock) which are removable by splitting with the help of crow bar, pick axe, wedges, pavement breakers, pneumatic tools, hammers or such implements etc and not requiring blasting (for excavation) in the opinion of the engineer.

c) Hard Rock

It includes the rocks, which require blasting for excavation in the opinion of the engineer. Where blasting is prohibited for any reasons, the excavation shall be carried out by chiselling or any other method as approved by the engineer. The mere fact that the contractor resorts to blasting shall not classify the soft rock under hard rock.

However, the engineer's decision on the type of strata encountered during excavation shall be the final and binding on the contractor.

3.02

Materials for Filling

Any coarse grained or fine grained low plastic soil free from vegetation, roots, shingle, salts, organic matters, sod and any other harmful chemicals shall be used for filling. The contractor shall test the fill material to establish its suitability and submit the results to the engineer for approval. Fill material shall be got approved by the engineer. The following type of materials shall not be used for filling.

- a) Materials from swamps, marshes and bogs
- b) Expansive clays
- c) Peat, logs, sod and perishable materials
- d) Materials susceptible to combustion
- e) Any material or industrial and domestic produce which will adversely affect other materials of work
- f) Materials from prohibited areas

The earth available by cutting the high grounds within the project site and the materials (if) available from the road excavation or any other excavation under the same contract shall be used for filling depending upon its suitability as fill



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material. Filling with excavated rock (in the project site) shall be done only with

the written permission of the engineer in the following manner. The boulders shall be broken into pieces not exceeding 150mm size in any direction and mixed with fine materials consisting of decomposed rock, moorum or any approved earth to fill the voids as far as possible and the mixture shall then be used for filling. In case the earth required for filling is over and above the earth available from the compulsory excavations within the project area, then borrow areas for obtaining suitable fill material shall be arranged by the contractor himself from outside the plant boundary limits and all expenses including royalties, taxes, duties etc shall be borne by him. He shall obtain and submit the necessary clearances/permissions from the concerned authorities to the engineer for the borrow areas/materials acquired.

4.00

QUALITY CONTROL

All works shall conform to the lines, levels, grades, cross sections and dimensions shown on the approved drawings and/or as directed by the engineer. The contractor shall establish and maintain quality control for the various aspects of the work, method of construction, materials and equipments used etc. The quality control operation shall include but not be limited to the following.

Sl. No.	Activity	Check
1	Lines, levels & grades	a) By periodic surveys b) By establishing markers, boards etc
2	Filling	(a) On quality of fill material (b) On moisture content of fill material (c) On degree of compaction achieved

5.00

EXECUTION

The contractor shall prepare and submit the detailed drawings/schemes for excavation and filling works as proposed to be executed by him showing the dimensions as per the construction drawings and specification adding his proposal of approaches, dewatering (if any), drainage and compaction etc within 15 days of award of the contract to the engineer for approval.

5.01

Site Clearance

Before the commencement of earthwork, the entire area of cutting and filling shall be cleared of all trees, stumps, bushes, grasses, vegetation etc with their roots, fences, logs, rubbish, water, slush etc. It is not necessary to remove all the soil containing fine hair like roots but only the rather heavy mats are to be removed. Cutting of trees shall include trees having girth of any size and removing roots upto a depth of 600mm below the existing ground level or 300mm below the formation level whichever is deeper. After the removal of



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roots of trees, the pot holes formed shall be filled with good earth in 250mm layers (loose thickness) and compacted unless otherwise directed by the engineer. The trees shall be cut in to suitable pieces as instructed by the engineer. Before earthwork is started, all the spoils, unserviceable materials and rubbish shall be burnt or removed and disposed off to the approved disposal area(s) as specified by the engineer. Useful materials, saleable timbers, fire woods etc shall be the property of owner and shall be stacked properly at the worksite in a manner as directed by the engineer.

5.02

Setting Out

On receiving the approval from the engineer with modifications and corrections if any, the contractor shall set out the work from the control points furnished by the engineer and fix permanent points and markers for the ease of periodic checking as the work proceeds. These permanent points and markers shall be fixed at the interval as prescribed by the engineer and shall be got checked and certified by the engineer after whom the contractor shall proceed with the work. It should be noted that this checking by the engineer prior to the start of the work will in no way relieve the contractor of his responsibility of carrying out the work to true lines, levels and grades as per the drawings and specification. If any errors are noticed in the contractor's work at any stage, the contractor at his own risk and cost shall rectify the same. The contractor shall take spot levels of the area (with respect to the bench mark/ available source as provided by the engineer) to be excavated or to be filled at an interval of not more than 10m or as directed by the engineer before starting any earth work and shall be submitted to the engineer for prior approval.

5.03

Excavation

Levelling by excavation shall be carried out where the existing ground levels are higher than the specified formation level. Excavation shall include removal of all materials whatever nature as may be and whether wet or dry shall be carried out exactly in accordance with the line, levels, grades and curves shown on the approved drawings and/or as directed by the engineer. All excavations shall be done to the minimum dimensions as required. The contractor shall obtain prior approval of the engineer for the method he proposes to adopt for excavation in different types of strata including dimensions, side slopes and dewatering if any, stacking or disposal etc. This approval however shall not in any way make the engineer responsible for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. The work shall be carried out in a workmanlike manner without endangering the safety of nearby structures/services or works and without causing hindrance to any other activities in the area. **Prior to starting the excavation, the ground level at the location shall be checked jointly with the engineer.**

The rough excavation may be carried up to a maximum depth of 150mm above the final formation level. The balance shall be excavated with special care and the final surface shall be compacted by rolling with 6 passes of 8 to 10 tonne roller. If directed by the engineer, soft and undesirable spots shall be removed

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even below the final level. The extra excavation shall be filled up with good earth in 250mm layers (loose thickness) and compacted unless otherwise directed by the engineer. The contractor shall be paid for the extra excavation and filling at the appropriate items of work.

If the excavation is done to a depth greater than that shown on the drawing or as directed by the engineer due to the contractor's fault, the excess depth shall be filled up to the required level with good earth in 250mm layers (loose thickness) and compacted unless otherwise directed by the engineer at the own risk and cost of the contractor.

Suitable slope in cutting as per the requirements and as directed by the engineer shall be adopted to withhold the face of earth. The contractor shall be held responsible for any damage to any part of the work caused by the collapse of the side of excavations.

5.03.01 Excavation in Hard Rock

Excavation in hard rock shall normally be done with blasting. In case where blasting is prohibited for any reasons, the excavation shall be carried out by chiselling or any other approved method as directed by the engineer. Personnel deployed for rock excavation shall be protected from all hazards such as loose rock/boulder rolling down and from general slips of excavated surfaces.

5.03.02 Blasting**a) General**

Storage, handing and use of explosives shall be governed by the current explosive rules/regulations laid down by the Central and the State Governments. The contractor shall ensure that these rules/regulations are strictly adhere to. The following instructions are also to be strictly followed and the instructions wherever found in variance with the above said rules/regulations, the former (instructions) shall be superseded with the later (above said rules/regulations).

No child under the age of 16 and no person who is in a state of intoxication shall be allowed to enter the premises where explosives are stored nor they shall be allowed to handle the explosives. The contractor shall obtain licence from the District Authorities for undertaking the blasting work as well as for obtaining and storing the explosives as per Explosives Rules, 1940 corrected upto date. The contractor shall purchase the explosives, fuses, detonators etc only from a licensed dealer and shall be responsible for the safe custody and proper accounting of the explosive materials. The engineer or his authorized representative shall have the access to check the contractor's store of explosives and his accounts at any time. It is the full responsibility of the contractor to

transport the explosives as and when required for the work in a safe manner to

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the work spot.

Further, the engineer may issue modifications, alterations and new instructions to the contractor from time to time. The contractor shall comply with the same without these being made a cause for any extra claim.

b) Materials

All materials such as explosives, detonators, fuses, tamping materials etc proposed to be used in the blasting operation shall have the prior approval of the engineer. Only explosives of approved make and strength are to be used. The fuses known as instantaneous fuse must not be used. The issue of fuse with only one protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and shall be not less than 4 seconds per inch of length with 10% tolerance on either side. Before use, the fuse shall be inspected. Moist, damaged or broken ones shall be discarded. When the fuses are in stock for long, the rate of burning of fuses shall be tested before use. The detonators shall be capable of giving an effective blasting of the explosives. Moist and damaged detonators shall be discarded.

c) Storage of Explosives

The current Explosive Rules shall govern the storage of explosives. Explosives shall be stored in a clean, dry and well-ventilated magazine to be specially built for the purpose. Under no circumstances should a magazine be erected within 400m of the actual work site or any source of fire. The space surrounding the magazine shall be fenced and the ground inside shall be kept clear and free from trees, bushes etc. The admission to this fenced space shall be through a single gate only and no person shall be allowed without the permission of the officer-in-charge. The clear space between the fence and the magazine shall not be less than 90m. The magazine shall be well drained. Two lightning conductors, one at each end shall be provided to the magazine. The lightning conductors shall be tested once in every year.

Explosives, fuses and detonators shall each be separately stored. Cases of explosives must be kept clear of the walls and floors for free circulation of air on all sides. Special care shall be taken to keep the floor free from any grains of explosives. Cases containing explosives shall not be opened inside the magazine and the explosives in open cases shall not be received into a magazine. Explosives which appear to be in a damaged or dangerous condition are not to be kept in any magazine but must be removed without delay to a safe distance and be destroyed.

Artificial light, matches, inflammable materials, oily cotton, rag waste and articles liable to spontaneous ignition shall not be allowed inside the magazine.

Illumination shall be obtained from an electric storage battery lantern. No

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smoking shall be allowed within 100m distance from any magazine. Magazine shoes without nails shall be used while entering the magazine. The persons entering the magazine must put on the magazine shoes which shall be provided at the magazine for this purpose and should be careful

* not to put their feet on the clean floor unless the magazine shoes on.

* not to touch the magazine shoes on ground outside the clean floor.

* not to allow any dirt or grit to fall on the clean floor.

Persons with bare feet shall dip their feet in water before entering the magazine and then step directly from the tub to the clean floor. No person having article of steel or iron with/on him shall be allowed to enter the magazine. Workmen shall be examined before entering the magazine to check none of the prohibited articles are with them. A brush broom shall be kept in the lobby of the magazine for cleaning the magazine. Cleaning shall be done immediately after each occasion whenever the magazine is opened for receipt, delivery or inspection of the explosives.

The mallets, levers, wedges etc for opening the barrels or cases shall be of wood. The cases of explosives are to be carried by hand and shall not be rolled or dragged inside the magazine. Explosives which have been issued and returned to the magazine are to be issued first; otherwise those which have been stored long in the store are to be issued first. Neither the magazine shall be opened nor any person shall be allowed in the vicinity of the magazine during any dust storm or thunderstorm. All magazines shall be officially inspected at definite intervals and a record of such inspections shall be kept.

d) Carriage of Explosives

Detonators and explosives shall be transported separately to the blast site. Explosives shall be kept dry and away from direct rays of the sun, artificial lights, steam pipes or heated metal and other sources of heat. Before explosives are removed, each case or package shall be carefully examined to ascertain that it is properly closed and shows no sign of leakage.

No person except the driver shall be allowed to travel on the vehicle conveying explosives. No explosive shall be transported in a carriage or vessel unless all iron or steel therein the carriage or vessel which are likely to contact the package containing explosives are effectually covered with lead, leather, wood, cloth or any other suitable material. No light shall be carried on the vehicle carrying explosives and no operation connected with the loading, unloading and handling of explosives shall be conducted after sunset.

e) Use of Explosives

The contractor shall appoint an agent who shall personally superintend the

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firing and all operations connected therewith. The contractor shall satisfy himself that the person so appointed is fully acquainted with his responsibilities. Holes for charging the explosives shall be drilled with pneumatic drills and the drilling pattern shall be so planned that the rock pieces after blasting will be suitable for handling. The hole diameter shall be of such a size that the cartridges can easily pass down through them and any undue force is not required during charging. Charging operation shall be carried out by or under the personal supervision of the shot firer. Wrappings shall never be removed from the explosive cartridges. Only one cartridge at a time shall be inserted in a hole and wooden rods shall only be used for loading and stemming the shot holes. Only such quantities of explosives as are required for a particular work shall be brought to the work site. Should any surplus remain when all the holes have been charged shall be carefully removed to a point at least 300m away from the firing point.

The authorized shot firer himself shall make all the connections. The shot firing cable shall not be dragged along the ground to avoid any damage to the insulation. The shot firing cable shall be tested each time for its continuity and possible short circuiting. The shot firer shall always carry the exploder handle with him until he is ready to fire shots. The number of shots fired at a time shall not exceed the permissible limits. Before any blasting is carried out it shall be ensured that all workmen, vehicles and equipment on the site are cleared from an area of minimum 300m radius from the firing point or as required by the statutory regulations at least 10 minutes before the time of firing by sounding a warning siren and the area shall be encircled by red flags.

The explosives shall be fired by means of an electric detonator placed inside the cartridge. For simultaneous firing of a number of charges, the electric detonators shall be connected with the exploder through the shot firing cable in a simple series circuit. Due precautions shall be taken to keep the firing circuit insulated from the ground, bare wires, rails, pipes or any other path of stray current etc and keep the lead wires short circuited until it is ready to fire. Any kink in the detonator leading wire shall be avoided. For simultaneous firing of a large number of shot holes, use of cordtex may be done. An electric detonator attached to its side with adhesive tape shall initiate cordtex connecting wire or string. Blasting shall only be carried out at certain specified times to be agreed jointly by the contractor and the engineer.

At least five minutes after the blast has been fired in case of electric firing or as stipulated in the regulations, the authorized shot firer shall return to the blast area and inspect carefully the work and satisfy himself that all the charged holes have exploded. Cases of misfired unexploded charges shall be exploded by drilling a parallel fresh hole at a distance of not less than 600mm from the misfired hole and by exploding a new charge. The authorized shot firer shall be

present during the removal of debris as it may contain unexploded explosives near the misfired hole. The workmen shall not return to the site of firing until at

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least half an hour after firing.

Where blasting is to be carried out in proximity of other structures, controlled blasting by drilling shallow shot holes and proper muffling arrangements with steel plates loaded with sand bags etc shall be used on top of the blast holes to prevent the rock fragments from causing any damage to the adjacent structures and other properties. Adequate safety precautions as per building byelaws, safety codes, statutory regulations etc shall be taken during blasting operations.

5.03.04**Restrictions on Blasting**

- a) Blasting which may disturb or endanger the stability, safety or quality of the adjacent structures/foundations shall not be permitted.
- b) Blasting within 200m of a permanent structure or construction work in progress shall not be permitted.
- c) Progressive blasting shall be limited to two third of the total remaining depth of excavation.
- d) No large scale blasting operations will be resorted to when the excavation reaches the last one metre and only small charge preferably black powder may be allowed so as not to shatter the parent rock.
- e) The last blast shall not be more than 0.50 m in depth.
- f) In rocky formations, at locations where specifically indicated or ordered in writing by the engineer, the use of explosives shall be discontinued and excavation shall be completed by chiselling or any other suitable method as approved by the engineer.

5.04**Sorting of Excavated Materials**

The excavated material shall be carefully sorted for use in filling the areas in the project site by removing roots, grasses, organic matters and other objectionable materials and be sorted out into different types of materials for use and as directed by the engineer. The excavated material which is not considered fit for filling purpose shall be immediately removed and disposed at such a place and in such a manner as will be directed by the engineer. The material found unusable should be got approved by the engineer before actually disposing it off. The useful materials that cannot be used directly shall be heaped in separate area as stock piles. Stockpiles shall be of regular size as far as possible for ease of measurement. The materials heaped shall be utilised as and when required and as directed by the engineer. The cost of complete item of earthwork includes the cost of rehandling of the materials and temporarily heaped and reused.

5.05**Disposal of Surplus/ Waste Materials**

Surplus and other waste materials shall be removed and disposed of from the construction site to the area demarcated by the engineer. No material shall be wasted unless approved by the engineer.

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5.06**Earth Work in Filling**

Levelling by raising with controlled fill of approved excavated/borrowed earth shall be carried out where the existing ground levels are lower than the specified formation level. After clearing site as per clause 5.01, the original ground shall be compacted by rolling subject to a minimum 6 passes of 8 to 10 tonne roller. The approved earth/fill material shall then be spread in horizontal layers not exceeding 300mm in compacted thickness. Each layer shall be watered and thoroughly compacted with proper moisture content and such equipments as may be required to obtain a minimum of 95% of its maximum dry density as determined by standard Proctor's test as per IS: 2720 part-VII or 85% of relative density as per IS:2720 part-XIV as specified. Moisture content of the fill material shall be controlled near optimum moisture content during compaction.

The fill material shall be tested for its optimum moisture content and maximum dry density as per IS: 2720, part-VII. Moisture content shall be checked at the source of supply in accordance with IS:2720 part- II and if found less than that required for proper compaction, the same shall be made good either at the source or after spreading the soil in loose thickness for compaction. In the latter case, water shall be sprinkled directly from the hose line or from the truck-mounted water tank etc making due allowance for evaporation losses and the fill material be thoroughly mixed by means of harrows, rotary mixers or by any other suitable approved method until the layer is uniformly wet. **Flooding shall not be permitted for watering purpose under any circumstances.** If the material delivered is too wet, it shall then be dried by aeration and exposure to the sun till the moisture content is suitable for compaction. Should circumstances arise owing to wet weather the moisture content cannot be reduced to the required amount by the above procedure, the work on compaction shall be suspended. Clods or hard lumps of earth shall be broken to have a maximum size of 150mm when being placed in the layers before compaction. For each of the above tests on the fill material, one sample for every 10,000cu.m shall be tested. Additional samples shall be tested whenever there is a change of source or type of material.

Before start of filling, the contractor shall submit the engineer his proposal for the methodology to be adopted for compaction. The compaction equipments as approved by the engineer shall only be employed to compact the different type materials encountered during construction. If directed by the engineer, the contractor shall demonstrate the efficacy of the plant he intends to use by carrying out compaction trials. Moisture content of the fill material shall be controlled near optimum moisture content during compaction.

The compacted layer shall be tested for its dry density as per IS:2720, part-XXVIII or XXIX as directed by the engineer. Samples shall be taken at the rate of one sample for every 10,000sq.m area of each compacted layer. In addition random checks shall be carried out in compacted layers by means of Proctor needle penetration test. Contractor shall submit all the test results to the engineer immediately after completion of the tests. A sample shall be deemed to have passed the test when the dry density of the compacted fill is equal to or more



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than 95% of its maximum dry density. When field density measurements reveal any soft areas in the fills, further compaction shall be carried out as directed by the engineer. If in spite of that, the specified compaction is not achieved, the material in the soft areas shall be replaced with approved material compacted to the density requirements and satisfaction of the engineer.

Subsequent layers shall be placed only after the finished layer has been tested and accepted by the engineer.

Where the filling is to be done across low swampy ground that will not support the weight of trucks or other hauling equipments, the lower part of the fill shall be constructed by dumping successive loads in a uniformly distributed layer of a thickness not greater than that necessary to support the hauling equipment while placing subsequent layers.

5.07

Dewatering and Drainage

It shall be ensured that the area to be excavated/filled shall be free from water. The contractor shall remove the water (if any) by pumping or by any other means as approved by the engineer. At all times, the surface of cutting/filling during execution shall be maintained at such a cross fall as will shed water and prevent ponding. All existing drains/channels (if any) in the work area shall be suitably diverted by the contractor before taking up any excavation or filling. These diversions shall be such that it shall ensure effective disposal of water without any accumulation or flooding within the project site and in adjoining areas.

5.08

Finishing Operations

Finishing operation shall include the work of shaping and dressing the excavated/filled ground to the required grades, levels, lines, side slopes, crosssections and dimensions as shown on the approved drawings or as directed by the engineer.

5.09

Turfing

Turfing shall be provided at the slopes and other locations as shown on the drawings or as directed by the engineer. The turf shall be of approved quality of grass. The sod shall consist of dense, well rooted growth of permanent and desirable grasses indigenous to the locality where it is to be used and shall be practically free from weeds or other undesirable matter. The grass on the sod shall have a length of approximately 50mm and the sod shall be free of any

debris. Thickness of the sod shall be as uniform as possible with 50 to 80mm of soil covering the grass roots depending on the nature of the sod so that all the dense root system of the grasses are retained in the sod strip. The sods shall be cut in rectangular strips of uniform width not less than about 300mm x 250mm size but not so large so that it is convenient to handle and transport without



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damage.

The area to be sodded shall be previously constructed to the required slope and cross section. Prior to placing the sods, the slopes shall be **roughened** and wetted in order to have a satisfactory bond. The strips of sod shall be laid in close contact with each other and be tamped firmly in place so as to fill and close the joints between them. The turfing so laid shall be well watered and protected until final acceptance.

5.10 Approaches

The contractor shall provide proper approaches for workmen and inspection.

5.11 Lighting

Full scale lighting are to be provided if night work is permitted or directed by the engineer. If no night work is in progress, red warning lights should be provided at the edges of excavations and fills.

6.00 RATES AND MEASUREMENTS

6.01 Rates

a) The item of work in the schedule of quantities describe the work very briefly. The various items of the schedule of quantities shall be read in conjunction with the corresponding sections in the technical specification including amendments and additions if any. For each item in the schedule of quantities, the bidder's rate shall include all the activities covered in the description of the items as well as for all necessary operations in detail as described in the technical specification.

b) No claims shall be entertained if the details shown on the released for construction drawings differ in any way from those shown on the tender drawings.

c) The unit rate quoted shall include minor details which are obviously and fairly intended and which may not have been included in these documents but are essential for the satisfactory completion of the work.

d) The bidder's quoted rate shall be inclusive of supplying and providing all labour, men, materials, equipments, tools and plants, supervision, services, approaches, schemes etc.

6.02 Measurements

Method of measurements are specified in the proceeding sections. Where not so

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specified, the latest version of IS:1200, Part-1 shall be applicable.

a) The length, breadth and depth shall be measured correct to the nearest centimetre if measurements are taken by tape. Rounding of numericals shall be as per relevant IS Codes. If the measurements are taken with staff and level, the levels shall be recorded correct to 5mm. The area and volume shall be worked out in square meter and cubic meter correct to the nearest of two decimal places.

b) For earth work in excavation, the ground levels shall be taken before and after completion of the work in the actually excavated area. The quantity of earth work in cutting shall be computed from these levels in cubic meter.

c) Where soft rock and hard rock are mixed, the measurement shall be done as follows. The two types of rock shall be stacked separately and measured in stacks. The net quantity of each type of rock shall be so arrived by applying a deduction of 50% for looseness/voids in the stacks. If the sum of net quantity of the two types of rock so arrived exceeds the total quantity of excavation then the quantity of each type of rock shall be worked out from the total quantity (from excavation) in the ratio of net quantities in stack measurements of the two types of rock. If stacking is not feasible, the method as suggested by the engineer shall be followed.

d) Where soil, soft rock and hard rock are mixed, the measurement shall be done as follows. The soft and hard rock shall be removed from the excavated material and stacked separately and measured in stacks. The net quantity of each type of rock shall be so arrived by applying a deduction of 50% for looseness/voids in stacks. The difference between the entire excavation and the sum of the quantities of soft and hard rocks so arrived shall be taken as soil.

e) For earth work in filling, the actual measurements of fill shall be calculated by taking levels of the original ground before start of the work but after site clearance and after compaction of fills. The quantity of earth work in filling shall be computed from these levels in cubic meter.

f) For turfing, the measurement shall be made on the finished work in square meter.



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SECTION - D | SUB-SECTION – D23

REV.NO. 00 DATE 30/11/2015

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ANTI-TERMITE TREATMENT

SPECIFICATION NO. PE-TS-999-600-C023



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**TECHNICAL SPECIFICATION
FOR ANTI-TERMITE
TREATMENT**

SPECIFICATION NO. PE-TS-999-600-C023

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**TECHNICAL SPECIFICATION
FOR
ANTI-TERMITE TREATMENT**

1.00.00

SCOPE

The scope of work is to set up a chemical barrier against attack by subterranean termites while the building is under construction.

2.00.00

EXECUTION

2.01.00

General

All work shall in general be executed as specified in IS: 6313 Part II-1981 and as per approved specification of the agency having special know-how for the job.
All necessary work to ensure uniform distribution and proper penetration of treatment of treating solution shall be done according to the instruction of the Engineer.
Soil treatment shall not be done when it is raining or when the soil is wet with rain or subsoil water. Once formed, the treated soil barrier shall not be disturbed.

2.02.00

Chemicals and Rate of Application

Any of the following chemicals (conforming to relevant Indian Standards) in water emulsion shall be applied by pressure pumps, uniformly over the area treated.

Chemicals	Concentration by Weight, Percentage
Chlorpyrifos Emulsifiable (IS 8944 - 1978)	: 1.0
Heptachlor Emulsifiable Concentrate (IS: 6439 - 1978)	: 0.5
Chlordane Emulsifiable Concentrate (IS: 2682 - 1984)	: 1.0

2.02.01

Treatment of Column Pits, Wall Trenches and Basement Excavations

Foundations, basements etc. may either be fully enveloped by the chemical barrier or the treatment may start 500 mm below ground level. The bottom surface and sides of excavation (upto a height of about 300 mm) for column pits, walls trenches and basements shall be treated with chemicals at the rate of 5 litres / M² of surface area. Backfills around columns, walls etc. shall be treated at the rate of 7.5 litres / M² of the vertical surface. Chemical treatment shall be done in stages following the compaction of earth in layers. The treatment shall be carried out after the ramming operation is done by

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	rodding the earth at 150 mm centres close to the wall surface and spraying the chemicals in the specified dose. 2.02.02 Treatment of Top Surface of Plinth Filling Holes 50 mm to 75 mm deep at 150 mm centres both ways shall be made with crowbars on the surface of compacted plinth fill. Chemical emulsion at the rate of 5 litres / M² of surface shall be applied prior to laying soling or sub-grade. Special care shall be taken to maintain continuity of the chemical barrier at the junction of vertical and horizontal surfaces. 2.02.03 Treatment of Soil Surrounding Pipes, Wastes and Conduits Special care shall be taken at the points where pipes and conduits enter the building and the soil shall be treated for a distance of 150 mm and a depth of 75 mm at the point where they enter the building. 2.02.04 Treatment of Expansion Joints These shall receive special attention and shall be treated in a manner approved by the Engineer. 2.02.05 Treatment at Junction of the Wall and the Floor Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surfaces from ground level up to the level of the filled earth surface. A small channel 30 x 30 mm shall be made at all the junctions of wall and columns with the floor. Rod holes made in the channel up to the ground level 150 mm apart and the chemical emulsion poured along the channel at the rate of 7.5 litres per square meter of the vertical wall or column surface. The soil should be tamped back into place after this operation. 3.00.00 ACCEPTANCE CRITERIA The Contractor shall give a 10-year service guarantee in writing supplemented by a separate and unilateral guarantee from the specialised agency for the job to keep the building free of termites for the specified period. 4.00.00 RATES Rates shall be of complete work per unit area as stated in the Schedule. 5.00.00 METHOD OF MEASUREMENT Complete work of anti-termite treatment shall be measured for plinth area treated.	



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This includes treatment, to foundations, walls, trenches, basements, plinth, buried pipes, conduits etc. The extended portions of foundation and like beyond plinth limit shall be the part of complete work.

6.00.00

I.S. CODE

Relevant code applicable for this Specification.

IS: 6313 (Part-II) 1981 : Code of Practice of Anti-Termite Measures in Buildings
Pre-constructional chemical treatment measures.