

1X800 MW SIPAT STPP STAGE-III

TECHNICAL SPECIFICATION FOR INDUCED DRAFT COOLING TOWER BOOK 2 OF 2

SPECIFICATION No. **PE-TS-520-165-W001**
REV NO. 00



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA



TECHNICAL SPECIFICATION
INDUCED DRAFT COOLING TOWER
1X800 MW SIPAT STPP STAGE-III

PE-TS-520-165-W001

Rev. No. 00

Date : 23.10.2024

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SECTION A (SCOPE OF WORKS)

SCOPE OF THIS PACKAGE COVERS THE FOLLOWING:	
1	Complete civil works including excavation, shoring, dewatering, backfilling, concrete work including casing, sidewalls, top deck, recovery stacks at tower fans outlet, foundations (including Piling, if required), cold water basins, sludge pit for each basin section, staircase at both ends of cooling tower, all other staircases / ladders as required, doors and their frames, walkways, platforms, hand railing, water-proofing, finishing and all other incidental civil works including earth work for grading, removal of surplus soil to a space decided by the engineer, shuttering, steelworks for reinforcement etc
2	The scope of the work for cooling tower shall also include preparation of detailed design and construction drawings, submission of design basis report, calculation of BOQ against drawing submitted, complete all as required to give satisfactory performance and as stipulated in various clauses in this document/ specification.
3	Bidder shall also submit all drawings in AutoCAD format along with PDF files. All excel sheets depicting all formulae used in calculations, structural analysis files and other files used in detail design shall also be submitted in executable form along with design documents. Overall quantities for cooling tower as a whole shall also be prepared and submitted.
4	In case, STAAD is not used for carrying out structural analysis of Tower, a licensed version of the used software shall then be installed in BHEL computer (to enable review of document) along with submission of all the related design and calculation files.
5	Bidder has the freedom of proposing both RCC as well as FRP cooling towers. In case FRP cooling tower is selected, 2 sets of official copies of Indian standards (IS) pertaining to analysis and design of FRP towers used in design shall be submitted to BHEL/NTPC.
6	The specification covers general requirements of materials, design and testing of RCC/ FRP works, structural works and finishing work etc. involved in the design of Reinforced Concrete/ FRP Induced Draft Cooling Tower. This document is not exhaustive. Relevant codes and standard practices to be followed by bidder where ever required, not conflicting with the provisions of this specification, for delivering performance as per the satisfaction of owner.
7	Various plant facilities are envisaged around IDCT area which may or may not have interface with IDCT system. Bidder is required to establish that the conceptualised IDCT is in sync with these facilities. These facilities include but not limited to storm water drainage system, sewerage discharge, effluent discharge, foundations of nearby structures etc. Bidder drawings shall be prepared so as the other facilities are not affected.
8	Any other design, drawing etc. if required for completion of the system but not mentioned above shall also be included in the scope of bidder.

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CIVIL TECHNICAL REQUIREMENTS	
1	The cooling tower shall be capable of cooling the rated quantity of water through the specified thermal range at the design wet bulb temperature and it shall conform to the other design parameters as stipulated in mechanical section of this document.
2	Bidder shall submit detail design calculation and construction drawings to BHEL for obtaining approval from NTPC prior to commencement of work at site.
3	All the material specification and design criteria mentioned here shall be read in conjunction with the customer specification.
4	CODES AND STANDARDS:
4.1	MATERIALS:
4.1.1	IS: 432 Mild steel and medium tensile steel bars. (parts1&2) and hard drawn steel wire for concrete reinforcement.
4.1.2	IS: 1785 Plain hard drawn steel wire for pre-stressed (parts 1 & 2) concrete.
4.1.3	IS: 1786 High strength deformed steel bars and wires for concrete reinforcement.
4.1.4	IS: 2062 Steel for general structural purposes.
4.1.5	IS: 3589 Seamless or electrically welded steel pipes for water, gas & sewage (168.3mm- 2032mm).
4.1.6	IS: 8112 43 Grade Ordinary Portland cement.
4.1.7	IS: 12330 Sulphate resisting Portland cement.
4.2	CODES OF PRACTICE
4.2.1	IS: 456 Code of practice for plain and reinforced concrete.
4.2.2	IS: 800 Code of practice for general construction in steel.
4.2.3	IS: 875 Code of practice (part 1 to 5) for design loads other than earthquake for building and structures.
4.2.4	IS: 1080 Code of practice for design and construction of simple spread foundations.
4.2.5	IS: 1343 Code of practice for pre-stressed concrete
4.2.6	IS: 1893 Criteria for earthquake resistant design of structures.
4.2.7	IS: 2309 Code of practice for the protection of buildings and allied structures against lightning.
4.2.8	IS: 2629 recommended practice for hot dip galvanizing on iron and steel.
4.2.9	IS: 2950 Code for practice for design and (part 1) construction of raft foundation.
4.2.10	IS: 3043 Code of practice for earthing.
4.2.11	IS: 3370 Code of practice for concrete structures (part 1 to 4) for storage of liquids.
4.2.12	IS: 12200 Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.

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4.2.13	BS: 8007 B.S. Code of Practice for design of concrete structures for retaining aqueous liquid.	
4.2.14	IS 13920 : 1993 Ductile detailing of reinforced concrete structures subjected to seismic forces — code of practice.	
4.2.15	IS: 1904 Code of practice for design and construction of foundations in soil: General	
4.2.16	IS: 2950 (PART-1) Code of practice for design and construction of raft foundations - design.	
4.3	CODES FOR STOP-LOGS AND TRASH RACK:	
4.3.1	IS: 4622 Recommendations for fixed - wheel gates structural design.	
4.3.2	IS: 5620 Recommendations for structural design criteria for low head slide gates.	
4.3.3	IS: 11388 Recommendations for design of trash rack for intakes.	
4.3.4	IS: 11855 General requirements for rubber seals for hydraulic gates.	
4.4	CODES AND STANDARDS FOR FRP COMPONENTS	
4.4.1	The design of FRP components of cooling tower shall comply with the requirements stipulated below mentioned standards. The cooling tower and its components shall be designed to withstand the most onerous loading case / combination resulting from the various loading cases / combinations stipulated in CTI ESG 152.	
4.4.2	All material properties, stresses and their reduction factors, deflection criteria, material service factors, connection details and their tolerances etc., as applicable as per CTI codes CTI STD- 131, CTI STD -137, CTI ESG-152, shall be so considered such that the cooling tower and its components withstand the severest temperatures in the place of installation and application and serve a reasonably long life not less than CTI indicated life expectancy.	
4.4.3	Following is the list of few codes/ standards to be followed for FRP cooling tower design:	
4.4.3.1	CTI STD – 131 : Fiberglass-Reinforced Plastic Panels	
4.4.3.2	CTI STD – 137 : Fiberglass Pultruded Structural Products for Use in Cooling Towers	
4.4.3.3	CTI ESG – 152 : Structural Design of FRP Components	
4.4.3.4	CTI STD – 203 : Industrial Cooling Tower Standard	
4.4.3.5	ASCE 7 -10 : Minimum design loads of buildings and other structures. (as per CTI ESG – 152)	
4.5	The applicability of the provisions for conformity to the various codes and standards stipulated shall be in the following order:	
4.5.1	Bureau of Indian Standards.	
4.5.2	British Standards Institution.	
4.6	Wherever the above standards are in conflict with the stipulations of this specification, the technical specification shall govern.	
5	FOUNDATION OF COOLING TOWER	

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5.1	For all major foundations, the minimum founding depth and the minimum size of foundation shall be as per foundation system specified elsewhere in the specification and geotechnical data.	
5.2	For open foundations, the total permissible settlement shall be as per the criteria furnished under the foundation system specified elsewhere in this specification.	
5.3	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.	
5.4	No major foundation shall rest on filled up soil. Loose soil if any below foundation is to be removed and replaced with PCC of grade M7.5.	
5.5	NTPC had carried out geo-technical investigation in the proposed cooling tower site. The sub-strata details encountered at some bore holes in the cooling tower area are enclosed as Annexure-A.	
6	CONSTRUCTION JOINTS: The number of construction joints shall be kept as low as possible consistent with reasonable precautions against shrinkage. Concreting shall be carried out continuously up to construction joints.	
7	FRP STRUCTURE: Design criteria for FRP cooling tower shall be as specified elsewhere in the mechanical specification. However, design has to be strictly carried out as per relevant codes and standards.	
8	LOADING: For consideration of loads on structures and load combinations IS: 875 (Part -1 to 5) Code of Practice for design loads (other than Earthquake) for Buildings and Structures shall be followed. Site specific seismic data and wind data shall be followed for design of cooling towers.	
9	LIVE LOADS: The following live loads (minimum) shall be adopted for the design of buildings and structures Associated with Cooling Towers:	
9.1	Roof / Fan deck 500 Kg / Sq. M.	
9.2	RCC Floors 500 Kg / Sq. M.	
9.3	Stair, landings 500 Kg / Sq. M.	
9.4	Chequered & Grating floor 400 Kg / Sq. M.	
9.5	Basin, sump and duct Earth pressure; water pressure as applicable and additional surcharge load of 2.0 T/Sq. M.	
9.6	Covers for H.W. channels / H.W. distribution basin 300 Kg / Sq. M.	
9.7	Walkways inside cooling towers 300 Kg / Sq. M.	
9.8	Underground pipes and ducts Earth pressure and surcharge load of 2.0 T / Sq. M.	
10	MISCELLANEOUS WORK:	
10.1	Concrete structures, floors and foundation coming in direct contact with acid/alkalis/other Corrosive chemicals shall be provided with lining/treatment.	

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10.2	Concrete structures, floors and foundations indirectly affected by acid/acidic fumes shall be treated with appropriate acid proof treatment in line with customer specification.	
10.3	For all underground structures and water retaining structures special care shall be taken to water-proof them and water proofing shall conform to provision of relevant IS standards or as per the specifications of approved manufacturer. Water-tightness shall be ensured by provision of PVC water bars of approved type with all necessary fittings and clippings to keep it in position during concreting. Water proofing compound as admixtures must be used in concrete.	
10.4	Internal surface of all water retaining structures shall be plastered in line with requirement mentioned in customer specification.	
10.5	Any surface treatment required for RCC structure not covered here shall be provided as mentioned elsewhere in the customer specification.	
11	BHEL has developed General Technical specifications based on which all kinds of excavation, construction, erection etc of civil & steel structures are carried out at site. Bidder will be required to comply with those specifications during execution.	

NTPC Limited

(A Government of India Enterprise)



SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1x800 MW)

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

PART – B

(BOOK 4 OF 5 – CIVIL WORKS)

SECTION - VIB

BIDDING DOCUMENT NO.: CS-8003-001-2

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TECHNICAL REQUIREMENTS

D-1-1

GENERAL

1.01.00

This specification is to cover, survey works, site leveling works, design, preparation of general construction and fabrication drawings, supply of labour & materials and structural and architectural works by the Bidder.

This specification is to cover, survey works,.....

Detailed geotechnical investigation in the proposed area has been carried out by the Owner and the bore-log data is furnished in Annexure 'C'.

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 / NTPC Ltd.....

Items of work under this specification and nature of work in detail are complete work under this scope is referred to as civil works. Various plant and systems, facilities, etc., covered under the scope is given in

formed 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 in s be All stri per functioning of the plant, all d amendments thereto as may

Bidder understands that FQA building and testing laboratory is same building. Please confirm.
Also kindly clarify the following:
1. FQA building/testing laboratory is permanent structure or temporary structure.
2. In case of permanent structure, please furnish the detailed specification, layout drawings and finishing schedule etc.

FQA building and testing laboratory are separate buildings.
1. FQA building is permanent building. Testing laboratory is temporary structure.

el, coarse & fine aggregate, y 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.

	एनटीपीसी NTPC TECHNICAL REQUIREMENTS		
	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.		
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D-1-3 3.01.00	SUBMISSIONS 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.		
SIPAT THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	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.			
3.07.00	~~"As-built" drawings in AutoCad & PDF format shall be prepared and submitted to owner by the Contractor after completion of construction / erection, incorporating changes, if any.~~ "As-built" drawings in AutoCad & PDF format shall be prepared and submitted to owner by the Contractor after completion of construction / erection, incorporating changes, if any. Final executed quantities of RCC and structural Steel shall be incorporated in the As-Built drawing.			
SIPAT THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	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 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. a) All Statutory requirements including safe distances between various facilities as per applicable rules/acts/laws including local bye-laws are met. b) Face of the buildings and facilities are located in such a way so as to have an offset of minimum 15m with respect to center line of double lane road and 12 meter with respect to center line of single lane road. c) The entire construction activity shall take into account the commissioning of the unit in phases matching with the phased commissioning of the plant. d) 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. e) Available Area for laydown, preassembly and batching plant have been earmarked on the General Layout Plan. f) No permanent facility shall be located within the safety zone limit around the fuel Oil storage tanks etc., except those permitted by Owner. g) Transportation of all equipment and materials shall be by road as envisaged. Any other mode envisaged by the bidder may be proposed. h) All parts of the buildings and facilities shall be approachable by fire tenders. i) Main roads /peripheral roads are only shown in GLP and road layout tender drawing. Approach made of heavy-duty paving/passageway to buildings/structures/facilities in the scope of bidder from nearby plant road/peripheral road/grid road/internal access road shall be provided. Multiple connections of access to different parts of plant facilities shall be provided.							
4.02.00	<table><tr><th>Statement of Prebid Queries & Clarification</th><th>NTPC's Clarification</th></tr><tr><td>Subject to suitability of earth, Bidder can consider surplus available excavated earth from within the plant boundary for filling purpose. Please confirm</td><td>Bidder's understanding is correct. Further, Bidder to refer amendment Sl. No. D2-57.</td></tr></table>				Statement of Prebid Queries & Clarification	NTPC's Clarification	Subject to suitability of earth, Bidder can consider surplus available excavated earth from within the plant boundary for filling purpose. Please confirm	Bidder's understanding is correct. Further, Bidder to refer amendment Sl. No. D2-57.
Statement of Prebid Queries & Clarification	NTPC's Clarification							
Subject to suitability of earth, Bidder can consider surplus available excavated earth from within the plant boundary for filling purpose. Please confirm	Bidder's understanding is correct. Further, Bidder to refer amendment Sl. No. D2-57.							
4.03.00	Site Levelling and Slope Protection Work							
4.03.01	Complete levelling of entire plant area as shown in drawing Titled 'Site Levelling Plan' shall be done by the Bidder. 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 ash based units, ash silos, railyard, raw water pump house & associated facilities 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 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.							
SIPATII SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-4 CIVIL WORKS GENERAL LAYOUT PLAN	PAGE 1 OF 4				

CLAUSE NO.	TECHNICAL REQUIREMENTS 
	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 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 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 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. - 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.
SIPATII SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS- SUB-SECTION-D-1-4 CIVIL WORKS GENERAL LAYOUT PLAN PAGE 2 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
	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. 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) with Rip-Rap. For slope steeper than 1:2 encountered anywhere, slope protection shall be provided at slope with gabion wall/RCC retaining wall as per the requirement.			
SIPATII SUPER THERMAL POWER STAGE-III(1X800 MW) EPC PACKAGE		SECTION-VI, PART-B BID DOC NO. CS-		SUB-SECTION-D-1-4 CIVIL WORKS GENERAL LAYOUT PLAN PAGE 4 OF 4

TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
D-1-5	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. 5.01.00 Architectural Concepts & Design: a) 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. b) 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. c) 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. d) 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. e) For adequate light and ventilation, all buildings shall be designed to be followed. All buildings have to be designed to be suitable for installation of solar photovoltaic panels on roof tops for renewable energy purpose. f) Architectural design of all Power Plant Building shall be suitable for installation of solar photovoltaic panels on roof tops for renewable energy purpose. g) All the buildings shall be architecturally designed to meet the National Building Code requirement & Fire Safety Regulations. h) All public buildings shall be designed incorporating the provision of barrier free environment for physically disabled persons. 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	Please furnish the following details: 1. Detailed specification for Civil, structural, architectural works for SOLAR PV plant on 'roof top' of buildings; 2. List of buildings/facilities on which roof top Solar PV plant is to be installed. Refer clause 6.02.09 (i) of section VI part B-sub section D-1-6 of technical specification for loading details. Other details to be developed by bidder during detailed engineering. 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. Development of rainwater harvesting scheme for the project and obtaining approval of the scheme from Central Ground water board is in bidder's scope Bidder understands that landscaping is excluded from bidder's scope. Please confirm. Bidder understanding is correct. Landscaping is not in bidder's scope.	be lators.
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 1 OF 69

	TECHNICAL REQUIREMENTS एनटीपीसी NTPC			
	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 high to be provided between CCR and CER or AMP CR, WS CR & CHP CONTROL ROOMS 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. Bidder understands that the said provision is to be incorporated only for internal walls of the mentioned rooms, which is an air-conditioned area. Please confirm. Further, it is requested to give detailed specification for dry wall construction technology. Bidder shall follow the Technical specification. Refer Amendment no. D1-23			
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 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).			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 2 OF 69

	एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
5.02.02	Bidder shall integrate the Mill & Bunker Building with boiler supporting structure. 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			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 3 OF 69

	TECHNICAL REQUIREMENTS 		
5.02.03	Machine Foundations in Main Plant Area A. SG 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. 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.		
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	TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
	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: 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. Bidder understands that for alternative-2 i.e foundation without VIS, additional warranty is only for the foundations and not for the equipment coming over it. Please confirm. Extended warranty of five years for satisfactory static and dynamic performance of the foundation system is applicable for the foundation.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 5 OF 69

	TECHNICAL REQUIREMENTS 		
5.02.04	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. 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. Technical Requirements of prefabricated insulated metal Sandwich Panels/decking sheets shall be same as given elsewhere in this specification. For Elevator Machine Room other than Boiler Elevator Machine Room, Technical requirements shall be same as specified in Clause no 9.14 of Sub Section D-1-9, Section VI Part B of this 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.		
5.02.05	Compressor House i. Salient Features:		
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5.02.06	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: 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.			
	5.02.07	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. 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		
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5.02.08	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. 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 iii. Architectural Features This building shall 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	Air washer units and UAF units if placed on the roof shall be kept open without any shed. Technically there is no requirement of steel Shed over the Air Washer and UAF units. Please confirm. Steel Sheds (open) have been envisaged for UAF/AWU units placed on the roof for sunlight/rain protection. Bidder to comply with specification requirements.	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT
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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.

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 shall consist of the Turbine bay, adjacent Deaerator Bay, electrical bay & common control room building (CCR Building) (as stipulated elsewhere in this and specific design shall be per design Heater RCC for perma	Bidder understands that space for office are required above Control Room in MPH Building in addition to other facilities specified. In the past practice CCR located at 17.00m and as per this specification required office space will be envisaged above CCR i.e. at 24 m or above level. Please confirm. The required area for office space is limited to 350 sqm only. Please provide details about the type of material for noise reduction and dust isolation.	Bidder understanding is correct. However, final location of office area shall be decided during detailed engineering Stage. Refer amendment no. D1-34	this and per ling The as ab)

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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 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 40mm thick MS grating and handrail/ hand post shall be 32mm NB 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 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

TECHNICAL REQUIREMENTS

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 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

iii. Architectural Features This building shall be of Structural Steel Framed structure and shall be completely covered with external cladding and RCC roof.....

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 aer-ated concrete panels over that 50 mm thick mineral wool insulation with Single Skin Metal Panel cladding shall be provided in exterior of UPS Battery room area and Con-trol Equipment Room area. All internal side of Aerated con-crete panel and columns in air-conditioned areas other than CCR in MPH shall be encased with Aluminium Composite panel cladding from inside

amed structure and shall be completely The external vertical face (herein stated as t to) the transformer yard and also the two vertical cladding comprising 3.0m high brick tiled vertical metal sheet for the remaining operating floor & gantry girder bracket level provided.

de the A-row (part/full), there shall be a steel structure supporting the bus duct to cladding shall be designed to suit the

rier wall shall be provided as per functional he above mentioned RCC wall shall be al face.

inside the turbine hall shall be concealed ating floor level to crane girder bracket top

row) facing (& adjacent to) the Boiler area erator floor level with vertical cladding 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

TECHNICAL REQUIREMENTS



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.

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 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 **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 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. 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 toughned 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 glass wall with motorized curtain 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

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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 with air lock lobby.

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 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 clad 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.

Air Conditioned Office for 25 persons (Including 5 cabins for Senior persons) with Pantry, Toilet block(Ladies and gents toilet separately), conference room for 25 persons, shall be provided in MPH building in addition to other facilities specified . This area shall have access to natural light on three sides minimum. It shall have air lock lobby at entrance with auto sliding doors.

Minimum area of office area shall be 350 sq.m. This area shall be positioned over the CR with good aesthetic view and noise reduction and dust isolation.

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Bidder understands that space for office are required above Control Room in MPH Building in addition to other facilities specified. In the past practice CCR located at 17.00m and as per this specification required office space will be envisaged above CCR i.e. at 24 m or above level. Please confirm. The required area for office space is limited to 350 sqm only. Please provide details about the type of material for noise reduction and dust isolation.

Bidder understanding is correct. However, final location of office area shall be decided during detailed engineering Stage. Refer amendment no. D1-34

5.02.11

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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.

		TECHNICAL REQUIREMENTS 		
	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: - Water filled inside up to design level and no earth outside. - Earth pressure with surcharge of 2.0 T/m² and ground water table up to FGL outside and no water inside. - 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. - 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.			
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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.

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% $\pm$ 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

	TECHNICAL REQUIREMENTS 		
	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. 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.		
5.02.11.06	Foundation of Over Ground Steel Circular Water Storage Tanks		
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5.02.11.07	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^oC 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. 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^o 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

1.05.22.01	Transition duct inside the chimney and chimney flue liner shall be painted with corrosion resistant paint for Borosilicate Lining and insulated for Titanium/C-276 cladding irrespective of surface temperature	Bidder understands that only outer surface of chimney flue liner is to be painted with corrosion resistant paint for borosilicate lining. Inner surface of flue liner shall be provided with borosilicate lining so there shall be no exposed surface. Kindly confirm.	The specification clause is intended for the complete exposed surface to be painted with corrosion-resistant paint in case of borosilicate lining.
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.	For Borosilicate lining, bidder proposes to provide 8mm thick (minimum) mild steel flue with Borosilicate Glass Block Lining of minimum 38 mm thickness for the top flue liner above the roof slab. This is proposed to avoid creation of welding joint between two different materials. It is not feasible to weld MS liner with solid titanium due to non-availability of suitable electrode for weld-ing. External surface of chimney flue liner projecting over the chimney roof shall be wrapped with 2 mm thick Titanium / C-276 sheet. Kindly confirm.	Bidder's proposal is not acceptable. The specification requirement is clear in this regard. Bidder to comply with technical specification requirements.
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 atleast equal to 150mm.	For Borosilicate lining, bidder proposes to provide 2mm thick titanium sheet over the top portion of the flue can to avoid any damage in between flue can and borosilicate lining. Bidder proposes to provide the 100mm length of the capping from the top portion of the flue inside flue liner as a standard practice of bidder. Kindly confirm.	Bidder's proposal is not acceptable. The specification requirement is clear in this regard. Bidder to comply with technical specification requirements.

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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.

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. If required as per design or as per the recommendation of expansion joint manufacturer, 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

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5.03.02	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. 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.			
	5.03.03	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.		
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	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 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.			
5.03.05	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.			
5.03.06	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.			
5.03.07	Foundation			
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5.03.08

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 shall be wrapped on the outer-most surface with galvanised wire mesh using MS galvanised pins and speed washer.

5.03.09

Chimney Painting

- (i) All exposed steel surfaces (including exterior surface of mild steel flue liner in case of titanium) shall be painted with epoxy phenolic coating system having total 220 microns DFT. Further, no painting is envisaged on inner surface of concrete chimney shell below top portion.
- (ii) All exposed steel surfaces (including exterior surface of mild steel flue liner in case of titanium) shall be painted with epoxy phenolic coating system having total 220 microns DFT. Further, no painting is envisaged on inner surface of concrete chimney shell below top portion.
- (iii) All exposed steel surfaces (including exterior surface of mild steel flue liner in case of titanium) shall be painted with epoxy phenolic coating system having total 220 microns DFT. Further, no painting is envisaged on inner surface of concrete chimney shell below top portion.

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. Further, no painting is envisaged on inner surface of concrete chimney shell below top portion.

- (iv) 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.
- All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% $\pm 2\%$) 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.
 - 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.
 - 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% $\pm 2\%$) 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

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	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	Bidder understands that a rack and pinion elevator shall be provided for travel from the grade level up to the platform just below the roof platform. Kindly confirm.	Bidder's understanding is in order. Elevator shall be provided for travel from the grade level up to the platform just below the RCC roof platform.	
	A rack and pinion elevator, (to be provided for carrying goods, passengers, etc. per 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.			
5.04.00	DELETED			
5.05.00	ASH HANDLING SYSTEM			
5.05.01	The civil works for Ash handling system shall comprise of bottom ash and fly ash handling systems, which includes 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 Slurry trench (In case of SCC system), Transport/instrument Air Compressor house, Conveying air compressor house, Switchgear /Control/RIO rooms, , AHP Control room building, Ash classifier, Ash silo, supporting structures and foundations for Bottom ash hopper, Buffer hoppers, dewatering bins, bottom ash overflow tank, Settling tanks and Surge tanks, Seal water tank, Bagging plant Complex, Silo Utility Building complex 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 Ash disposal pipe supports (inside the plant boundary) 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.			
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	*Vertical clearance: A minimum vertical clearance of 8.5m shall be maintained between Rail top level and bottom of structure.			
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, 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.			
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	DELETED			
5.05.05	The Silo area 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	Pipe supports shall be provided for ash slurry pipes—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			
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	above surrounding ground level/paving level. Pipes shall be suitably anchored with RCC pedestals to resist lateral and vertical movements as per system requirement.				
5.05.07	DELETED	Please furnish High Flood level (HFL) of the plant area.			High Flood level (HFL) of the plant area is RL(+) 272.6M
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 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 th				
5.05.10	DEL	33	VI/R	D-1-5	24 of 69
5.05.11		34	VI/R	D-1-6	4 of 20
					5.05.11
					8.02.01 b)
		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. 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. The referred clauses are contradictory. Bidder understands that the minimum grade of reinforced cement concrete for all foundations and super structure shall be M25 except for the structures where M30 is exclusively specified. Please confirm. As referred in clause 8.02.01 b) Minimum grade of reinforced cement concrete for all foundations shall be M25 unless noted otherwise.			
	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 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			

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5.05.15	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 shed, 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.	projections, if any, in dered in this case.	GS	hutters / ventilators.
5.06.00	FGD SYSTEM			e provided for pump ystem requirements.
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.			ith silicon additives. ealed double
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.			and cage ladder
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.			y.
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 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.			
5.06.02.03	Gypsum Dewatering Building			
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5.06.03	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 Booster Fan and Ball Mill foundations: Fan 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. 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. 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			
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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 soling 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

Bidder request to give information regarding number of users for the design of sewage treatment plant.

As mentioned in the referred clause - "The capacity of the Decentralized Sewage Treatment' units should be as per the design requirements, subject to minimum combined capacity of 75 Cum/day."

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.

5.08.00

Plant Storm Water Drainage System

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Bidder understands that Boundary wall, patrol road along boundary wall and associated drains is not in bidder's scope. Please confirm.

Bidder understanding is correct. However, Layout of drain shall be as per layout given in tender drawing "Layout of drain".

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alues
RCC
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 shall be

5.23.18	All open RCC drains shall have removable steel gratings designed for loads as specified under loading clause.	Referred clauses are contradictory. Please specify areas where drains shall have removable steel grating/precast covers. For all other areas, open drains with no cover will be provided.	This clause is for applicable for COAL, BIO MASS, LIMESTONE & GYPSUM HANDLING SYSTEM area.
5.08.00	Open RCC rectangular section, unless required otherwise due to functional requirement, shall be provided for all drains.	Please Clarify.	This clause is for applicable for plant storm water drainage system

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5.08.01	Open RCC rectangular section, unless required otherwise due to functioned 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.			
	Watch towers shall be RCC construction with all-weather en-closure 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 MS STAIRCASE.			
	~~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 MS ladders.~~			
	Deleted			
5.08.02	Deleted			
5.08.03	Deleted			
5.09.00	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 elsewhere5.09re 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			
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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 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.

5.10.00

Roads

All roads shall be of rigid pavements unless otherwise specified. Rigid pavements shall be constructed with Geopolymer concrete. Concrete road/pavement or rigid pavement, mentioned in specification, shall mean road /pavement constructed with 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.

Turning Circle radius adequate for 16 Wheel Truck shall be provided at all relevant points including approach (Entry/Exit) and access road for Truck movement at loading/unloading/weight facilities of Limestone, Gypsum, Ash, Biomass for efficient and safe movement of truck.

Construction of road as per Drawing'.

For road to be constructed with Conventional Cement Concrete or Geopolymer Concrete

For road to be constructed with Geopolymer 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

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.....

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	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 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	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 in 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" .	Conventional Cement Concrete or Geo-pol-ymer concrete road..... is provided in Chapter D-1-8.		
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".			
5.10.04	INTERMEDIATE ROAD:	Bidder understands that patrol roads and associated drains are not in bidder's scope. Please confirm. Patrol road is not in bidder's scope. Drain shall be as per Layout of drain drawing.		
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	The intermediate lane roads shall be (8 meter wide) with 5.5 meter wide concrete pavement and 1.25 meter wide raised shoulders on both sides of the road as given in tender drawing Details of Road. *Concrete roads anywhere mentioned in specification shall be read as Geo-polymer concrete road.		
5.11.00	DELETED		
5.12.00	Fuel Oil Handling system The civil works are to be provided for following fuel oil handling system areas as mentioned below: - Fuel Oil pressurizing pump house. - 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. - 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 connected through shear anchor studs. Waterproofing of Roof slab shall be done as per architectural specifications. The building shall be completely covered with 230mm thick brick wall with provisions for fire proof doors, windows, rolling shutters. The basement RCC slab and RCC wall shall be designed as for uplift and external surcharge load as per the design criteria specified elsewhere. All pump foundations shall be designed for both static and dynamic loading. 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. 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).		
5.12.02	DELETED		
5.12.03	DELETED		
5.12.04	DELETED		
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.			
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	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. 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, Boiler area, ESP area, Chimney area & FGD area.		
5.13.01	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	DELETED		
5.15.00	DELETED		
5.16.00	DELETED		
5.17.00	Induced Draft Cooling Towers The civil , structural and architectural works for cooling towers are related mainly to following areas, but not limited to:		
5.17.00.01	Cooling Tower Basin		
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The basin of the cooling tower for collection of cold water shall be made of Reinforced Cement Concrete (RCC M - 30 grade as per IS: 456). The floor of the basin shall be sloped to minimum 1 in 80 towards the sludge drains. The required slope shall be achieved by screed concrete of grade M-15 as per IS:456 having minimum thickness at edge as 25 mm. Drainage arrangement of basin shall be as specified elsewhere in the Technical Specifications. If the cooling tower basin and sludge sump is below ground level, FRP hand railing shall be provided all around the cooling tower basin and sludge sump pit. The bottom 500 mm of hand railing shall also have FRP/PVC wire mesh with opening size of 50mm grid to avoid ingress of leaves, vegetation, and debris into the basin. The basin shall be tested for water tightness as per IS:3370. Bottom of the lowest level beam shall be at least at free board level. In case, the beams are provided into the water, the same shall be designed for un-cracked section as per IS:3370. The outlet channel shall be covered on top with removable precast concrete slabs for about 5m length from cooling tower basin and the entire length of cold water outlet channel shall be provided with 32 NB (Medium) G.I pipes. Hot water duct around cooling towers, if placed below ground shall be encased with min. 500mm thick PCC (M20 grade). a) Foundation of Cooling Tower The foundation of the Cooling Tower shall be as detailed out elsewhere in the specifications. b) Super Structure of Cooling Tower (applicable in case of RCC cooling tower) Columns, beams and other structures like tie beams, slabs etc. shall be of reinforced cement concrete of grade M-30 (minimum) as per IS : 456. Uniform concrete grade shall be used for the entire cast-in-situ reinforced concrete superstructure. The fan deck slab shall be properly sloped so that rain water does not accumulate over the deck slab. The slope shall be 1 : 120 (min.). The slope shall be provided with screed concrete of grade M-15 (minimum) as per IS : 456.. Fan Deck slab and all other over ground platforms shall be provided with FRP handrailing. Suitable arrangement for drainage of rain water to be provided. However, there is no specific requirement of Rain Water down comers. c) Cells, Distribution System and Stack (applicable in case of RCC cooling tower) Cooling tower cells shall consist of RCC columns, beams and walls. The spacing of columns shall be minimum 4000 mm c/c. Inclined bracings shall not be provided between the columns. Hot water distribution channel shall also be of RCC. Cell division partition walls shall be of precast solid concrete blocks with provision of pilasters for walls, if required. The peripheral wall shall be Cast-in-Situ RCC wall and shall have two layers of reinforcement on either faces in both directions with minimum dia of reinforcement bars as 8 mm and maximum spacing as 150 mm c/c. Minimum thickness of Cast-in-Situ RCC peripheral walls shall be 200 mm. Hot water channel shall be covered with suitably designed precast / cast - in - situ concrete slab. Wherever flow control valves are located over hot water basin, these shall be placed over precast concrete covers / concrete slab and designed for specified load. The minimum thickness of RCC fan stack shall be 150 mm. The fanstack shall have two layers of reinforcement on either faces in both directions with minimum dia of reinforcement bars as 8mm and maximum spacing as 200mm c/c. d) Stairs RCC staircase for approach to fan deck for each cooling tower shall be provided. The stairs shall have 1000 mm clear width and FRP hand railing. The riser shall be			
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	maximum 175 mm & treads 250 mm (minimum). Edge protection angle (min 35X35X6, made of aluminum) shall be provided to the treads with the lugs. e) Steel Structures All mild steel parts of structures used in cooling towers shall be hot dip galvanized or seal spray zinc coated as per BS:5493 (for a very long period of maintenance of more than 20 years). The minimum coating for galvanization 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 SS 316. f) Water proofing of structures and construction joints For water proofing of underground structures including basin slab and hot water distribution channel, water proofing cum plasticizer compound shall be mixed with the concrete. In addition Chemical injection treatment shall be provided for the construction joints of all underground structures. g) Expansion Joints PVC sealing strips shall be used for all expansion joints where water is retained. The minimum thickness of PVC sealing strip will be 6 mm (minimum) and minimum width 225 mm. The expansion joint shall be as per IS: 3370. At expansion joints, joints filler material with sealing compound on both sides shall be provided throughout the length of the joint. h) Grade of concrete All RCC associated with induced draught cooling towers including switchgear and control room, unless specified otherwise, shall be design mix (controlled) concrete of grade M 30 of IS: 456. Water - cement ratio shall not exceed 0.45. Minimum 75 mm thick PCC of grade M-7.5 as per IS: 456 shall be provided as mud mat below foundation unless specified otherwise. The PCC shall extend 75 mm beyond the outer edge of structural concrete. For water retaining structure minimum 100 mm thick PCC of grade M-10 as per IS:456 shall be provided as mud mat below the bottom slab / raft. The PCC shall extend 100 mm beyond the outer edge of the structural concrete. i) Form-Work Plywood Form-work shall be used for basin, basin walls, outlet channel and super structures. j) Doors (applicable in case of RCC cooling tower) FRP door shall be provided in each fan stack at fan deck level. Door height & width as per requirement for equipment movement (clear) shall be provided. However, door size shall be minimum 2100 mm high (clear) & 1200 mm wide (clear). Door shall have locking facility. k) Coating ~~All concrete surfaces in direct contact with water/ water spray/moist air shall be applied with Moisture Compatible Corrosion Resistant Coating System or its equivalent as specified in Annexure-G. All concrete surfaces subject to water/ water spray/moist air upto and including Fan Deck slab level including basin slab, inner faces of peripheral walls, all faces of cell partition wall, all faces of columns, all faces of beams (both cast~~		
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k) Coating

All concrete surfaces subject to water/ water spray/moist air including cold water basin, inner faces of peripheral walls, all faces of cell partition wall, all faces of columns, all faces of beams (both cast in situ and precast), bottom surface of fandeck slab for counter flow tower and both surface of fandeck slab for cross flow tower, inner face of fanstack, all faces of hot water basin (for cross flow tower), etc. **except exterior surface** shall be applied with High build heavy duty polyurethane coating having formulation of 100 % solids, solvent free over proper cleaned and complete dried 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 polyurethane coating is given in **ANNEXURE-III**.

Exterior surfaces of cooling tower shall be coated with one coat of High Performance Moisture Compatible Corrosion Resistant Coating System of minimum 150 micron as per **Annexure-G** followed by 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.

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in situ and precast), bottom surface of fandeck slab for counter flow tower and both surface of fandeck slab for cross flow tower, inner face of fanstack, all faces of hot water basin (for cross flow tower), etc as applicable shall receive the said coating after cleaning and drying of the concrete surface. The detailed specification of the coating system on concrete surfaces is given in Annexure-G.

External surfaces of Cooling tower peripheral walls and fanstack shall be painted with two or more coats of waterproof cement paint of approved shade, make and color.

I)

Paving

Paving shall be provided for a minimum clear width of 5.0 m from the outer face of the HW pipes all around the cooling tower basin. Paving shall also be provided in between the hot water pipes and space available between HW pipes and CT basin wall spray catcher. The minimum total width of paving around CT basin shall be atleast 8.5 m from outer edge of the spray catcher or basin wall. Paving shall consist of reinforced concrete base slab laid over 75 mm thick PCC of grade M-10 as per IS:456 sub-base and 200 mm thick stone soling. The sub-base shall be laid on the compacted and suitably prepared sub-grade. The degree of compaction of sub-grade shall be as specified elsewhere in the specification. The thickness of the RCC base slab of grade M - 25 shall be suitably designed considering a superimposed load intensity of 5T / Sq.m. However the minimum thickness of base slab shall be not less than 150 mm having double layered reinforcement in both directions both top and bottom. The maximum spacing of the reinforcement bars shall be 150mm c/c and minimum dia of reinforcement bars shall be 8mm.

RCC peripheral drain of minimum cross sectional dimensions 300mm X 300mm to dispose storm water shall be provided around area paving and shall be connected to nearest Owner's storm water drain.

RCC paving all around cooling towers shall be connected to the existing road so as to provide approach to both cooling towers and switchgear & control room building as indicated in tender drawing. The clear width of this approach road shall be 5.5M and top of approach road shall be 350 mm above FGL.

m)

Walkways

Permanent walkways at least 1000mm clear width shall be provided at hot water distribution level and at drift eliminator level for counter flow type cooling towers. The clear working height available above these walkways shall be at least 2.0 meters. The walkway and its supporting structure shall be of RCC M - 30 grade. Suitable RCC guards rails 300 mm high shall also be provided on both sides of these walkways. Over the guard rails FRP hand railing shall be provided. The vertical post of handrail shall be 700 mm high and at an interval of 1500mm c/c. There shall be two levels of horizontal pipes for hand railing spaced equally in vertical plane.

Permanent walkways at least 1000 mm clear width shall also be provided for access to fan and around gear box with FRP gratings of clear opening size not more than 50 MM x 50 mm and grating thickness of 50 mm on RCC supports at fan deck Level.

05.17.00.02

Design Criteria

R.C.C. Structures

- (a) The design of all liquid retaining/conveying structures like of cooling tower like C.W. basin, sump, hot water distribution channel/basin, sludge drain and pits 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 :-

(a) The design of all liquid retaining/ conveying structures of cooling tower like C.W. basin, sump, hot water distribution channel/basin, sludge drain and pits shall be designed as per IS 3370 with limiting crack width to 0.1mm. These structures shall be designed for following conditions 1. Water filled inside upto the designed level and no earth outside. 2. Earth pressure plus 2.0 T / M² surcharge (Vertical direction) plus ground water table at Finished Graded ground Level (FGL) outside and no water inside.

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1. Water filled inside upto the designed level and no earth outside.
2. Earth pressure plus 2.0 T / M² surcharge (Vertical direction) plus ground water table at Finished Graded ground Level (FGL) outside and no water inside.

- (b) The design of all structures other than liquid retaining/conveying structures of cooling tower above CW basin slab such as columns, beams, fins, walkways, slabs, cladding/partition wall, fan stack, precast beams etc. as applicable shall be carried out by limit state method as outlined in Clause 4.4 of IS: 3370 (Part 2): 2009. 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.

Wherever, the foundation raft of cooling tower is same as CW basin slab, the foundation shall be designed by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2): 2009 (all faces). However, if the cooling tower foundation is not the same as the CW basin slab and a separate foundation for the cooling tower is provided below the CW basin slab due to founding level requirements, the basin slab shall be designed as a structural slab resting on grid of beams taking support from columns or as a flat slab taking support from columns. Arrangement with providing walls between the columns and the periphery to support the structural basin slab is not permitted. The CW basin slab (both faces, including beams at CW basin slab level) shall be designed as structural slab by working stress method as outlined in Clause 4.5 of IS 3370 (Part 2): 2009 and the structures below CW basin slab shall be designed as per IS:456 (2000). However, the size of the column below CW basin slab upto foundation shall be maintained same as the size of the columns just above CW basin slab.

- (c) The design of staircase, switchgear building, control room/RIO room, transformer and trestle foundation, storm water drain shall be as per IS: 456 (2000).
- (d) 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.
- (e) Fan deck shall also be designed for rolling loads due to movement of equipment during Installation / maintenance operation.

Minimum Clear cover for all RCC structures/elements of cooling towers to meet durability requirements shall conform to severe exposure condition as per IS: 456 (2000).

- (b) The design of all structures other than liquid retaining/con-veying structures of cooling tower above CW basin slab such as columns, beams, fins, walkways, slabs, cladding/partition wall, fan stack, precast beams etc. as applicable shall be carried out as per IS 3370 with limiting crack width to 0.2mm. Further, for limiting the crack width, the stress for the reinforce-ment steel shall be limited to 130 MPa (on all faces) as per clause 4.4.3.1 of IS: 3370 using the partial safety factor for serviceability condition as per clause 4.4.1.3. Wherever, the foundation raft of cooling tower is same as CW basin slab, the foundation shall be designed by working stress method as per IS 3370 with limiting crack width to 0.1mm (all faces). However, if the cooling tower foundation is not the same as the CW basin slab and a separate foundation for the cooling tower is provided below the CW basin slab due to founding level requirements, the basin slab shall be designed as a structural slab resting on grid of beams taking support from columns or as a flat slab taking support from columns. Arrangement with providing walls between the columns and the periphery to support the structural basin slab is not permitted. The CW basin slab (both faces, including beams at CW basin slab level) shall be designed as structural slab as per IS 3370 with limiting crack width to 0.1 and the structures below CW basin slab shall be designed as per IS:456 (2000). However, the size of the column below CW basin slab upto foundation shall be maintained same as the size of the col-umns just above CW basin slab

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Dynamic Analysis

(a) Free vibration analysis

A free vibration analysis of the fan supporting structure including the intermediate supporting structure for motor, gear box and pillow block (if applicable) shall be carried out to calculate the natural frequency of the fan supporting structure and its fundamental natural frequency shall be at least + 20% away from the operating speed of the fan and motor.

(b) Forced vibration analysis

Forced response analysis shall be carried out on the fan supporting structure including the intermediate structure supporting the motor, gear box and pillow block to calculate the vibration amplitudes for the following unbalance condition: -

1. For unbalance load corresponding to G16 as per ISO 1940-1: 2003
2. For unbalance load corresponding to one blade failure condition.

The amplitude derived shall be within the permissible values as specified by the fan manufacturer or IS: 2974 (Part - IV), whichever is more stringent.

Mid Bearing Supporting Structure

The intermediate supporting structure for motor, gear box and pillow block if provided shall be so arranged that it does not cause any torsional moments on the beams / pedestals on which the intermediate support rests. The intermediate supporting structure shall be orthogonal to the grid of beams on which it rests. The motor shall be supported on a base frame. The concrete block supporting the fan/gear reducer shall be connected to immediate lower level of beam column junctions by means of at least four diagonal columns.

Fan Stack

The fan stack shall be made of RCC with minimum 150 mm thickness. With reinforcement provided on both faces in either direction. Design of the fan stack shall be made on the basis of relevant stipulations of IS : 11504 for Natural Draught Cooling Towers. The fanstack shall have two layers of reinforcement on either surfaces in both directions with minimum dia of reinforcement bars as 10mm and maximum spacing as 150mm c/c.

Steel Structure

These structures shall be designed, fabricated and erected as per IS: 800 (latest revision).

All mild steel parts or structural steel works used in the cooling towers shall be hot dip - galvanised as per IS: 4759 with 610gm/sq.m. coating or seal spray zinc coated as per BS:5493 (for a very long period of maintenance of more than 20 years). Nails and all components coming in direct contact with water shall be of stainless steel of SS 316 or equivalent.

For all steel structures, other than hot water pipes, sludge pipes and hot water distribution pipes, which are outside cooling tower painting shall be as specified in corrosion protection clause. However, for painting of hot water pipes, sludge pipes and hot water distribution pipes, relevant clause for painting specified elsewhere in the technical specification shall be referred.

The minimum cement content as specified in subsequent clauses of this specification shall be applicable for all structures of cooling towers.

Test for water tightness

The water tightness of C.W. basin, outlet channel, CW channel and all other water retaining structures shall be tested for water tightness as per the provisions of IS : 3370.

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5.17.00.03	Stoplog gates and Trash racks for Cooling Tower Stoplog gate and trash rack/screen shall be provided in the outlet channel of each cooling tower. The design criteria and material specification for Stoplog gates and Trash racks shall be as specified for Circulating Water Pump House.			
5.18.00	CW SYSTEM, RAW WATER SYSTEM CIVIL WORKS			
5.18.01	Circulating Water Pump House (CWPH), Existing Stage-I Raw Water Pump House (RWPH)			
5.18.01.01	A circulating water pump house (CWPH) for housing circulating water pumps and civil works associated with installation of one number pump in existing 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. Civil works associated with addition/alteration/modification as required in existing Raw Water Pump House (RWPH) for installation of raw water pumps as necessary for commissioning of system 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. d) The steel structure shall be provided to carry EOT crane of the CW Water pump houses. The over ground portion of CWPH 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 CWPH pump house shall be structurally separated from forebay by providing an expansion joint. The pump house shall be provided with separate maintenance bay ~~f) Civil works associated with existing Stage-I Raw Water Pump House with required modification 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	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			
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	NB (medium) pipes shall be provided around the operating floor on the forebay side in the stoplog and trash rack area. For Raw Water Pump House (RWPH), suitable connection shall be provided to meet the flow requirement to the existing concrete lined by cutting & making of concreting works including dewatering and under water works with all necessary arrangement & precautions. During construction it should be ensured that in any case running operation of water channel/ RCC conduit of Stage-I&II shall not be hampered. Further, associated structure for & including supply of valves/gates are also to be provided for isolation of the connection. All raw water 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.			
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 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: - 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			
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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:

- i. Maximum water level in the sumps with maximum GWT.
- ii. No water in the sumps and maximum GWT.
- iii. Alternate bays of sumps filled with water with maximum GWT.
- 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.

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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 shall be carried out to ensure proper separation of natural frequency of the structure and pump operating frequency

5.18.01.05

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:

- 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

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5.18.01.06	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 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: a. Maximum design water pressure b. Surge or water hammer pressure of 5.0 Kg / Sq.cm. 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.		
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		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 for stability against overturning and sliding. Pressure relief valves and under drainage arrangement 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. Forebay Structure Forebay consists of both side retaining walls and bottom slab. The side walls shall be analysed as isolated retaining wall for stability against overturning and sliding. The forebay bottom slab shall be structurally separated from the side walls and water stops shall be provided at the junction of bottom slab and retaining wall. Minimum thickness of forebay slab shall be 250 mm. 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. 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.		
5.18.01.07	DELETED.			
5.18.01.08	Stop-logs and Trash Racks for CWPB			
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		
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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**

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

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5.18.01.08.07	Sl. No.	Component Parts	Recommended materials	Reference
	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
5.18.01.08.08	Materials for various components of Trash Rack:			
	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)
5.18.01.09	6.	Guides	Corrosion resistant steel.	IS 6603
	Painting Specification for Structural Steel parts for Stoplog Gates and Trash Racks			
	(i) All structural steel surfaces shall be cleaned by shot blasting.			
(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.				
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5.18.01.10	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. 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.			
5.18.02.00	DELETED			
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.			
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All liquid retaining and conveying structures shall be designed by working stress method as per IS 3370 with limiting crack width to 0.1.

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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 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
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																
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.																		
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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.			
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.			
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	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.		
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 relevent clause of foundation chapter.		
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 ⁰ C to 190 ⁰ 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.		
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5.20.00 5.20.01	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.			
	Switchyard Civil Works 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. 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 Control room/Auxiliary building including civil works for panel fixing etc.			
	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			
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	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 "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 equipment's 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".
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	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 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.		
5.20.02.06	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.		
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.		
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5.20.08	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-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	CIVIL WORKS FOR FIRE PROTECTION SYSTEM Salient Features:		
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	The scope of the Bidder shall be design and construction of Civil, Structural, Architectural, Water Supply, Plumbing and Sanitary Works of Fire Water Booster Pump House including supply of all materials. The Fire Water Booster Pump House shall be structural Steel Shed superstructure with provision for a structural steel monorail. Switchgear/MCC room (if applicable), battery room & 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 ventilation fans. Fire water pipes shall be provided with either RCC trench or buried underground as per requirement. 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, BIO MASS, LIMESTONE & GYPSUM HANDLING SYSTEM		
5.23.01	Deleted	Tubular sections have been allowed in various structures of coal handling plant but not mentioned for other areas like power house, mill bunker building etc. Bidder would like to use tubular sections wherever feasible. Please confirm. Tubular sections to be used only where specifically mentioned. Bidder to comply with specification.	
5.23.02	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		
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	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. 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 8.5m 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 $1.6 \quad \times \quad \text{Rated Capacity of Conveyor system} \quad \times$		
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	----- F Conveyor Belt Speed Where, $F = 1100/800$ for coal, $1700/1400$ for lime, 1000/600 for Biomass & $1250/900$ 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 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 ...Base plates of trestle columns shall be kept 300 mm above the finished ground level. Encase-ment of the pedestal shall be done the top of the stiffener plate. 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		
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	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 section of Technical Specification. Adequate slope shall be provided for quick drainage of rain water.			
5.23.05	Deleted			
5.23.06	Deleted			
5.23.07	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.			
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5.23.09	Brick wall cladding (1m height above FFL) shall be provided all around the periphery of pump houses Deleted Brick wall cladding (1m height above FFL) and sheeting shall be provided all around the periphery of pump houses.	
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 ground level. The building shall be provided with 750 mm wide plinth protection all around as detailed elsewhere in the specification.	
5.23.11	Toilets Toilet with potable water line facilities shall be provided in each of the following locations: (A) In CHP/LHP/GHP Control Room building – (Gents and Ladies Toilets-1 No. 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.	
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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.

5.23.12

Staircases

All floors of transfer 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 MCC/control room (with only ground floor).

All stairs of over ground portion of transfer houses shall be of steel (minimum 1200 mm wide) and maximum rise should not be more than 180 mm and minimum tread width 275 mm. Stringers shall be of rolled steel channel (minimum ISMC 250) and tread shall be of electro forged steel 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 shall be of RCC construction. The minimum width of stairs for

Treads and landing shall be suitable for the prescribed load-ing. The maximum width of openings in gratings shall not ex-ceed 40 mm. The minimum size of main bars shall be 40 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.

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5.23.13	MCC/Control room shall be 1200 mm. Maximum rise should not be more than 180 mm and minimum tread with 250 mm.. 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 multi- storied MCC cum control room building. Minimum headroom in all staircases and all levels shall be 2200mm from floor finish level. Trenches 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 Deleted			
	5.23.16 Lime stone and Biomass Storage Silo The supporting structure for silo shall be of structural steel. Enclosure with side metal cladding is to be provided above Limestone/biomass Storage Silos for limestone/biomass handling equipment. Side metal cladding is also to be provided for outgoing conveyors below limestone/biomass storage silos. Stored Limestone/biomass load shall be treated as dead load for analysis and design of silo supporting structure.			
	5.23.17 Drainage & Water Supply Works			
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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 etc. with water periodically.

Minimum 4 nos. down comers shall be provided in each transfer house. In case of conveyor galleries, the down comer shall be provided at every trestle location.

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 transfer house each down comer shall lead the water / coal slurry/lime 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.

Suitable kick plates/Curb beams shall be provided around the floor openings, stair case landings, in the transfer points 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.

~~The scope for pota-~~
~~ble.....~~

~~Minimum size of main bar of steel grating (Galvanised to 610 gm/m²) shall be 40mm x 5mm and cross bars 6mm.....~~

~~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.....~~

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5.23.19	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. 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, 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, 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. 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 mummt, 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.			
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	Roofs of all M. C. C./control rooms,and TP(if applicable) 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 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. 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-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 truck hopper, MCC rooms, pump houses, transfer houses) 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 and transfer houses. 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.		
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	TECHNICAL REQUIREMENTS 		
	Finished Floor level of all buildings shall be kept at least 500 mm above the finished grade / formation level.		
5.23.21	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.		
5.23.22	CONCRETE Refer General Specification.		
5.23.23	De-watering of Deep Excavations For deep underground structures 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.		
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. / m² 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. / cm². 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		
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	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	Deleted			
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 / mm ² 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	DELETED			
5.23.29	DELETED			
5.24.00	DELETED			
5.25.00	DELETED			
5.26.00	DELETED			
5.27.00	DELETED			
5.28.00	DELETED			
5.29.00	DELETED			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-5 CIVIL WORKS SALIENT FEATURES AND DESIGN CONCEPT	PAGE 66 OF 69

TECHNICAL REQUIREMENTS

5.30.00

PARKING

30 nos
to all of

Bidder understands that FQA building and testing laboratory is same building. Please confirm.
Also kindly clarify the following:
1. FQA building/testing laboratory is permanent structure or temporary structure.
2. In case of permanent structure, please furnish the detailed specification, layout drawings and finishing schedule etc.

FQA building and testing laboratory are separate buildings.
1. FQA building is permanent building. Testing laboratory is temporary structure.

be provided in addition

5.31.00

FQA BUILDING

Amendment 08 to Technical Specifications (Section VI)

S. No.	SPECIFICATION REFERENCE				Existing	Read as
	Section / Part	Sub-Section	Clause No.	Page No.		
DB-1	VI B	D-1-5	5.31.00	67 of 69	FQA BUILDING FQA building shall be RCC construction of single or double storey and parking lots to be provided as per specifications mentioned elsewhere in the technical specifications.	DELETED
DB-2	NTPC's Clarification at (i) of SI. no. 703 of Clarification 02 for FQA lab building				(i) Bidder's understanding is not correct. FQA lab is in bidder scope. FQA lab is permanent building.	(ii) DELETED

construction of single or double storey. Total area shall be decided based in QA chapter, however, minimum area shall not be less space required to accommodate and operate all the equipments list, office space for 5 executives, one meeting room, spectroscopy room, welding booth, welding simulator area, platforms for lifts and gents toilets, space for water cooler and pantry has to be

provided as per specifications

Sheds for Construction workers and O&M Workers
Sheds for Construction workers and O&M Workers shall be permanent structure with truss roof provided with insulated sheeting with common rest room, cooking area, Food serving kiosk, drinking water facility, toilet and bathing area along with covered verandah for easy approach to facilities. The sheds should be well ventilated. The sheds to be scattered as per work locations and suitably located. Minimum 6 nos of sheds shall be constructed.

External finishes shall be Premium smooth Exterior Paint with silicone additives over Texture Coat. Bidder to refer Tender Drawings 1150-999-POC-A-020.

5.33.00

SAFETY CONTROL ROOM

Safety control room shall accommodate equipment. Additionally, it shall have

5.34.00

BIO TOILET

Bio-Toilet shall be provided. Besides these are a Bio-toilet.

Bio-toilets shall be decomposition and 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

i) SUB-SECTION-D-1-5
ii) SUB-SECTION-D-1-9
iii) SUB-SECTION-D-1-5

i) 67 of 69
ii) 29 of 33
iii) 67 of 69

i) 5.31.00
ii) Table A
INTERIOR
FINISHING
SCHEDULE
iii) 5.30.00

i) FQA BUILDING
ii) Vehicle parking sheds
iii) PARKING

i) Owner to please confirm location and scope for FQA Building as same is not mentioned in Section VI / Part A (Sub-Section-11D Civil Works)
Bidder understands that same is not in the scope of work and temporary FQA lab will be provided during construction period.
In case permanent FQA building is envisaged, request owner to furnish necessary details such as size of FQA building, location in plot plan etc.
Owner to also confirm.
ii) Location in plot plan & Size of vehicle parking sheds, capacity etc.
iii) Location in plot plan & Size of open car/scooter parking, capacity etc.

i) Bidder's understanding is not correct. FQA lab is in bidder scope. FQA lab is permanent building
ii) GLP is to be further developed by bidder during detailed Engineering stage. Accordingly vehicle parking shed shall be located in GLP by bidder
iii) GLP is to be further developed by bidder during detailed Engineering stage. Accordingly car/scooter parking shall be located in GLP by bidder

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

- 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.
- For Male Toilets Urinal as per requirements, with all fittings with photovoltaic control flushing system as per IS: 2556.
- One number looking mirror 600 x 900 x 6 mm, edge mounted with teak beading and

TECHNICAL REQUIREMENTS

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.

In addition to this permanent sample collection provision(tap/alternate arrangement) to be made before reaching of treated effluent to soak pit. This is to ascertain the quality of effluent at all periods of time and this would also help in the seeding requirement of bacteria.

Kindly clarify the following:

1. Worker's Accommodation building is permanent structure or temporary structure.
2. In case of permanent structure, please furnish the detailed specification, finishing schedule etc.

Worker's Accommodation building is temporary structure.

5.35.00

DELETED

5.36.00

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.~~ **WORKER'S ACCOMODATION BUILDINGS**

~~Toilet, bathroom and washing area. It shall have structure having sandwich panel roof sheeting.~~

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

5.37.00

OCCUPATIONAL HEALTH CENTRE WITH CRECHE

Occupational Health Centre shall be R.C sq.m. This building shall have following facilities

Waiting Lobby cum Reception

Doctor's Chamber with attached toilet (Two Nos)

First Aid Room

Two bedded patient Room

Driver's Room with attached bath and toilet

Section VI)

physically handicapped

n & toilets for construction

R.C

facilities for drinking water & sanitation, approach road, dust suppression, drainage, sewage treatment plant, solid waste collection & disposal, fuel for cooking, medical healthcare, creches, Occupational Health Center etc. The Occupational health centre shall be a single storied RCC framed building of minimum area of 300 sqm. meeting the statutory requirements.

Bidder understand Occupational health

Please furnish the creche.

Kindly clarify the following:

1. O & M worker's shed is permanent structure or temporary structure.
2. In case of permanent structure, please furnish the detailed specification, layout drawings and finishing schedule etc.

1. O & M worker's shed (Sheds for Construction workers and O&M Workers) is permanent structure.
2. Refer amendment no. D1-59

5.38.00

O & M WORKERS SHED

RCC framed structure with truss roof provided with insulated sheeting catering to 20. No of workers each (approximately 18m x 7.5m area) with common rest room, cooking area, drinking water facility, toilet and bathing area along with covered verandah for easy approach to facilities. The rest room should be well ventilated. The rest rooms to be scattered as per work locations and suitably located in GLP.

External finishes shall be Premium Smooth Exterior Paint with silicone additives.

	TECHNICAL REQUIREMENTS 		
5.39.00	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. HARD CRUSTING Hard crusting in preassembly area and any other areas shall be done with 63mm to 45mm graded stone aggregate, watering and compacting each layer (not exceeding 200mm in thickness) to minimum of 85% of original volume of stone stack including filling the interstices of stone aggregate with moorum/locally available non-expansive soil. The minimum compacted thickness of stone aggregate layer shall be 200mm. The compacted subgrade below stone aggregate shall be 85% of standard proctor density		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
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, 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			
SIPAT SUPER THERMAL POWER PROJECT STAGE-II (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-6 CIVIL WORKS DESIGN CRITERIA	PAGE 1 OF 23

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																																																															
	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><thead><tr><th>Sl.No.</th><th>Location</th><th>Imposed Loads (T/Sq.m.)</th></tr></thead><tbody><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></tbody></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) <table><tr><td>iv)</td><td>MCC, switchgear and Control building floors</td><td>1.00</td></tr><tr><td>v)</td><td>Roof (Where no equipment are located)</td><td>0.15</td></tr><tr><td></td><td>(Where equipment are located)</td><td>0.5</td></tr><tr><td>vi)</td><td>A.H.U Room, Battery Room, Air Washer Room</td><td>1.0</td></tr></table> D) Coal, Bio mass, ,Limestone and Gypsum handling structures <table><tr><td>i)</td><td>Roofs</td><td>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.</td></tr><tr><td>ii)</td><td>Conveyor galleries</td><td>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/lime/biomass dust load (Dead load) of 50 kg. / sq. m. on walkway way shall also be considered.</td></tr><tr><td>iii)</td><td>Covers for trenches / channels/ drain</td><td>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.</td></tr><tr><td>iv)</td><td>Sumps and tanks and other underground basement type structures/ drain</td><td>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</td></tr></table>			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	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/lime/biomass 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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SIPAT SUPER THERMAL POWER PROJECT STAGE-II (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-6 CIVIL WORKS DESIGN CRITERIA																								
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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. iv) Bio mass 1000 kg. / Cu. M. For sizing calculation v) Lime stone 1400 kg. / Cu. M. vi) Gypsum 1100 kg. / Cu. M. vii) Coal 800 kg. / Cu. M. viii) Bio mass 600 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		
(I)		Loads for solar installations over roof to be taken not less than 1 KN/sqm. Roof slab to be design for local effect due to wind load at support location for installations		
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 unfavourable Combination of Dead Loads, Imposed Loads, Equipment Loads, Piping / Cables / Ducts Loads, Wind / Seismic		
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		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 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 Prints and Conveyor Trestles			
i) 6 of 23 ii) 55 of 69 & 61 of 69		i) 6.03.03 ii) 5.23.02 & 5.23.14 i) Design of steel structures shall be done as per provisions of IS:800: 2007 (Limit state design) and other relevant IS standards including National Building Code(2016). For design of coal bins and loading hopper IS:9178 (part I to III) shall be followed. ii) 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." NTPC to kindly confirm: Steel section using tubular sections shall be design as per IS:800-2007(Limit state design), and not using IS : 806.		Limit state design philosophy is to be followed for design of steel structures as per IS : 800-2007. However, IS : 806 is to be referred for properties of tubular sections. Bidder to comply to specifications requirement.	
6.03.03		Design of steel structures shall be done as per provisions of IS:800: 2007 (Limit state design) and other relevant IS standards including National Building Code(2016). 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) 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, Biomass, Limestone and Gypsum handling structures: 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. 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.			
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6.03.08.01	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 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 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, 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 foundations of transfer points & 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				
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.				
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	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.																			
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: <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>10 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	10 mm	b)	Beams	12 mm	8 mm	c)	Columns	12 mm	8mm
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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 requirements-																					
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 or 6mm flats. 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	Deleted																					
6.03.09	Horizontal Deflection criteria																					
	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 colspan="3">-----</td></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><tr><td colspan="3">-----</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	-----		
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	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.																						
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	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 repose of 37 degrees.		
6.03.13	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		
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	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.			
6.03.14	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.			
6.03.15	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.			
6.03.16	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.			
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 TG, TDBFP, MDBFP & Fan foundations			
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6.03.18	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: 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. 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.		
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6.03.19	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.			
6.03.20	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.			
	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.			
6.03.23.01	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		
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	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
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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.																								
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	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 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.			
6.03.31	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:			
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6.03.33	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 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). 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).			
	6.03.34	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		
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6.04.00 6.04.01	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. CORROSION PROTECTION General (a) All Steel structures shall be provided with painting system as mention below in this specification for the Corrosivity category mentioned in Part A-IID-Civil Works 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 considerations in ISO 12944 Part 3. Where steel is fully accessible for cleaning and repainting and where it is feasible to follow design criteria given in ISO 12944 part 3, minimum thicknesses of structural members shall be as follows																											
	<table><tr><td>Structural Sections</td><td>Minimum thickness</td><td>Minimum Flange thickness</td><td>Minimum Web thickness</td></tr><tr><td>Plates</td><td>6</td><td></td><td></td></tr><tr><td>Built up Sections</td><td></td><td>6</td><td>6</td></tr><tr><td>Angle sections</td><td>6</td><td></td><td></td></tr><tr><td>ISMB /ISMC</td><td></td><td>6</td><td>4.5</td></tr><tr><td>NPB/ WPB</td><td></td><td>6</td><td>4.5</td></tr></table>				Structural Sections	Minimum thickness	Minimum Flange thickness	Minimum Web thickness	Plates	6			Built up Sections		6	6	Angle sections	6			ISMB /ISMC		6	4.5	NPB/ WPB		6	4.5
	Structural Sections	Minimum thickness	Minimum Flange thickness	Minimum Web thickness																								
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	All dimensions in mm				
6.04.02	Where steel surfaces are inaccessible for cleaning and repainting (such as back to back sections, lap joints etc.) 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 minimum thickness specified above, whichever is more). The minimum thickness consideration shall apply for both web and flange. However minimum gusset plate thicknesses shall be followed as mentioned else where in the specification and minimum angle section to be used is ISA 50x50x6. Ends of tubular sections to be effectively sealed at both ends. Also tubular handrail thicknesses will be as governed by mentioned clauses in the spec 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.				
	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) Following painting system corresponding to corrosion category as mentioned in Part A IID Civil Works of this specifications shall be adopted for the project.				
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC
	CORROSSIVITY CATEGORY (as per ISO 12944-2)	PRIMER COAT	INERMEDIATE 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 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 100 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.	
	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	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	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	
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CLAUSE NO.	TECHNICAL REQUIREMENTS 			
6.04.04		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.	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.	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: - 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. - The most frequent problem associated when top coating Primer is bubbling/pinholes 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. - 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. - 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. Coating for Mild Steel parts in contact with Water. - 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. - 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. Gratings			
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6.04.06	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. Hand Railings and Ladders All Mild steel (MS) handrails and ladders in outdoor locations and in pump valve pits shall be galvanized 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	Chequered plate to receive same corrosion protection measures as structural steel unless specified other wise.			
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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एनटीपीसी NTPC TECHNICAL REQUIREMENTS			
7.00.00	FOUNDATION SYSTEM AND GEOTECHNICAL DATA		
7.01.00	Soil Data Owner has carried out detailed geotechnical investigation at the project site. Bore logs data and Bearing capacity for design of foundations are given at Annexure - C of this specification. The detailed geotechnical investigation report comprising of Boreholes, Laboratory tests, Chemical analysis, etc for the sub-strata prevailing at site would be made available for the Bidder's study at the Owner's office, if required. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data lies with the Bidder. 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 for any area not covered in the provided geotechnical data, the bidder has to carry out geotechnical investigation in the area at no cost to Owner. Geotechnical investigation work shall got executed by the Contractor through the agencies as mentioned in Clause No. 7.06.00. 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. Net allowable bearing pressure shall be limited to Table-1 of Annexure-C. 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 ground level (EGL) / natural ground level (NGL) and finished ground level (FGL). As per borelog data and topographical survey drawing, Natural ground level at few location is approximately 1m to 4.5m below finished ground level. Further, wherever ash/coal deposit/brick-bats etc. is found the same shall be treated as filled up soil. As per borelog data, water table is varying from 0.0m to 6.2m at the time of field investigation and may fluctuate with season.		
7.01.01	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.		
7.01.02	Tank Foundations - 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. - 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. - Natural sand/ sand manufactured from other than natural sources as specified elsewhere in the technical specification shall be spread in layers not exceeding 30cm		
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				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 foundation 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) 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 $4 T / M^2$ 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 $4T/m^2$. 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 $4T/m^2$. 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. b) In case of soil, minimum founding level shall be 1.0m below Finished ground level (FGL) or, 1.0m below Natural ground level (NGL) whichever is lower.
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	In case of rock, minimum founding level shall be 1.0m below Finished ground level (FGL) or, 0.3m embedment in rock whichever is lower. For meeting the bearing capacity and /or functional requirement lower depth to be adopted based on requirement. 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 M7.5 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 minimum embedment as per Annexure-C into the rock, shall be removed and built up through PCC M10 upto the designed bottom level of the foundation. The founding level for all the open foundations shall be kept at same level for 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.			
7.03.00	Excavation, Filling and Dewatering			
7.03.01	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.			
7.03.02	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.			
7.03.03	<u>Backfilling in Power House & Boiler Area</u> Backfilling around foundations, trenches, sumps, pits, plinths, etc. shall be carried out with natural sand/ sand manufactured from other than natural sources as specified elsewhere in the technical specification 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 00mm 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.			
7.03.04	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.			
7.03.05	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.			
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7.03.06	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.		
7.04.00	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.		
7.04.01	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).		
7.04.02	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. 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.		
7.05.00	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.		
7.06.00	Geotechnical investigation work may be got executed by the Contractor through the following 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 5. Secon Private Limited, Bangalore 6. Soil Engineering Consultants, New Delhi 7. CEG Test House and Research Centre Private Limited, Jaipur		
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8. Geomarine Consultants Pvt Ltd., Chennai

9. Soiltech India Private Limited, Pune

Annexure-C

SOIL DATA AND FOUNDATION SYSTEM

Employer has carried out geotechnical investigation in the proposed area. Logs of boreholes of proposed area are enclosed with this Annexure.

- a) The minimum founding level and the corresponding net allowable bearing pressure shall be as given in Table – 1 below.

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 Soil			
1.0m below NGL	12	12	12
2.0m below NGL	15	15	15
3.0m or more than 3.0m below NGL	25	25	25
In case of rocky strata			
Minimum 0.30m Embedment in weathered rock	25	25	25
Minimum 0.60m Embedment in weathered rock	30	30	30
Minimum 1.0m Embedment in weathered rock	35	35	35
Minimum 1.5m Embedment in weathered rock	40	40	40
Minimum 2.0m Embedment in weathered rock	45	45	45
Minimum 2.5m Embedment in weathered rock	50	50	50

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Minimum 3.5m or more than 3.5m embedment into weathered rock	55	55	55

For Finished ground level (FGL) refer General layout plan (GLP)

To determine the Natural Ground Level (NGL) the tender drawings titled TOPGRAPHICAL SURVEY shall be referred. Further the above tender drawings shall also be referred in conjunction with borelog data attached at Annexure to this chapter.

The NGL for any particular structure/facility shall be the lowest of all the NGLs mentioned in the extent of the building/facility.

The NGL of any point shall be the lowest of the levels at (a) TOPGRAPHICAL SURVEY and (b) Borelog data attached at Annexure to this chapter.

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 M7.5.

The net allowable bearing pressure higher than above mentioned values shall not be permitted. At intermediate levels the bearing capacity shall be same as the net allowable bearing pressure corresponding to the immediate shallower level mentioned above.

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:**

i) Chemicals in ground water and subsoil, as observed during investigation are:

Chemical	Sulphates	Chlorides	pH
Ground Water	12.9-15.5 mg/l	14-64 mg/l	6.80-7.13
Sub-soil	0.05%	0.005-0.007 %	6.38-6.91

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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.
	Please furnish the list of vulnerable structures, buildings, where anti termite treatment is required.
Anti-termite treatment is to be carried out by bidder in all vulnerable area in consultation with NTPC during project execution.	
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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 confirming to IS:15658, 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.			
8.01.02.31	All opening in floors/roofs/cladding for routing of pipes/cables/ducts shall be suitably sealed by the contractors after completion of erection works.			
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- 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

Sl No	Description	Minimum concrete grade	of
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, Stackers and Reclaimers 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	

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8.02.02	<table><tr><td>vi)</td><td>Rail load Bearing Structures</td><td>M35</td></tr></table>			vi)	Rail load Bearing Structures	M35	
	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: i) OPC 43 grade cement shall be used to design M50 grade of concrete mix. However in case the mix design using OPC 43 grade cement fails to achieve the target strength of M50 grade concrete, OPC 53 grade cement may be used provided adequate precautions for higher heat of hydration and quality assurance measures are in place. ii) The concrete slump shall be in the range of 150-180mm at pouring point. iii) Maximum cement content (OPC) shall be limited as stipulated in IS 456. iv) Free water-cement ratio shall be as per clause 5.1 of IS 10262. v) PCE type superplasticizers shall be used as high range water reducing admixtures (Type F as per ASTM C494 or equivalent) in the concrete mix. Dosage & mixing methodology of this chemical admixture shall be as per manufacturer's recommendation. vi) Fly ash shall be not be used as replacement of total cementitious materials. d) Higher grade of concrete than specified above may be used at the discretion of the Bidder. e) Unless otherwise specified, 20mm and down aggregates shall be used for all structural concrete works. However, 40mm and down aggregates may also be used under special conditions for mass concreting in foundation. f) For thin concrete sections such as roof slab over profiled metal deck sheets, 12mm and down coarse aggregates shall be used for coarse aggregates. g) Minimum 75mm thick lean concrete M-7.5 shall be provided below all other underground structures, foundations, trenches, etc., to provide a base for construction. h) All structural(reinforced) concrete production shall be done at automated batching plant of suitable capacity, conforming to IS:4925., situated within the area allocated to the contractor. Batching plant shall also have provision to mix fly ash (by weight). The batching plant shall have facility of digitised recording of the materials added along with quantity of concrete produced in each batch and printout of the same. Batch-wise report for each shift shall be submitted to the Engineer. Reinforcement Couplers Reinforcement couplers (mechanical splicing systems with upset parallel threaded couplers) may be used in reinforced concrete works, subject to following conditions: a. Couplers shall meet the performance requirements of IS 16172 for class H. i. It shall have minimum tensile strength corresponding to Fe550D which is 600 N/mm2 and failure shall take place outside the length of splice as per clause no 9.2.1 of IS 16172. ii. Percentage elongation at maximum force in the reinforcing bar outside the length of mechanical splice shall be minimum 3 % before the failure of test piece as per clause no. 9.2.2 of IS:16172. iii. Slip test value shall not exceed 0.10 mm. as per clause no 9.3 of IS 16172.							
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8.02.03	iv. Cyclic tensile test corresponding to Fe550D reinforcement bar as per clause no 9.4 of IS 16172. v. Low cycle fatigue test as per clause no 9.5.1 of IS 16172. vi. High Cycle Fatigue test as per clause no 9.5.2 of IS 16172.			
	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				
Admixtures in concrete for promoting workability, retarding setting, reduction in permeability, facilitating pumping of concrete, etc., shall be used as per the approved mix design after approval from the Engineer. Admixtures shall conform to clause 5.5 of IS: 456. These shall be free from injurious amount of chloride, etc. Addition of admixtures should not reduce the specified strength or durability of concrete and should not have detrimental effect on reinforcement.				
The admixtures shall conform to IS: 9103 or ASTM C-494 and shall be proven performance record make and from a reputed manufacturer. Calcium chloride as accelerating admixture is not permitted to be used.				
Admixtures shall either be naphthalene based or any other material approved by the Engineer. Ligno-sulphonate based materials shall not be used. Admixtures shall be used in liquid form only, quantity of which shall be as per manufacturer's				
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8.02.04	recommendation and approved mix design. 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 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		
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8.03.00	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. 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.~~ as per the criteria specified in metal deck roof material clause in Chapter 9. These profiled metal deck sheets shall be fixed to the structural 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.			
	8.04.00	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:		
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		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 minimum vertical clearance of 8.5m shall be maintained between Rail top level and bottom of structure. However, a minimum vertical clearance of 6.5m shall be maintained between Rail top level and bottom of structure in case of FA silo. 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	Bidder understands that fencing for isolation between existing station and the project is excluded from bidder's scope. Please confirm.		Bidder understanding is correct. Fencing for isolation between existing station and the project is excluded from bidder's scope.	
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. 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				
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8.06.00	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.			
	GRATING All gratings shall be electroforged types. Minimum thickness of the grating shall be 40 mm 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. All steel structures shall be fabricated in factory, transported and erected at site. All factory fabricated structures shall have bolted field connections. Coal bunkers, Lime storage silo and biomass silo 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, 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.			
	8.07.01	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		
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8.07.01.1	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 separation is 1.5mm or greater, the fillet weld size shall be increased by the amount of separation. Edge preparation for welding as per weld joint detail shall be prepared either by machines or by automatic gas cutting. All edges cut by flame shall be ground before they are welded. Electrodes a) The electrodes used for welding shall be of suitable type and size depending upon specification of the parent materials, the method of welding, the position of welding and quality of welds desired e.g. normal penetration welds or deep penetration welds. However, only low Hydrogen electrodes shall be used for plate thickness above 20 mm. b) All low hydrogen electrodes shall be baked and stored before use as per manufacturer recommendation. The electrodes shall be rebaked at 250°C - 300°C for one hour and later on cooled in the same oven to 100°C. It shall be transferred to a holding oven maintained at 60°C - 70°C. The electrodes shall be drawn from this oven for use. c) Where coated electrodes are used they shall meet the requirements of IS: 814 and relevant ASME-Sec. Covering shall be heavy to withstand normal conditions of handling and storage. d) Only those electrodes which give radiographic quality welds shall be used for welds which are subjected to radiographic testing e) Where bare electrodes are used, these shall correspond to specification of the parent material. The type of flux-wire combination for submerged arc welding shall conform to the requirements of F-60 Class of AWSA-5-17-69 and IS: 3613. The electrodes shall be stored properly and the flux shall be baked before use in an oven in accordance with the manufacturer's requirements as stipulated. f) 308L and 309L electrodes / fillers shall be used for welding of stainless steel to stainless steel and stainless steel to mild steel respectively.			
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	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 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			
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8.07.01.6 8.07.01.7 8.07.02	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. 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. 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 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. Painting
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8.07.03	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.		
8.07.04	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.		
	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.			
	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.			
8.07.04	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			
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8.08.00 8.08.01 8.08.02 8.08.03	columns, their location shall generally be just above a floor level.			
	STEEL HELICAL SPRINGS AND VISCOUS DAMPERS UNITS			
	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. 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.				
Design & Supply of Material				
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				
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8.08.04	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 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		
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8.08.09.1	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.			
	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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8.09.00	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. 8.10.00 Controlled Low Strength Material (CLSM) Bidder to refer Annexure-AC-3			
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D-1-9 9.01.C 9.02.0 9.02.C	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 finished with suitable paint. All rungs and ladders shall also be finished with suitable paint. 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.	refer to 5.01.00 in this specification. for/ roof level) hand railing shall be provided around is/balconies, walkways, platforms, steel stairs, etc., ng is more than 12m, railing height shall be 1.2m. All pt at operating floors) shall be 32 mm nominal bore ming to IS: 1161 and shall be galvanised as per IS: paint. All rungs and ladders shall also be galvanised. rall be 610 g/sqm. The spacing of vertical posts shall ber of horizontal rails shall be provided including the rd/ kick plate of min size 100x6th shall be provided	
Section VI	b) All stairs shall have a maximum riser height of 150mm and a minimum tread width of 300 mm. Minimum clear width of stair shall be 1500 mm unless specified otherwise. The width of staircase shall meet the National Building Code require-ments.	b) All stairs shall have a maximum riser height of 150mm and a minimum tread width of 300 mm. Minimum clear width of stair shall be 1500 mm unless specified otherwise. The width of staircase shall meet the National Building Code require-ments.	
9.03.00	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. For SS handrail 32NB/50NB/60NB (polished) stainless steel pipe with wall thickness 1.65 mm (minimum) 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 knee guard (100 mm wide and 6 mm thick) shall be provided above the floor level. b) All stairs shall have a maximum riser height of 150mm and a minimum tread width of 300 mm. Minimum clear width of stair shall be 1500 mm unless specified otherwise. The width of staircase shall meet the National Building Code requirements 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. Water Supply and Sanitation	riser height of 175mm and a minimum tread width of stair shall be 1200 mm unless specified otherwise. ng shall be provided with 1 meter high brick wall at aving metal cladding shall be provided with a 150 mm or) at the edge of the floor along the metal cladding. ailing shall be provided on this RCC kerb, wherever view. le arrangement for draining out water collected from , floor washings, fire fighting, etc., shall be provided all be suitably covered with grating or precast RCC provided for main entrance of all RCC construction indow and 600mm door heads, 900mm over rolling shutters, architectural facia, projections, etc., shall be provided with drip course in cement sand mortar 1:3.	
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9.03.01	Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement shall be provided. e. Polyethylene water storage tanks conforming to IS: 15778, having thermal stability and added fittings shall be used for internal piping with CPVC pipes as shall be followed. guidelines as stipulated above ground level. Chlorinated Polyethylene (CPVC) for hot & cold water internal piping with CPVC pipes as shall be followed. UPVC (conforming to IS: 15778, having thermal stability and added fittings shall be used for internal piping with CPVC pipes as shall be followed. All Buildings shall have the following facilities: All buildings shall have the following facilities: block shall depend on the number of users and 8 hours requirement shall be as stipulated above ground level. requirements for the buildings shall be as stipulated above ground level. In addition, IS:2556 shall be followed.	Each Toilet block shall have the following minimum facilities. Unless specified all the fittings shall be of Chromium plated brass (decorative type). (Jaquar / Hindware/ equivalent) 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. (Jaquar / Hindware/ equivalent) b) One number colour glazed ceramic oval shaped wash basin 450x 550 mm (approx.) mounted under the counter with 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 boarding and minimum 12 mm thick plywood backing or mounted with SS Studs, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser. (Jaquar / Hindware/ Asahi/ Saingobain / equivalent) e) One toilet with required facilities shall be provided for physically challenged persons on Ground floor of Main Power House Building. 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 coupling, CP bottle 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 minimum 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, CPVC concealed water supply pipe of minimum 12 mm diameter, CPVC 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 Control Room floor of ESP control room building and One number of pantry shall be provided in Buildings having Control Room .. i) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS: 2556 (Part-5) with single 15 mm C.P. brass pillar taps with elbow operated levers ISI Marked.	15778, having thermal stability and added fittings shall be used for internal piping with CPVC pipes as shall be followed. as above ground level. ms. facilities provided in the toilet facilities to be provided shall be followed for working out the basic
9.03.02	Each Toilet block shall be of Chromium plated brass (decorative type). (Jaquar / Hindware/ equivalent) a) One number dual flushing valve system, water faucet (Jaquar / Hindware/ equivalent) b) One number colour glazed ceramic oval shaped wash basin 450x 550 mm (approx.) mounted under the counter with 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 boarding and minimum 12 mm thick plywood backing or mounted with SS Studs, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser per physically challenged persons e) One toilet with required facilities shall be provided for physically challenged persons 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 coupling, CP bottle 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 minimum 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, CPVC concealed water supply pipe of minimum 12 mm diameter, CPVC 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 Control Room floor of ESP control room building and One number of pantry shall be provided in Buildings having Control Room .. i) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS: 2556 (Part-5) with single 15 mm C.P. brass pillar taps with elbow operated levers ISI Marked.	Unless specified all the fittings shall be of Chromium plated brass (decorative type). (Jaquar / Hindware/ equivalent) ina European water closet and faucet (Jaquar / Hindware/ equivalent) basin 450x 550 mm (approx.) mounted under the counter with 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. tings with photovoltaic control flushing system as per IS: 2556. ar / Hindware / Asahi) , edge mounted with teak boarding and minimum 12 mm thick plywood backing, one number liquid soap dispenser per physically challenged persons 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 coupling, CP bottle 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 minimum 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, CPVC concealed water supply pipe of minimum 12 mm diameter, CPVC 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)	
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	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 Control Room floor of ESP control room building and One number of pantry shall be provided in Buildings having Control Room . i) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS: 2556 (Part-5) with single 15 mm C.P. brass pillar taps with elbow operated levers ISI Marked. 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 necessary plumbing and sanitary arrangement, shall be provided for workers (O&M workers). 9.04.00 Flooring Floor finishes of approved shade and colour 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 50/70 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. Water proofing treatment in sunken portion of WCs, bathroom, kitchen, pantry etc., shall be done in two (2) coats by applying cement slurry mixed with water proofing cement compound (confirming to IS 2645). The First layer shall be of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer shall be allowed to air cure for 4 hours. The Second layer shall be of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing. The water proofing shall be done for the entire sunken area.
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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 ceramic Hardener Topping shall be 12 mm thick. Metallic Hardening Compound shall be of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. The ratio of Metallic hardener and Cement shall be 1:4. This mix	using white cement s for wearing course		
9.04.05	Digitally glazed and wall tiles shall be	glazed ceramic floor		
	a) Floor - 300x300 equivalent	Somany/ Johnson or		
	b) Walls - 300x600 equivalent	omany/ Johnson or		
	c) Walls - 300x450 equivalent	omany/ Johnson or		
9.04.06	12mm / 20mm thick on all surfaces, at all levels. 12 mm thick bitumen under-bed by PCC with acid/alkali resistant 20 mm and bitumen	horizontal and vertical in primer followed by R. tiles, 6 mm thick inting of joints of tiles t-l), up to a depth of		
9.04.07	Battery Room in 1200mm high.	as on flooring & dado		
	(i) Mirror polished tiles with stainless steel hardener	zed Vitrified ceramic neatly with 3x4mm ed shade (0.10kg of as under:		
	a) Double charged , Size of tile 600x600/605x605 of Kajaria/ Somany/ Series Johnson / NITCO / JHONSON / RAK or equivalent			
	b) Double Charged, Size of tile 800x800 of Kajaria/ Somany/ NITCO / Johnson /RAK or equivalent			
	ii) Anti-Skid Full Body Vitrified Tiles			
	Antiskid, full body Vitrified Tiles (KAJARIA/ RAK/NITCO / JOHNSON)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 (KAJARIA/ RAK/NITCO / JOHNSON) 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.			
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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	
9.04.11	Mirror (making minimum) / Flame finish/ 18 mm thick
9.04.12	Decorative concrete tiles
9.04.13	Skirting level from false ceiling
9.04.14	Interlocking 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	24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern. Engineered wooden flooring (15mm thick) of Mikasa/ Century/ Pergo / Equivalent shall be provided in VIP area, conference rooms.
9.04.16	Ru Ru of res an gra 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 3x4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile. Porcelain tiles shall be provided in Service Building.
9.05.00	Ep Se sul col 24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern.
9.06.00	Rd
9.06.01	Ex wo de ha be the Engineered wooden flooring (15mm thick) of Mikasa/ Century/ Pergo / Equivalent shall be provided in VIP area, conference rooms of Service Building and MPH building.
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	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.
9.06.02	~~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
9.06.04	ment mortar (1:4) shall be provided on top to IS 13592 , Type A with with joints with seal rain off rain water from the roof. These shall at concrete / or sheeting work to match with comers shall be governed by IS 1742 and IS ings having cast-in-situ RCC roof shall be n size Khurras having minimum thickness of x 1 m x 400 micron and finished with 12 mm be provided with suitable fittings and fixtures.
9.06.05	Over-Deck Insulation Roof insulation with 40 mm thick impervious sprayed, closed cell free Rigid Polyurethane foam over deck insu-lation conforming to IS: 12432 Part-III (density of foam being 40-50 Kg/Cum), over a coat of Polyurethane primer applied @ 6-8 sqm per litre, laid over 400 G Polythene sheet over PUF spray and provided with a wearing course of 40 mm cement screed 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) in chequered rough finish, in panels of 2.5m X2.5m and em-bedded with 24G wire netting and sealing the joints with polymerized mastic, shall be provided on the roof of Ser-vice Building above the waterproofing. be finished with 15mm thick cement plaster ric membrane shall be laid. The elastomeric applied urethane laid over reinforcing layer e. The top of the elastomeric membrane shall nd (1:4) mortar with chicken wire mesh and thickness where applicable shall be laid over al 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) with coping for all accessible roofs and 600 mm height for all non-accessible roofs shall be provided. Alternatively, parapet

The elastomeric membrane above mentioned for water-proofing shall be of two component, instant setting, 100% solids spray applied hybrid polyurea polyurethane liquid applied elastomeric seamless waterproofing membrane meeting the requirements of LAM as per ASTM C836 and having excellent tensile strength of 15MPa (As per ASTM D412), elongation more than 450% (as per ASTM D 412), tear strength of 60 Kn/m (As per ASTM D1004/ASTM D624), adhesion to concrete of 2MPa (as per ASTM D 4541), abrasion resistance of 60mg loss (1 Kg,CS 10 Wheels,1000 cycles - As per ASTM D4060), Shore A Hard-ness of 85 (As per ASTM D2240), resistance to hydrostatic pressure head of 7 Bar (As per ASTM D 5385/ DIN 16726), puncture resistance of 1000N (As per ASTM E154), water vapour permeability of 25 mg/m2/day (As per ASTM E96), Impact resistance of 17 N.m (As per ASTM D2794), Low temperature

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	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. For control room , control equipment room in MPH Building, where dry wall construction is envisaged, the walls shall be constructed 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. The Outer wall of control room, control equipment room in MPH Building shall be made of aerated concrete panels over that 50 mm thick mineral wool insulation and metal sheeting on outside.	shall be of Autoclaved Aerated Concrete Block. block masonry shall be with blocks having dimensions of from 100 mm to 300 mm conforming to I.S. :2185(part III).The composition of 1: 6 (Cement: sand) shall be used and having modulus of fineness 1.1 shall be used. The jointing cement sand mortar shall be approximately 10 mm. In case of partition walls joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall 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 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. The Outer wall of control room, control equipment room in MPH Building shall be made of aerated concrete panels over that 50 mm thick mineral wool insulation and metal sheeting on outside	
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.		
9.07.07	Enclosure of the elevator shall have 2 hours fire rating and it shall be sealed from outside to ensure dust free environment.		
9.08.00	COLOUR COATED AND OTHER SHEETING WORK		
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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 Y250 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 Y350 as per IS15961/ 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 Y550 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. 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 (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.		
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	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.			
9.08.02	Colour Coating	Steel shall be colour coated with total coating thickness of at least 40 microns (nominal) comprising of silicon modified polyester (SMP) paint or Super Polyester paint or SDP paint (Super Durable Polyester with no TGIC Triglycidyl Isocynurate) . The silicon content in the SMP paint to be 30 to 50%. The paint to be , 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/SDP systems shall be of industrial finish of product type 4 of AS/NZ2728. Also the heavy metal content (Lead, Cadmium, Chromium etc) to be within environmental norms so that the sheet is also suitable for rainwater harvesting		
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.		
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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. 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. 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 Y250 as per IS15961/ 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 Y350 as per IS15961/ 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 Y550 as per IS15961/ 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		
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	(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. The contractor shall prepare working drawings of sheeting system including end and side laps fixing details etc. 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.			
9.08.07	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,			
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 / other equivalent approved sahde). 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.			
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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.~~			
9.10.10	All internal paints shall be of low VOC (Less than 50 g /L) content. 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: a) 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. b) Aluminium Composite Panel cladding (Alucobond/ Alpolic / Aludecor /Equivalent) 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. c) 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	DELETED.			
9.10.11	DELETED			
9.10.13	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.~~			
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P Fi fu sl w al A B P C a: m oi ar cr oi fo Ti al oi cr bi e: A Ti m aj st m st aj w Fi a: P W cr g: e: th Ti pi	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 pre- Section VI pared surface shall have received the approval of the Engineer in charge after inspection before painting is commenced. Textured base coat Exterior wall Texture-New work (Two or more coats applied @ 6.5kg/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm). High Quality Exterior Acrylic Modified resin and special quality Silica Quartz with Trowel Texture (Asian / Dulux/ Nerolac/ Berger/ Equivalent) as per selection.....	lae, ster sing rge ring be and n to hall jud be e to ase be the its ring be the per The ore be aint ish, on on be ely. ater
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	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 incharge 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 airconditioned areas wherever clear view is necessary.			
9.11.04	a) The doors frames shall be fabricated from 1.6 mm thick MS sheets and shall meet the general requirements of IS: 4351.			
	b) 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 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 Alluminium 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. At the entrance of all common control rooms in MPH G.I. framed with fire resistant glass, sliding doors shall be provided.			
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	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 (Swing / Sliding) shall be of uniform GI profile 50X50 mm with 14mm(Minimum) 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 thick , 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 37 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 shall 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 shall 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. The sliding door system shall be connected to the surrounding construction by means of interlocking labyrinths lined with intumescent tapes as per the test evidence and connected to the sliding mechanism at the top. The sliding mechanism shall be as mentioned in the tested evidence or Assessment and shall have steel rollers. The glass should 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 sliding mechanism shall be fixed to adequate supporting construction (MS channel / Reinforced concrete) to ensure proper support for the door. Fire Rated Door (swing / sliding) shall be of Makes- Saint Gobain, Acodor, IGI, Matrix. 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		
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	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 made in India . The shutters shall be fixed to the frame using Weld-on hinges of dimensions 179mm X 20mm. The profiles shall have groves 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, Acodur , IGI, Matrix.			
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).			
9.12.06	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. For internal glazed partition, 8mm thick clear toughened glass shall be provided. Internal Glazed partition in in MPH shall be 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.			
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	The glass shall be 14mm(minimum) (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 37 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 noncombustible 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,Acodor , IGI , Matrix ,Tata Pravesh.			
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 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			
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	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	to facilitate fixing of lighting fixtures, AC grills,			
9.14.00	Batten ceiling made up of extruded aluminum / metal of minimum 0.6mm thickness with powder coated finish (min. 40 microns) / wooden finish (minimum 0.11mm). The ceiling must have superior acoustics and must adhere to the highest health and safety standards. The bat-tens shall have possibility of curvilinear arrangement. The batten ceiling shall be Greenguard, tested/certified from UL/ Intertek. The product shall meet technical requirements of ASTM E84. Batten ceiling of 1"x1" made up of extruded aluminum with "click-on system". Subli-mation/Heat transfer method should not be used for bet-ter scratch resistance. Die-casted click on joinery shall not be used. Designer membrane ceiling: The ceiling shall be have demountable translucent stretch ceiling membrane with harpoon, corners ready to install. It shall not get discolored & sag. All joints shall be provided with appropriate interface trims to be able to demount the ceiling to access the lights. The ceiling shall be installed using ceiling aluminum suspension system, complete as per manufacturer's installation guidelines and as per approved shop drawings in line with the design intent and approval by Engineer In-charge. LED strips shall be installed using custom alumi-num extrusions to ensure longevity of the installation. The ceiling shall have following features and properties: - Durable: The systems shall resist shocks and shall not crack with movement or under stretch conditions. Safe: The membranes and profiles shall have passed the stringent fire and safety tests. The membrane shall have been classified as non-toxic upon burning. The Flexible membrane shall be b-s1-d0 / ASTM E-84 class A tested/certified. Green: Membranes shall be 100% recyclable. There shall not be any welding defect on Membranes.			
9.15.00	be provided with Prefabricated Insulated Metal Sandwich Panels shall be as per technical Specification.			
	steel flush doors of thickness 45 mm with steel face between two sheets shall be filled with pressed steel sheets of 16 gauge. All doors shall be provided with rubber sealing, for making the doors airtight.			
	and anodised Aluminium Sections of minimum thickness 1.2 mm. Double glazing consisting of two 6 mm thick glass panes with 12 mm air gap.			
	metal sandwich panels/decking sheets shall be provided as per technical Specification.			
	conceived with the intention of projecting a safe and healthy working environment. It shall take into consideration the various factors involving power plant technology, and control hierarchy and man machine interface. All the details of furniture, colour scheme equipment design and ergonomics requirements shall be detailed in the design process.			
	design process shall be control room complex, conference rooms and office areas in the design process and evaluated for design. Furniture to be provided in control room complex and other control rooms shall be as per the design process.			
	face and suitable ergonomic practices. The design shall be in line with the design process and interior design.			
	acoustic interference levels, taking into account the design process.			
	conditioning, fire fighting, fire escapes, etc.			
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9.16.00	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. 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.~~ Revised Table A B attached as annexure sl no AC-2 'D-1-9 - Table A and Table B'		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. CS	SUB-SECTION-D-1-9 CIVIL WORKS ARCHITECTURAL CONCEPTS AND DESIGN PAGE 19 OF 33

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

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	g) Deaerator floor	Cement concrete with Metallic hardener topping.		-
	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	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	k) MCC Room	Cement concrete with Metallic hardener topping	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 & Metal Batten panel cladding for columns and walls	Metal Batten panel ceiling in combination with demountable translucent stretch ceiling membrane or as per approved design

TECHNICAL REQUIREMENTS

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

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	q) Toilet area	ceramic tiles	Digitally glazed ceramic wall tiles up to False Ceiling Height	Alluminium False ceiling in size 600x 600
	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

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	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
	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.	-	-

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
2.	DELETED			
3	ESP control building/Air compressor house/ Safety Control Room			
	a) Operating/Maintenance areas	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	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	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	e) RCC Stair case	Cement concrete with Metallic hardener topping	Polished Granite stone up to 1.2m.ht. & Acrylic Distemper	Acrylic Distemper (except metal deck area)

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	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.
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 booster water pump house/ CW PH/RWPH/ Switchgear Building			
	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.

TECHNICAL REQUIREMENTS

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 false ceiling level.	Acrylic distemper
6.	Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Transport air compressor house/ Fuel Oil pressurizing Pump House with switchgear building& control room / Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Switchgear room, control room/Any other Building..			
	a) Operating/Maintenance areas/ MCC room	Cement concrete with Metallic hardener topping	Acrylic distemper	Acrylic distemper (except metal deck area)
	b) Office Room, / Control Room	Matt Finished Vitrified ceramic tiles.	Acrylic emulsion paint.	Mineral Fibre Board False Ceiling in A.C area

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	c) Toilet area	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to false ceiling level.	Acrylic distemper
7.	DELETED			
8.	Rest Room for O&M Workers			
	Rest room	Cement concrete with Metallic hardener topping.	Acrylic distemper	Metal roof
	Toilets	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above	Metal roof
9.	First Aid Centre with Creche Facilities.			

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
	Waiting Lobby cum Reception/ Doctor's Chamber / First Aid Room/ Driver's Room	Matt Finished Vitrified ceramic tiles.	Acrylic emulsion paint.	Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area
	Toilets/ Bath room	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above	Metal roof/ Acrylic Distemper
	Crèche Facilities	5 mm thick vinyl flooring	Glass mosaic tiles in murals & patterns and Acrylic Emulsion Paint	Acrylic Emulsion paint
	Porch		Acrylic distemper	Acrylic distemper
	Covered Parking	Concrete Blocks	Acrylic distemper	Acrylic distemper
10.	Vehicle parking sheds			
		Concrete Blocks		

TECHNICAL REQUIREMENTS

TABLE –A
INTERIOR FINISHING SCHEDULE

S.N O.	DESCRIPTION OF AREA	FLOOR FINISH	WALL FINISH	CEILING FINISH
9.	FQA Building			
	RT Film Processing and Viewing Room, DGM Room, Staff room , Passage	Matt Finished Vitrified ceramic tiles.	Acrylic emulsion paint.	Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area
	Toilets/ Pantry / Bath room	ceramic tiles.	Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above	Metal roof/ Acrylic Distemper
	Store, Civil Equipment room, Concrete mixture and Cube casting area , Cement Testing Room, Mechanical Equipment room, Record Room.	Cement concrete with Metallic hardener topping.	Acrylic distemper	Acrylic distemper
	Porch		Acrylic distemper	Acrylic distemper
	Covered Parking	Concrete Blocks	Acrylic distemper	Acrylic distemper

TECHNICAL REQUIREMENTS

- Note :
1. All wall 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.

TECHNICAL REQUIREMENTS

TABLE –B
EXTERIOR FINISHES SCHEDULE
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.	DELETED		

TECHNICAL REQUIREMENTS

- 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.

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. a) Ordinary Portland Cement (OPC) shall necessarily be used for RCC for Chimney shell. b) TG foundation top deck/ Substructure c) 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 a) 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). b) 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). c) 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			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO	SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION	PAGE 1 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS			
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 10 degree Celsius to 65 degree 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/Fe550D 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.			
10.04.00				
10.04.01	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..			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO	SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION	PAGE 2 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	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.			
10.04.02	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.			
10.05.00	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/cm2. 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%.			
10.06.00	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.			
10.07.00	Stainless steel The material specification for stainless steel plates are mentioned in the design concept area of Mill Bunker building.			
10.08.00	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.			
10.09.00	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.			
10.10.00	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. These shall include provision of continuous walkways along the crane - girder level on both			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO	SUB-SECTION-D-1-10 CIVIL WORKS MATERIAL SPECIFICATION	PAGE 3 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
10.11.00	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. Autoclave Aerated Concrete (AAC) Block Providing and laying of Autoclave Aerated Concrete (AAC) block masonry using blocks having dimensions of 625mm x 250mm. thickness ranging from 100 mm to 300 mm conforming to IS:2185 (Part-III), for dimension and tolerance, with minimum compressive strength of 30 kg/ sq.cm. 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 (1000 mm/ 125 mm thk.) the jointing reinforcement i.e 1 number of 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 instruction laid down in IS:6041-1985, IS-1905) (Reinforcement bars shall be measured & paid separately under relevant items). AAC blocks shall have the following physical properties: Density (oven dry) - 550-650kg/ cum. Compressive Strength - Min. 30 kg/ sq. cm. Thermal Conductivity - 0.162W/mk (avg) Resistant to fire - 2-6 hrs depending upon thickness Dry shrinkage - 0.02% (avg) Design gross density - 800 kg/cum (approx)		
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D-1-11 11.01.00 <				

CLAUSE NO.	TECHNICAL REQUIREMENTS		
D-1-12 D-1-12(A)	ANNEXURES ANNEXURE (A) (a) List of Codes and Standards All applicable standards, references, specifications, codes of practice, etc., shall be the latest edition including all applicable official amendments and revisions. A complete set of all these documents shall be available at site with Bidder. List of some of the applicable Standards, in original Codes and references is as following: Where provisions are not covered in Indian Standards, reference shall be made to ACI, AISC, EN, CICIND and other International Standards. <u>LIST OF CODES AND STANDARDS</u> Excavation and Filling IS :2720 Methods of test for soils(relevant parts) IS:4701 Code of practice for earth work on canals. IS:9759 Guide lines for dewatering during construction. IS:10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS:269 33 grade for ordinary Portland cement. IS:383 Coarse and fine aggregates from natural sources for concrete. IS:432 Specification for mild steel and medium tensile steel bars and (Part 1&2) hard drawn steel wires for concrete reinforcement. IS:455 Portland slag cement. IS:702 Industrial bitumen. IS:712 Specification for building limes. IS:1077 Common burnt clay building bricks. IS:1161 Steel tubes for structural purposes. IS:1239 Mild steel tubes, tubulars and other wrought steel fitting - MS tubes. IS:1363 Hexagon head bolts, screws and nuts of productions (Part 1-3) grade - C. IS:1364 Hexagon head bolts, screws and nuts of productions (Part 1-5) grade-A & B. IS:1367 Technical supply condition for threaded fasteners. (Part 1-18) IS:1489 Portland-pozzolana cement. (Part-I) Fly ash based IS:1542 Sand for Plaster.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 1 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:1566 Hard drawn steel wire fabric for concrete reinforcement. IS:1786 High strength deformed steel bars & wires for concrete reinforcement. IS:2062 Hot Rolled Low, Medium and High Tensile Structural Steel IS:2116 Sand for masonry mortars. IS : 2185 Hollow & solid concrete blocks. (Part 1) (Part 2) Hollow & solid light weight concrete blocks. IS:2386 Testing of aggregates for concrete. (Part I-VIII) IS:3812 Specification for fly ash for use as pozzolona and admixture. IS:4082 Recommendation on stacking and storage of construction materiel and components at site IS:8112 43 grade ordinary portland cement. IS:8500 Structural steel-Microalloyed (Medium and high strength qualities). IS:12269 53 grade ordinary portland cement. IS:12894 Specification for fly ash lime bricks. IS:13757 Burnt clay fly ash building bricks. Cast in-situ Concrete and Allied Works IS:280 Mild steel wire for general engineering purpose. IS:456 Code of practice for plain and reinforcement concrete. IS:457 Code of practice for general construction of plain and reinforced concrete for dams and other massive structures. IS:516 Method of test for strength of concrete. IS:1199 Methods of sampling and analysis of concrete. IS:1791 General requirement for batch type concrete mixers. IS:1834 Hot applied sealing compound for joints in concrete. IS:1838 Preformed fillers for expansion joints in concrete pavement and structures. IS:2438 Specification for roller pan mixers. IS:2502 Code of practice for bending and fixing of bars for concrete reinforcement. IS:2505 Concrete vibrators - immersion type.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 2 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:2506 General requirements for screed board concrete vibrators. IS:2722 Specification for Portable Swing weigh batchers for concrete (single and double bucket type). IS:2750 Steel scaffoldings IS:2751 Recommended practice for welding of mild steel plain and deformed bars for reinforced construction. IS:3150 Hexagonal wire netting for general purposes. IS:3366 Specification for pan vibrators. IS:3370 (Part 1-4) Code of practice for concrete structures for the storage of liquids. IS:3558 Code of practice for use of immersion vibrators for consolidating concrete. IS:4014 (Part-1&2) Code of practice for steel tubular scaffolding. IS:4326 Code of practice for earth quake resistant design and construction of buildings. IS:4656 Form vibrators for concrete. IS:4925 Concrete batching and mixing plant. IS:4990 Plywood for concrete shuttering work. IS:4995 Criteria for design of reinforced concrete bins for storage of granular and powdery materials IS:5256 Code of practice for sealing expansion joints in concrete lining on canals. IS:5525 Recommendations for detailing of reinforcement in reinforced concrete works. IS:6461 Glossary of terms relating to cement concrete. IS:6494 Code of practice for water proofing of underground reservoir and swimming pools. IS:6509 Code of practice for installation of joints in concrete pavements. IS:7861 (Part -1&2) Code of practice for extreme weather concreting. IS:9012 Recommended practice for shotcreting. IS:9103 Admixtures for concrete. IS:9417 Recommendations for welding cold worked bars for reinforced concrete construction. IS:10262 Recommended guidelines for concrete mix design. IS:11384 Code of practice for composite construction in structural steel and concrete.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 3 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:12118 Two parts polysulphide based sealants. IS:12200 Code of practice for provision of water stops at transverse construction joints in masonry and concrete dams. IS:13311 Non destructive testing of concrete - methods of test. (Part 1) Ultrasonic pulse velocity. (Part 2) Rebound hammer. IS:17452 Use of Alkali Activated Concrete for Precast Products-Guidelines SP-16 Design codes for reinforced concrete to IS:456-1978. SP-23 Hand book of concrete mixes. SP-24 Explanatory handbook on Indian standards code for plain and reinforced concrete. (IS : 456) SP-34 Hand book on concrete reinforcement and detailing. ACI-318 American Concrete Institute code for structural concrete. Precast Concrete Works SP:7 National Building Code - Structural Design (Part 6/Sec.7) Prefabrication and system building and mixed / composite construction. IS:10297 Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. IS:10505 Code of practice for construction of floors and roofs using pre-cast reinforced concrete waffle units. IS:15658 Pre-cast concrete block for paving. IS 15916 Building Design and Erection using Pre fabricated concrete Masonry & Allied Works IS:1905 Code of practice for structural use of unreinforced masonry. IS: 2185 Part-1 Concrete Masonry Units - Specification Part 1 Hollow and Solid Concrete Blocks Part-3 Specification for concrete masonry units: Part 2 Hollow and solid light weight concrete blocks IS:2212 Code of practice for brick work. IS:2250 Code of practice for preparation and use of masonry mortars. IS:2572 Code of practice for construction of hollow concrete block masonry. SP:20 Hand book on masonry design and construction.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.		SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Sheeting Works IS:277 Galvanised steel sheets (Plan & corrugated). IS:513 Cold-rolled low carbon steel sheets & strips. IS:730 Hook bolts for corrugated sheet roofing. IS:801 Code of practice for use of cold formed light gauge steel structural members in general building construction. IS:2527 Code of practice for fixing rain water gutters and down pipe for roof drainage. IS:7178 Technical supply condition for tapping screw. IS:8183 Bonded mineral wool. IS:8869 Washers for corrugated sheet roofing. IS:12093 Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. IS:12436 Preformed rigid Polyurethane (PUR) and isocyanurate (PIR) foams for thermal insulation. IS:12866 Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). IS:14246 Continuously pre-painted galvanised steel sheets and coils. BS:5950 Code of practice for design of light gauge profiled (Part-6) steel sheeting Fabrication and Erection of Structural Steel Works IS:800 Code of practice for General Construction of steel. IS:813 Scheme for symbols for welding. IS:814 Covered electrodes for manual metal arc welding of carbon & carbon manganese steel. 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 of metal arc welders. IS:1024 Welding in bridges and substructured subject to dynamic. IS:1181 Qualifying tests for Metal Arc welders (engaged in welding structures other than pipes). IS:1182 Recommended practice for Radiographic examination of fusion welded butt joints in steel plates			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.		SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:1608 Mechanical testing of metals - tensile testing IS:1852 Rolling and Cutting Tolerances for Hot rolled steel products. IS:2016 Specification for Plain washers. IS:2595 Code of practice for Radiographic testing IS:2629 Hot dip galvanising of iron and steel IS:3502 Steel chequered plate. IS:3613 Acceptance tests for wire flux combination for submerged arc welding. IS:3658 Code of practice for liquid penetrant flaw detection. IS:3664 Code of practice for ultra sonic pulse echo testing contact and immersion method IS:3757 High strength structural bolts. IS:4000 High strength bolts in steel structure - code of practice. IS:4353 Sub merged arc welding of mild steel and low alloy steel Recommendation IS:4759 Hot dip zinc coating on structural steel and other allied products. IS:5334 Code of practice for magnetic particle flaw detection of welds. IS:5369 General requirements for plain washers and lock washer IS : 6623 High strength structural nuts. IS:6649 Hardened and tampered washers for high strength structural bolts & nuts. IS:6911 Stainless steel plate, sheet and strip. IS:7205 Safety code for erection of structural steel. IS:7215 Tolerances for fabrication of structural steel. IS:7307 Approved test for welding procedures (Part - I) Fusion welding of steel. IS:7310 Approval test for welders working to approval welding procedure. (Part-I) Fusion welding of steel IS:9178 Criteria for design of steel bins for storage of bulk material. (Part-1to 3) IS:9595 Recommendations for metal arc welding of carbon & carbon manganese steel.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 6 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:12843 Tolerances for erection of steel structures. SP:6 ISI Hand book for structural Engineers. (Part 1 to 7) Plastering and Allied Works IS:1661 Code of practice for application of cement and cement lime plaster finishes. IS:2402 Code of practice for external rendered finishes. IS:2547 Gypsum building plaster. (Parts 1&2) Acid and Alkali Resistant Lining IS:158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. IS:412 Expanded metal steel sheets for general purpose. IS:4441 Code of practice for use of silica type chemical resistant mortars. IS:4443 Code of practice for use of resin type chemical resistant mortars. IS:4456 Method of Test for chemical resistant tiles. (Part I & II) IS:4457 Ceramic unglazed vitreous acid resisting tiles. IS:4832 Specification for chemical resistant mortars. (Part - 1) Silicate type (Part - 2) Resin type (Part - 3) Sulfur type IS:4860 Acid resistant bricks. IS:9510 Bitumastic acid resisting grade. Water Supply, Drainage and Sanitation IS:458 Precast concrete pipes (with & without reinforcement). IS:554 Pipe threads where pressure tight joints are made on the threads – dimensions, tolerances and designation. IS:651 Salt glazed stoneware pipes and fittings. IS:774 Flushing cisterns for water closets and urinals. IS:775 Cast iron brackets and supports for wash basins and sinks.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 7 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:778 Copper alloy gate, globe and check valves for water works purposes. IS:781 Cast copper alloy screw down bib taps & stop valves for water services. IS:782 Caulking lead. IS:783 Code of practice for laying of concrete pipes. IS:1172 Code of basic requirements of water supply, drainage and sanitation. IS:1230 Cast iron rain water pipes and fittings. IS:1239 (Part 1&2) Mild Steel tubes, tubulars and other wrought steel fittings IS:1536 Centrifugally cast (Spun) iron pressure pipes for water. IS:1537 Vertically cast iron pressure pipes for water, gas and sewage. IS:1538 Cast iron fittings for pressure pipe for water, gas and sewage. IS:1703 Copper alloy float valve for water supply fitting. IS:1726 Cast iron manhole covers and frames. IS:1729 Cast iron / Ductile iron drainage pipes and pipe/fittings for over ground non pressure pipeline socket and spigot series. IS:1742 Code of practice for building drainage. IS:2064 Selection, installation and maintenance of sanitary appliances. IS:2065 Code of practice for water supply in buildings. IS:2326 Automatic flushing cisterns for urinals. IS:2548 Plastic seats and covers for water closets. IS:2556 Vitreous sanitary appliances (vitreous china). IS:3114 Code of practice for laying of cast iron pipes. IS:3311 Waste plug and its accessories for sinks and wash basins. IS:3438 Silvered glass mirrors for general purposes. IS:3486 Cast iron spigot and socket drain pipes. IS:3589 steel pipe for water and sewage (168.3 to 2540mm outside diameter) IS:3989 Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. IS:4111 (Part 1 to 5) Code of practice for ancillary structure in sewerage system.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.		SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:4127 Code of practice for laying of glazed stone ware pipes. IS : 4733 Methods of sampling and testing sewage effluents. IS:4764 Tolerance limits for sewage effluents discharged into inland surface waters. IS:1068 Electroplated coating of nickel plus chromium and copper plus nickel plus chromium. IS:5329 Code of practice for sanitary pipe work above ground for buildings. IS:5382 Rubber sealing rings for gas mains, water mains and sewers. IS:5822 Code of practice for laying of electrically welded steel pipes for water supply. IS:5961 Specification for cast iron grating for drainage purpose. IS:7740 Code of practice for construction and maintenance of road gullies. IS:8931 Copper alloy fancy single taps combination tap assembly and stop valves for water services. IS:9762 Polyethylene floats for float valves. IS:10592 Industrial emergency showers, eye and face fountains and combination units. IS:12592 Specification for precast concrete manhole covers and frames. IS:12701 Rotational moulded polyethylene water storage tanks. IS:13983 Stainless steel sinks for domestic purposes. SP:35 Hand book on water supply and drainage with special emphasis on plumbing. CPH&EEO Manual on sewage and sewage treatment Publication - as updated. Doors Windows and Allied Works IS:204 Tower Bolts. (Part 1) Ferrous metals (Part 2) Non - ferrous metals IS:208 Door Handles. IS:281 Mild steel sliding door bolts for use with padlocks. IS:362 Parliament Hinges. IS:419 Putty, for use on window frames. IS:451 Technical supply conditions for wood screws			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 9 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:733 Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purposes. IS:1003 Timber panelled and glazed shutters (doors shutters). (Part I) IS:1003 Timber panelled and glazed shutters (Part-1) door shutters. IS:1038 Steel doors, windows and ventilators. IS:1081 Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators. IS:1285 Wrought aluminium and aluminium alloy extruded round tube & hollow section (for general engineering purposes). IS:1341 Steel butt hinges. IS:1361 Steel windows for Industrial buildings. IS:1823 Floor door stoppers. IS:1868 Anodic coatings on Aluminium and its alloys. IS:2202 Wooden flush door shutters (solid core type) particle (Part-2) board face panels and hard board face panels. IS:2209 Mortice locks (vertical type) IS:2553 Safety glass. (Part-1) General purposes IS:2835 Flat transparent sheet glass. IS:3548 Code of practice for glazing in buildings. IS:3564 Door closers (Hydraulically regulated) IS:3614 Specification for fire check doors : (Part-1) plate, metal covered and rolling type. (Part-2) Resistance test and performance criteria. IS:4351 Specification for steel door frames. IS:5187 Flush bolts. IS:5437 Figured, rolled and wired glass. IS:6248 Specification for metal rolling shutters and rolling grills.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 10 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:6315 Specification for floor springs (Hydraulically regulated) for heavy doors. IS:7196 Hold fast. IS:7452 Hot rolled steel sections for doors, windows and ventilators. IS:10019 Mild steel stays and fasteners. IS:10451 Steel sliding shutters (top hung type) IS:12823 Prelaminated particle boards. Roof Water Proofing and Allied Works IS:3067 code of practice for general design details and preparatory work for damp proofing and water proofing of buildings. ASTM Standard specification for high solid content cold C836-89a liquid applied elastomeric water proofing membrane for use with separate wearing course. ASTM Standard guide for high solid content cold C898-89 liquid applied elastomeric water proofing membrane for use with separate wearing course. Floor Finishes and Allied Works IS:5318 Code of practice for laying of flexible PVC sheet and tile flooring. IS:8042 White portland cement. IS:13755 Dust pressed ceramic tiles with water absorption of 3%, E 6% (Group B11a). IS:13801 Chequered cement concrete tiles. Painting and Allied Works IS:162 Ready mixed paint, brushing fire resisting, silicate type for use on wood, colour as required. IS:428 Distemper, oil, emulsion, colour as required. IS:1477 Code of practice for painting of ferrous metals in buildings. (Part -1) Pretreatment. (Part -2) Painting. IS:1650 Specification for colours for building and decorative materials. IS:2074 Ready mixed paint, air drying, red oxide-zinc chrome, priming.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 11 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	IS:2338 Code of practice for finishing of wood and wood based materials. (Part -1) Operations and Workmanship. (Part -2) Schedule. IS:2395 Code of pratice for painting concrete, masonry and plaster surfaces. (Part-1) Operations and Workmanship. (Part -2) Schedule. IS:2524 Code of practice for painting of nonferrous metals in buildings. (Part -1) Pretreatment (Part -2) Painting. IS:2932 Enamel, synthetic, exterior, (a) under coating and (b) finishing. IS:2933 Enamel exterior, (a) under coating, (b) finishing. IS:4759 Hot dip zinc coatings on structural steel and other allied products. IS:5410 Specification for cement paint. IS:15489 Plastic emulsion paint. IS:6278 Code of practice for white washing and Colour washing. IS:10403 Glossary of term related to building finish. IS:12027 Silicone based water repellent IS:13238 Epoxy based zinc phosphate primer (2 pack) IS:13239 Epoxy surfacer (2 pack) IS:13467 Chlorinated rubber for paints IS:14209 Epoxy enamel, two component glossy. BS:5493 Code of practice for protective coating of iron and steel structures against corrosion. Piling and Foundation IS:1080 Code of practice for design and construction of shallow foundations on soils. IS:1904 Code of practice for design and construction of foundation in Soils : General Requirements. IS:2314 Steel sheet piling sections. IS:2911 Code of practice for design and construction of pile foundations.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 12 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	(Relevant Parts) IS:2950 Code of practice for designs and construction of Raft foundation. (Part-1) Design IS:2974 (Part-1 to 5) Code of practice for design and construction of machine foundation. IS:4091 Code of practice for design and construction foundations for transmission line towers and poles. IS:6403 Code of practice for determination of Bearing capacity of Shallow foundations. IS:8009 Code of practice for calculation of settlement of foundation. (Part -1) Shallow foundations. (Part -2) Deep foundations. IS:12070 Code of practice for design and construction of shallow foundations on rocks. ISO 10816 Criteria for assessing mechanical vibrations of machines. ISO 1940 Criteria for assessing the st of balance of rotating rigid bodies. DIN : EN 13906-1 Helical compression spring made of round wire and rod : calculation and design of compression . DIN:2096 Helical compression spring out of round wire and rod : Quality requirements for hot formed compression spring. DIN:4024 Flexible supporting structures for machine with rotating machines. Roads IRC:5 (Section-1) Standard specifications and Code of practice for road bridges, General Features of Design. IRC:14 Recommended practice for 2cm thick bitumen and tar carpets. IRC:15 Standard specifications and code of practice for construction of concrete roads. IRC:16 Specification for priming of base course with bituminous primers. IRC:19 Standard specifications and Code of practice for water bound macadam. IRC:21 (Section-III) Standard specifications and Code of practice for road bridges. Cement concrete (plain and reinforced). IRC:34 Recommendations for road construction in water logged areas.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 13 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IRC:36 Recommended practice for the construction of earth embankments for road works. IRC:37 Guidelines for the Design of flexible pavements. IRC:56 Recommended practice for treatment of embankment slopes for erosion control. IRC:58 Guidelines for the design of rigid pavements for highways. IRC:73 Geometric Design standards for rural (non-urban) highways. IRC : 86 Geometric Design standards for urban roads in plains. IRC:SP:13 Guidelines for the design of small bridges & culverts. IRC - Publication Ministry of Surface Transport (Road wing), specifications for road and bridge works. IS:73 Paving bitumen. Loading IS:875 Code of practice for design loads (other than earthquake) for (Relevant parts) buildings and structures. IS:1893 Criteria for earthquake resistant design of structures. IS:4091 Code of practice for design and construction of foundation for transmission line towers and poles. IRC:6 (Section-II) Standard specifications & Code of practice for road bridges. loads and stresses Safety IS:1641 Code of practice for fire safety of buildings - General principles of fire grading and classification. IS:1642 Code of practice for fire safety of buildings - Details of construction. IS:3696 (Part-1&2) Safety code for scaffolds and ladders. IS:3764 Excavation work - code of safety. IS:4081 Safety code for blasting and related drilling operations. IS:4130 Demolition of buildings - code of safety. IS:5121 Safety code for piling and other deep foundations. IS:5916 Safety code for construction involving use of hot bituminous materials. IS:7205 Safety code for erection of structural steel work.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.		SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS:7293 Safety code for working with construction machinery. IS:7969 Safety code for handling and storage of building materials. Indian Explosives (As updated) Act 1940) Architectural Design of Buildings SP:7 National Building Code of India SP:41 Hand book on functional requirements of buildings (other than industrial buildings) ECBC Energy Conservation Building Code GRIHA Green Rating For Integrated Habitat Assessment. Tall Structures, Chimneys IS:4998 Criteria for design of reinforced chimneys IS:6533 Code of practice for design and construction of steel chimneys ICAO International Civil Aviation Organisation (ICAO) DGCA Instruction of Director General of Civil Aviation , India ACI:307 Specification for the design and construction of reinforced concrete chimneys BS:4076 Specification for steel chimneys CICIND Model Code for concrete chimneys Model code for steel chimneys ASCE Code Design and construction of steel chimney liners prepared by Task committee on steel chimney liners. Fossil power committee, Power division published by ASCE - 1975. IS:1554 PVC insulated (heavy duty) electric cables IS:2606 Alloy lead anodes for chromium plating IS:3043 Code of Practice for Earthing IS:9537 Conduits for electrical installations. The Indian Electricity Rules The Indian Electricity Act The Indian Electricity (Supply) Act The Indian Factories Act IS:2309 Practice for protection of buildings and allied structures against lightning Miscellaneous			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.		SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	IS:802 (Relevant parts) Code of practice for use of structural steel in overhead trans- mission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Criteria for design of lined canals and guidance for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. IS 11504 Criteria for structural design of reinforced concrete natural draught cooling towers BS:4485 (IV) British Standard : Code of design for water cooling towers CIRIA Publication IS 4671 Design and construction of buried thin-wall pipes. Expanded polystyrene for thermal insulation purposes.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(A) CIVIL WORKS Annex(A)-LIST OF CODES AND STANDARDS	PAGE 16 OF 16

CLAUSE NO.	TECHNICAL REQUIREMENTS		
D-1-12(B)	ANNEXURE (B) CONSTRUCTION METHODOLOGY Construction and erection activities shall be fully mechanized from the start of the work. All excavation and backfilling work shall be done using excavators, loaders, dumpers, dozers, poclains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated places with specific approval of engineer. For controlled rock blasting specialized agency, equipped with sensors to assess the impact of the blast on the adjoining existing structures, shall be employed. Dewatering shall be done using the combination of electrical and standby diesel pumps. Pile installation equipment suitable for flushing with air lift technique shall be used for construction of bored piles. For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used. All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machines, gantry cranes, crawler mounted heavy cranes and other equipment like heavy plate bending machines, shearing machines, lathe, milling machines, etc. Use of derricks shall not be permitted. Special enclosures, for blast cleaning of steel structure surface preparation, shall be used. All handling of materials shall be with cranes. Heavy trailers shall be used for transportation. Mechanized modular units of scaffolding and shuttering shall be used. Grouting shall be carried out using hydraulically controlled grouting equipment. Roadwork shall be done using pavers, rollers and premix plant. All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. shall not be permitted. Heavy duty hoists for lifting of construction materials shall be deployed. Compressors for cleaning of foundations and other surfaces shall be used. Field laboratory shall be provided with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc. For testing of steel works, ultrasonic testing machines, radiographic testing machines, dye penetration test equipment, destruction testing equipment, etc. shall be deployed. All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.		
	SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO	SUB-SECTION-D-1-12(B) CIVIL WORKS ANNEX_B_CONSTRUCTION METHODOLOGY PAGE 1 OF 1

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC												
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 – B 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, ovaling 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>:</td><td>1.0%</td></tr><tr><td>b) Bolted steel structures/RCC structures</td><td>:</td><td>2.0%</td></tr><tr><td>c) Prestressed concrete structures</td><td>:</td><td>1.6%</td></tr><tr><td>d) Steel stacks</td><td>:</td><td>As per IS:6533 & CICIN 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	:	As per IS:6533 & CICIN Model Code whichever is more critical.
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 & CICIN Model Code whichever is more critical.														
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS	SUB-SECTION-D-1-12(D) CIVIL WORKS WIND DESIGN CRITERIA	PAGE 1 OF 2												

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																
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: <table><tr><td>a)</td><td>Steel structures</td><td>:</td><td>2%</td></tr><tr><td>b)</td><td>Reinforced Concrete Structures</td><td>:</td><td>5%</td></tr><tr><td>c)</td><td>Reinforced Concrete Stacks</td><td>:</td><td>3%</td></tr><tr><td>d)</td><td>Steel stacks</td><td>:</td><td>2%</td></tr></table>			a)	Steel structures	:	2%	b)	Reinforced Concrete Structures	:	5%	c)	Reinforced Concrete Stacks	:	3%	d)	Steel stacks	:	2%	
a)	Steel structures	:	2%																	
b)	Reinforced Concrete Structures	:	5%																	
c)	Reinforced Concrete Stacks	:	3%																	
d)	Steel stacks	:	2%																	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 1 OF 5																

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	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). 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.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA	PAGE 2 OF 5	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	<u>APPENDIX-I</u> SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT The various site specific seismic parameters for the project site shall be as follows: 1) Peak ground horizontal acceleration : 0.14g 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 : 0.035 b) For special concentrically braced steel frames designed and detailed as per IS:800 : 0.026 c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.021 d) for RCC chimney, RCC Natural Draft Cooling Tower : 0.07 e) for liquid retaining tanks (ground supported) : 0.042 f) for steel chimney, Absorber tower, Vessels : 0.0525 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 : 0.07 Note: g = Acceleration due to gravity The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO. CS-	SUB-SECTION-D-1-12(E) CIVIL WORKS SEISMIC DESIGN CRITERIA
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APPENDIX – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for SIPAT STPP

Period (Sec)	Damping Factor (as a percentage of critical damping)					
	0.80%	1%	1.60%	2%	3%	5%
≤ .04	1.0	1.0	1.0	1.0	1.0	1.0
.05	1.2262	1.1579	1.1467	1.1392	1.1299	1.1009
.06	1.4516	1.3487	1.3272	1.3104	1.2892	1.2449
.07	1.8388	1.6845	1.6345	1.5944	1.5666	1.5076
.08	2.3009	2.1316	2.0801	1.9571	1.8387	1.7396
.09	3.6683	3.3390	2.9378	2.6591	2.1409	1.9978
.10	4.5596	3.8254	3.3886	3.1526	2.4177	2.1830
.12	5.1376	4.4231	3.9292	3.6907	2.8694	2.4421
.14	5.4416	4.7467	4.2463	4.0499	3.2878	2.6563
.16	5.6857	5.0086	4.4829	4.2566	3.4812	2.8190
.18	5.8457	5.2097	4.6616	4.4118	3.5682	2.8920
.20	5.8971	5.3013	4.7794	4.5035	3.5972	2.9322
.22	5.9439	5.3612	4.8599	4.5652	3.6281	2.9490
.24	5.9729	5.3977	4.9076	4.5942	3.6383	2.9528
.26	5.9860	5.4369	4.9319	4.5793	3.6299	2.9406
.28	5.9850	5.4398	4.9291	4.5540	3.6028	2.9172
.30	5.9579	5.4239	4.8917	4.4231	3.5308	2.8770
.40	5.4248	4.7794	4.1453	3.5701	2.9584	2.5122
.50	3.8946	3.6309	3.1978	2.8761	2.4290	2.0867
.60	3.1651	3.0098	2.6638	2.4215	2.0334	1.7509
.70	2.6956	2.5674	2.3270	2.0885	1.7378	1.4899
.80	2.3345	2.2232	2.0418	1.8510	1.5498	1.3300
.90	2.0633	1.9548	1.8407	1.6892	1.4366	1.2224

APPENDIX – I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for SIPAT STPP

Period (Sec)	Damping Factor (as a percentage of critical damping)					
	0.80%	1%	1.60%	2%	3%	5%
1.00	1.8884	1.7874	1.6957	1.5844	1.3590	1.1532
1.10	1.7602	1.6695	1.5825	1.4899	1.2851	1.1037
1.20	1.6518	1.5564	1.4825	1.3955	1.2103	1.0503
1.30	1.5498	1.4619	1.3908	1.3104	1.1467	1.0148
1.40	1.4600	1.3730	1.3048	1.2281	1.0896	.9746
1.50	1.3693	1.2917	1.2281	1.1551	1.0373	.9344
1.60	1.2935	1.2112	1.1532	1.0887	.9821	.8923
1.70	1.2178	1.1411	1.0887	1.0176	.9372	.8549
1.80	1.1514	1.0812	1.0242	.9587	.8885	.8165
1.90	1.0850	1.0111	.9606	.9044	.8455	.7782
2.00	1.0204	.9549	.9072	.8567	.7969	.7426
2.10	.9690	.8988	.8577	.8118	.7482	.6996
2.20	.9185	.8511	.8147	.7772	.7062	.6519
2.30	.8801	.8109	.7810	.7389	.6669	.6154
2.40	.8455	.7782	.7473	.7090	.6285	.5771
2.50	.8090	.7445	.7155	.6744	.5995	.5387
2.75	.7333	.6706	.6407	.6014	.5341	.4536
3.00	.6566	.6061	.5808	.5406	.4714	.3910
3.25	.5920	.5509	.5210	.4798	.4162	.3535
3.50	.5369	.4976	.4705	.4302	.3732	.3227
3.75	.4910	.4602	.4312	.3910	.3311	.2956
4.00	.4536	.4228	.3966	.3564	.3012	.2750

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.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC NO.	SUB-SECTION-D-1-12(F) CIVIL WORKS QA REQUIREMENT	PAGE 1 OF 1

NTPC Limited

(A Government of India Enterprise)



SIPAT SUPER THERMAL POWER PROJECT STAGE - III (1x800MW)

PART - C

GENERAL TECHNICAL REQUIREMENTS

SECTION – VIB

TECHNICAL SPECIFICATION

FOR

EPC PACKAGE

BIDDING DOCUMENT NO.: CS-8003-001-2

(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).

PART - C

GENERAL TECHNICAL REQUIREMENTS

SIPAT SUPER THERMAL POWER PROJECT
STAGE-III (1X800 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI, PART-C
SEPARATOR
BID DOC NO.

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
1.00.00	INTRODUCTION This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.			
2.00.00	BRAND NAME Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.			
3.00.00	NOT USED			
4.00.00	COMPLETENESS OF FACILITIES			
4.01.00	Bidders may note that this is a EPC Package contract. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.			
4.02.00	All equipments 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, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All same standard components/ parts of same equipment provided, shall be interchangeable with one another.			
4.03.00	For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.			
5.00.00	CODES & STANDARDS			
5.01.00	In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following :			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 1 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	a) Indian Electricity Act b) Indian Electricity Rules c) Indian Explosives Act d) Indian Factories Act and State Factories Act e) Indian Boiler Regulations (IBR) f) Regulations of the Central Pollution Control Board, India g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India h) Pollution Control Regulations of Department of Environment, Government of India i) State Pollution Control Board. (j) Rules for Electrical installation by Tariff Advisory Committee (TAC). (k) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996 (l) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998 (m) Explosive Rules, 1983 (n) Petroleum Act, 1984 (o) Petroleum Rules, 1976, (p) Gas Cylinder Rules, 1981 (q) Static and Mobile Pressure Vessels (Unified) Rules, 1981 (r) Workmen's Compensation Act, 1923 (s) Workmen's Compensation Rules, 1924 (t) NTPC Safety Rules for Construction and Erection (u) NTPC Safety Policy			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 2 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
5.02.00	(v) CERC (Indian Electricity Grid Code) Regulations, 2023 (w) CEA (Flexible Operation of Coal Based Thermal Power Generating Units) Regulations, 2023 (x) Any other statutory codes / standards / regulations, as may be applicable. Unless covered otherwise in the specifications, the latest editions (as applicable at the date fifteen (15) days prior to the date of bid submission), of the codes and standards given below shall also apply: a) Bureau of Indian standards (BIS) b) Japanese Industrial Standards (JIS) c) American National Standards Institute (ANSI) d) American Society of Testing and Materials (ASTM) e) American Society of Mechanical Engineers (ASME) f) American Petroleum Institute (API) g) Standards of the Hydraulic Institute, U.S.A. h) International Organization for Standardization (ISO) i) Tubular Exchanger Manufacturer's Association (TEMA) j) American Welding Society (AWS) k) National Electrical Manufacturers Association (NEMA) l) National Fire Protection Association (NFPA) m) International Electro-Technical Commission (IEC)/ European Norm (EN) n) Expansion Joint Manufacturers Association (EJMA) o) Heat Exchange Institute (HEI) p) IEEE standard q) JEC standard			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 3 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
5.03.00	Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.			
5.04.00	As regards highly standardized equipments such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.			
5.05.00	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.			
5.06.00	Two (2) English language copies of all national and international codes and/or standards used in the design of the plant and equipment shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.			
5.07.00	In case of any change in codes, standards & regulations between the date fifteen (15) days prior to the date of bid submission and the date when vendors proceed with fabrication and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.			
5.08.00	A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification.			
6.00.00	EQUIPMENT FUNCTIONAL GUARANTEE			
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.			
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 4 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
7.00.00	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS			
7.01.00	DESIGN OF FACILITIES			
	All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere. The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.			
7.02.00	MAINTENANCE AND AVILABILITY CONSIDERATIONS			
	Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list. Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path, turbine & equipments, inspection of the steam path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage. 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. Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.			
8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 5 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
8.01.00	Bidders may note that this is an EPC Package contract. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical and power systems, control & instrumentation, civil & structural works as per the scope. Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated. The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification. A comprehensive engineering and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.			
8.02.00	The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in Annexure-VI to this Part-C, Section-VI of the Technical Specification.			
8.03.00	The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:			
8.03.01	A) BASIC ENGINEERING DOCUMENTATION Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum: i) System description of all the mechanical, electrical, control & instrumentation & civil systems. ii) Technology scan for each system / sub-system & equipment. iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options. iv) Optimization studies including thermal cycle optimization.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 6 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 			
	v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins. vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups. vii) Water Balance diagram. viii) Operation Philosophy and the control philosophy of the Main Plant and other plants. ix) General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope. x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area, transformer yard, switchyard and other areas included in the scope of the bidder. xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer. B) DETAILED ENGINEERING DOCUMENTS i) General layout plan of the station. ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant. iii) Flow diagram, Process and Instrumentation diagrams along with write up and system description. iv) Start-up curves for boiler and both turbines and boiler combined together as a unit for various start-ups, viz. Cold, Warm and Hot start up. v) Piping isometric, composite layout and fabrication drawings, design philosophy & design parameter selection for each piping system, Pressure drop calculation & flash tank sizing calculation.			
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	vi) Piping engineering diagrams, pipe and fittings schedules, System-wise or P&ID wise prepared pipe schedule, valve schedule, insulation schedule, hanger and support schedule and Piping isometric / fabrication isometric drawings for pipe size 65mm NB and above with BOM, Painting schedule. Hanger / support arrangement drawing with BOM, Valve GA drawings, Layout drawings for site routed piping (i.e. for pipe sizes below 65NB) along with BOM (and submission of the same to the employer / project manager before start of work) and System wise stress analysis / dynamic analysis report (including input) along with stress isometric drawing / sketch marked with node points. Also As-Built drawing for information & Records: (i) Piping fabrication isometric drawing (ii) composite piping layout drawing (iii) Hanger / Support arrangement drawing. vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors. viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like Mills, Fans, BFPs, CEPs, Heaters/ Deaerators, Water cooled Condensers, Vacuum pumps etc. ix) Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier. x) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes. xi) Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser, design ramp rates of SG and TG and heat exchanger thermal calculations etc.). xii) Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters. xiii) Comprehensive list of all Terminal Points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc. xiv) Power supply single line diagram, block logics, control schematics, electrical schematics, etc. xv) Protection system diagrams and relay settings.			
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	xvi) Cables schedules and interconnection diagrams. xvii) Cable routing plan. xxviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc. xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points. xx) Sequence and protection interlock schemes. xxi) Type test reports, insulation co-ordination study report and power system stability study report. xxii) Control system configuration diagrams and card circuit diagrams and maintenance details. xxiii) Detailed DDCMIS system manuals. xxiv) Detailed flow chart for digital control system. xv) Mimic diagram layout, Assignment for other application engg. xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design alongwith output results. xxvii) Underground facilities, levelling, sanitary, land scaping drawings. xxviii) Geotechnical investigation and site survey reports (if and as applicable). xxix) Model study reports wherever applicable. xxx) Functional & guarantee test procedures and test reports. xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.			
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8.03.02	xxxii) BOP documents such as P&IDs, Sizing calculations for various equipment's, performance curves, datasheet etc. (For CHP, AHP, PU, Water System etc.) shall be as per MDL. xxxiii) Bidder shall submit all tabulated design calculations/ data (e.g. Pipe schedule, valve schedule, etc.), in both EXCEL format as well as in PDF format to enable NTPC for fast review /approval. INSTRUCTION MANUALS The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-IV. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following. A) ERECTION MANUALS The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of a particular equipment/system. The erection manual should contain the following as a minimum. a) Erection strategy. b) Sequence of erection. c) Erection instructions. d) Critical checks and permissible deviation/tolerances. e) List of tools, tackles, heavy equipments like cranes, dozers, etc. f) Bill of Materials g) Procedure for erection and General Safety procedures to followed during erection/installation. h) Procedure for initial checking after erection. i) Procedure for testing and acceptance norms. j) Procedure / Check list for pre-commissioning activities.			
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	k) Procedure / Check list for commissioning of the system. l) Safety precautions to be followed in electrical supply distribution during erection. B) OPERATION & MAINTENANCE MANUALS a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side. b) The arrangement and contents of O & M manuals shall be as follows: 1) <u>Chapter 1 - Plant Description:</u> To contain the following sections specific to the equipment/system supplied (a) Description of operating principle of equipment / system with schematic drawing / layouts. (b) Functional description of associated accessories / controls. Control interlock protection write up. (c) Integrated operation of the equipment alongwith the intended system. (This to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers). (d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries. (e) Design data against which the plant performance will be compared. (f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets. (g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).			
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	(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume). 2) <u>Chapter 2.0 - Plant Operation</u>: To contain the following sections specific to the equipment supplied (a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc. (b) Limiting values of all protection settings. (c) Various settings of annunciation/interlocks provided. (d) Startup and shut down procedure for equipment alongwith the associated systems in step mode. (e) Do's and Don'ts related to operation of the equipment. (f) Safety precautions to be taken during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions. (g) Parameters to be monitored with normal value and limiting values. (h) Equipment isolating procedures. (i) Trouble shooting with causes and remedial measures. (j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing. (k) Routine Operational Checks, Recommended Logs and Records (l) Change over schedule if more than one auxiliary for the same purpose is given. (m) Preservation procedure on long shut down. (n) System/plant commissioning procedure. 3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied.		
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	(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population. (b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment. (c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc. (d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc. (e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out. (f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done. (g) Long term maintenance schedules (h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling. (i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement. (j) Tolerance for fitment of various components. (k) Details of sub vendors with their part no. in case of bought out items. (l) List of spare parts with their Part No, total population, life expectancy & their interchangeability with already supplied spares to NTPC. (m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares. (n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.			
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	(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.			
8.03.03	After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer. If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.			
8.03.03	PLANT HANDBOOK AND PROJECT COMPLETION REPORT			
8.03.03.01	PLANT HANDBOOK			
	The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including i) Design and performance data. ii) Process & Instrumentation diagrams. iii) Single line diagrams. iv) Sequence & Protection Interlock Schemes. v) Alarm and trip values. vi) Performance Curves. vii) General layout plan and layout of main plant building and auxiliary buildings viii) Important Do's & Don't's The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.			
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8.03.03.02	PROJECT COMPLETION REPORT			
	The Contractor shall submit a Project Completion Report at the time of handing over the plant.			
8.03.04	DRAWINGS			
	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. ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-VI of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC. Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site. The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats. iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per Annexure-VI of Part-C. iv) 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. All piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings and RCC layout of major buildings 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. Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through			
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	animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as & when required by employer. Observations of NTPC during the 3D model review to be incorporated and revised editable model to be submitted to NTPC within 2 weeks. The complete 3D data (editable model) which shall be utilised for all future detailed engineering related to maintenance, operation, R&M, efficiency improvement of the project etc. Complete 3D model along with as built GADs, layout, isometrics, reports extracted and 3D models for all disciplines , with any other document generated from 3D model and naming conventions with as-built updates along with complete reference databases, component catalogues for all the size range shall be handed over to owner. Apart from the 3D Model, all drawings like GADs, Isometrics etc. extracted from the model shall also be submitted by the Contractor in Electronic form. 3D model along with complete Project databases shall be submitted at each model review stage and as final as-built. The contractor shall also submit all the configuration files, customization files, templates and all referenced databases. 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 for Engineering 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. All software and hardware shall be supplied by bidder within 3 months of NOA. The 3D modelling software shall preferably be the same software bidder will be using for preparation of 3D model or it shall have all editable features to edit the model supplied by bidder on time to time basis. 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 .		
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	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. b) All documents/text information shall be in latest version of MS Office/MS Excel/PDF format as applicable. c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules. d) Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units. e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract. Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission in line with suggestive MDL. Further, space shall be identified on each drawing for Approval stamp and electronic signature. f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external			
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	connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract. g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer. h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package. Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability. j) As Built Drawings After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per Annexure VI. k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to			
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	submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. l) The Contractor shall submit adequate prints of drawing / data / document as per Annexure-VI. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule. m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.			
8.03.05	e-Learning Package: e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries and Steam Generator & auxiliaries along with associated electrical and C&I system.			
8.03.05.01	Steam Turbine Generator & Auxiliaries Steam Turbine including stop valves, control valves, overload valves and cross over piping. Steam Turbine Auxiliary Systems including Quick Closing and Ordinary NRVs, Turbine gland sealing system, Lubricating oil system and its purification system, Centralized oil storage and its purification system, Control fluid and its purification system, governing and protection system, exhaust hood spray cooling system, drainage and vent system, turbine preservation system, HP/LP Bypass system. Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable, complete seal oil system, complete water cooling system where applicable and complete excitation system. Condensing Plant including Condenser, Condenser air evacuation system and Condenser on load tube cleaning system as applicable etc.			
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8.03.05.02 8.03.05.03	Drip Pump along with all accessories as applicable, Condensate Extraction Pumps along with all accessories, Deaerator level Control Station, Feed Water Heating Plant including Drain Cooler, low pressure heaters, deaerator and feed storage tank, high pressure heaters and associated accessories, Boiler Feed Pumps along with all accessories, Drive Turbine for Boiler Feed Pump along with all accessories, Feed regulating station, Make up system to Condenser, Gland Steam Condenser Recirculation System, Turbine Hall EOT Cranes and EOT Crane for Boiler Feed Pump as applicable. Steam Generator & Auxiliaries Furnace/evaporator, separator & drain collection vessel, superheater, reheater, economiser, startup recirculation & drain system, desuperheating spray system, safety valves, soot blowing system, draft plant including FD & ID fans, PA fan, air preheaters, SCAPH, coal preparation and firing system including raw coal feeder and pulverisers, coal burners, fuel oil system and oil burners, Electrostatic precipitator, NOx control system and Flue gas desulphurisation system, Aux. PRDS system. These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI), NTPC located at Noida. The Project Manager / Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI. 1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system . 2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above. a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc. b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc. c. The operation course(s) should include instructions on the permissive, interlocks, physical check-ups, start-up, shutdown and protections etc. d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling. Depth of coverage of above courses shall be as specified for “Instruction Manuals” in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.		
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	3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of Project Manager / EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit. 4. e-Learning course broad requirements: a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc. b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices. c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent. d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI. e. Each course shall have every physical and functional detail of the equipment / system supplied. f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules. g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self-assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz. h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same. i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window. j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.			
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	k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it. l. The system shall provide the user with the ability to select the information with a Cursor. m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop-up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function. n. Every course shall contain the 3D design/drawing/exploded view/360° turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio. o. The users shall be able to control audio sound level associated with the courses. p. Drawings / text in the courses shall be scalable (Zoom In/ Out). q. The user shall have the capability to record a bookmark to mark displayed information for later recall, whenever he accesses the same course next time. Notes: 1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system. 2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system. 3. The vendor shall get the approval of one sample course from Project Manager / EIC before proceeding for further courses.			
8.04.00	Provision for Fail Safe operation of vital Equipments All the Plant and equipments / Systems supplied under the contract shall be designed following “Fail Safe” concept. In case of failure of Power supply like Electric power, Hydraulic pressure, Pneumatic pressure, Vacuum etc. the system should be designed in such a way that the equipment/Valves/dampers etc. shall always move/remains (as applicable) to safest position as per system requirement to ensure safety of Man and Machinery.			
8.05.00	Engineering Co-ordination Procedure			
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8.05.01	The following principal coordinators will be identified by respective organizations after award of contract: NTPC Engineering Coordinator (NTPC EC): Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____ Contractor's/ Vendor's Engineering Coordinator (VENDOR EC): Name : _____ Designation : _____ Address : _____ a) Postal : _____ b) Telegraphic / e-Mail : _____ c) FAX : _____ TELEPHONE : _____			
8.05.02	All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.			
8.05.03	Contractor's/Vendor's Drawing Submission and Approval Procedure: a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings". b) Not used c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance.			
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	d) Not used e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. g) The Contractor shall submit drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within three (3) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories: CATEGORY- I: Approved CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments. CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted. CATEGORY -IV For information and records. h) After Rev 0 comments, the drawing will be locked in the system. Contractor will review the Rev 0 comments within 7 days & furnish the Comment Reply Sheet (CRS) to NTPC as an agenda point for TCM. TCM shall be conducted with Contractor on non-agreed comments of CRS. System will not allow Contractor to submit approval category drawings before the scheduled submission date. However, documents may be unlocked on case to case basis. Based on resolution of all comments and agreements, the document will be approved in TCM itself. The contractor will revise the document based on the resolutions and certify that all the resolutions has been taken care of.			
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	Based on this certification, the document will be opened and submitted by contractor in the system for approval as Rev 01 within 10 days of TCM. i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work. j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule. k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing. l) These comments will be taken care by the contractor while submitting the revised drawing. The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.			
8.06.00	ENGINEERING PROGRESS AND EXCEPTION REPORT			
8.06.01	The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission b) Drawings which were not submitted as per agreed schedule.			
8.06.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.			
9.00.00	TECHNICAL CO-ORDINATION MEETING			
9.01.00	The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA /			
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	HYDERABAD / PROJECT SITE or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.			
9.02.00	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the comments of the Employer shall be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.			
9.02.01	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.			
9.02.02	Should any drawing remain unapproved for more than four (4) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.			
9.03.0	Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.			
10.00.00	DESIGN IMPROVEMENTS The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly. If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.			
11.00.00	EQUIPMENT BASES A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.			
12.00.00	PROTECTIVE GUARDS			
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	Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.			
13.00.00	LUBRICANTS, SERVO FLUIDS AND CHEMICALS			
13.01.00	All the first fill and one year's topping requirement of consumables such as greases, oils, 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 scope shall include supply of H₂, CO₂ and N₂ as applicable for the Generator till successful commissioning of Generator. 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.			
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. However, the lube oil for Main Turbine, Drive Turbine, TDBFP and MDBFP shall be kept same in view of ease of operation and maintenance. Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.			
14.00.00	LUBRICATION			
14.01.00	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.			
15.00.00	MATERIAL OF CONSTRUCTION			
15.01.00	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.			
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16.00.00	RATING PLATES, NAME PLATES & LABELS			
16.01.00	Each main and auxiliary item of plant shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.			
16.02.00	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.			
16.03.00	Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.			
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.			
16.05.00	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support.			
16.06.00	Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non-pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.			
16.07.00	Safety and relief valves shall be provided with the following: a) Manufacturer's identification. b) Nominal inlet and outlet sizes in mm. c) Set pressure in Kg/cm² (abs). d) Blowdown and accumulation as percentage of set pressure. e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.			
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16.08.00	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.			
16.09.00	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.			
17.00.00	TOOLS AND TACKLES The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer. 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.			
18.00.00	WELDING			
18.01.00	If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.			
19.00.00	COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES			
19.01.00	All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.			
20.00.00	PROTECTION AND PRESERVATIVE SHOP COATING			
20.01.00	PROTECTION All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be.			
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20.02.00	The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification. PRESERVATIVE SHOP COATING All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification. Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.			
20.03.00	Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.			
20.04.00	All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.			
20.05.00	All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.			
20.06.00	Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.			
21.00.00	QUALITY ASSURANCE PROGRAMME			
21.01.00	To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finalized during detailed engineering with employer / authorized representative after discussion. The QA programme shall be generally in line with ISO-9001/IS-14001. A quality assurance programme of the			
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	contractor shall generally cover the following: a) His organisation structure for the management and implementation of the proposed quality assurance programme b) Quality System Manual c) Design Control System d) Documentation Control System e) Qualification data for Bidder's key Personnel. f) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc. g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls. h) Control of non-conforming items and system for corrective actions. i) Inspection and test procedure both for manufacture and field activities. j) Control of calibration and testing of measuring testing equipments. k) System for Quality Audits. l) System for indication and appraisal of inspection status. m) System for authorising release of manufactured product to the Employer. n) System for handling storage and delivery. o) System for maintenance of records, and p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component. Format for the same is attached as Annexure VIII. 22.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE 22.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of			
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	inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalization of such Quality Plans shall be finalized during detailed engineering as per attached Annexure-VIII and format No QS-01-QAI-P-1/F3. Monthly progress report shall be furnished. 22.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP, for review and approval. 22.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site. 22.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning. 22.05.00 The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at Annexure-V. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site. 22.06.00 The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit			
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	the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.			
22.07.00	No material shall be despatched from the manufacturer's works before the same is accepted by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Dispatch Clearance Certificate (MDCC / CHP Clearance).			
22.08.00	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details			
22.09.00	All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer. All welding/brazing procedures shall be submitted to the Employer or its authorized representative prior to carrying out the welding/brazing.			
22.10.00	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer. All welding / brazing procedures qualified / used at shop, will be made available to NTPC during audit / inspection. Procedures to be qualified at site will be submitted to NTPC.			
22.11.00	Not Used.			
22.12.00	For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping shall be as per relevant code. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding			
22.13.00	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.			
22.14.00	No welding shall be carried out on cast iron components for repair.			
22.15.00	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.			
22.16.00	All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as			
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22.17.00	per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be Ultrasonically tested. The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-vendors proposed by the Main contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format as Annexure-III. List of NTPC approved sub vendors against similar Pkg/items is attached as Section-VI, Part-B ,Chapter E-60 Indicative sub-vendor list. The contractor's proposal for any new sub vendor for any of the items identified in indicative sub-vendor list shall necessarily be furnished in the sub vendor questionnaire & main Contractor Evaluation report format attached as Annexure- VII with all relevant documents and main contractor's own physical assessment report assessed as per their quality management system for NTPC review and acceptance. New sub vendor proposal will only be considered for NTPC review, provided the proposal is 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. Main contractor shall submit the documentation as mentioned below: Major checks and quality requirements as mentioned below shall necessarily be assessed by main contractor and complied with documentary support in case the same is not the part of their Quality management system. - Duly Filled Main supplier Evaluation Report. - Duly Filled Sub-Supplier Questionnaire. - Factory Registration Certificate. - Overall Organization Chart with Manpower details (Design, Manufacturing, Quality etc.) - Supply reference list of the Sub-Supplier indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning. - List of Manufacturing Equipment available with sub vendor. - List of Testing Equipment available with sub vendor. - Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any. - Details of Outsourced Manufacturing Processes, if any.			
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	x. Quality control exercised during receipt, in-process & final inspection. xi. Compliance of Statutory requirements (As applicable) After first submission of proposal to NTPC, in absence of relevant documents/ Incompleteness of the proposal, The main contractor will be given a period of maximum 07 days to submit the compliance of the NTPC comments. In case of noncompliance, it will be presumed that main contractor is not serious about pursuing the proposal & the proposal will be foreclosed. The proposed Sub vendor will be assessed broadly on following mandatory criteria i) Quality Management System Compliance including raw material/BOI control, traceability & control over outsources process ii) Design Capabilities (As applicable) iii) Manufacturing, Testing & Storage Facility iv) Processing Capabilities v) Supply Experience indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning vi) Safety Aspect In case of major observations or non-compliance observed during sub vendor works visit (Jointly with the main contractor) with respect to the submitted documents, proposed sub vendor will not be considered for acceptance and Main contractor will be solely responsible in such cases. Monthly progress reports on sub-vendor detail. Submission / approval shall be furnished preferably on enclosed format at Annexure-IV. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.			
22.18.00	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within two (2) weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.			
22.19.00	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.			
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22.20.00	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his subcontractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.			
22.21.00	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.			
22.22.00	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.			
22.23.00	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.			
22.24.00	Environmental Stress Screening Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for NTPC acceptance			
22.25.00	The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.			
22.26.00	Software Reliability / Quality Certification Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β -version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.			
23.00.00	QUALITY ASSURANCE DOCUMENTS			
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23.01.00	The Contractor shall be required to submit the QA Documentation in soft copies, as identified in respective quality plan with tick (✓)mark.			
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.			
	The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.			
	The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However, soft copies will be furnished not later than two (2) weeks.			
23.02.00	Typical contents of QA Documentation is as below:-			
	(a.) Quality Plan			
	(b.) Material mill test reports on components as specified by the specification and approved Quality Plans.			
	(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.			
	(d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.			
	(e.) Heat Treatment Certificate/Record (Time- temperature Chart)			
	(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).			
	(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.			
	(h.) Certificate of Conformance (COC) wherever applicable.			
	(i.) MDCC			
23.03.00	Similarly, the contractor shall be required to submit soft copies containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.			
23.04.00	Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The			
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	supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review. (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release. (b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector. (c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than two (2) weeks after the despatch of equipment.			
23.05.00	TRANSMISSION OF QA DOCUMENTATION On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer. For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than two (2) weeks after the date of the last delivery of equipment.			
24.00.00	PROJECT MANAGER'S SUPERVISION			
24.01.00	To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Settlement of Disputes' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.			
24.02.00	The work shall be performed under the supervision of the Project Manager.			
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	The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following: (a.) Interpretation of all the terms and conditions of these documents and specifications (b.) Review and interpretation of all the Contractor's drawing, engineering data, etc. (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract (d.) Inspect, accept or reject any equipment, material and work under the contract (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates (f.) Review and suggest modifications and improvement in completion schedules from time to time, and (g.) Supervise Quality Assurance Programme implementation at all stages of the works.			
25.00.00	INSPECTION, TESTING AND INSPECTION CERTIFICATES			
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.			
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.			
25.03.00	The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector,			
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	unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days (for domestic) / 45 days (for foreign) of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies. 25.04.00 The Project Manager or Inspector shall within fifteen (15) days (for domestic) / 45 days (for foreign) from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract. 25.05.00 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Failure on the part of Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract. 25.06.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing. 25.07.00 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract. 25.08.00 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no. 25.03.00 - of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of			
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25.09.00 25.10.00 25.10.01 25.10.02 25.10.03 25.10.04 25.10.05 25.11.00	each calendar month. All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector. ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III). Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV. Field Welding Schedule Format enclosed at Annexure-V. Main contractor evaluation report (MCER) and Sub vendor Questionnaire enclosed at Annexure VII. QA&I modalities and QA Co-ordination procedure (QACP) enclosed at Annexure-VIII. TESTING OF MAJOR DESIGN FEATURES: The major design features of the system shall be demonstrated by the Contractor at the Contractor's works, or any other place mutually agreed within Six months from the date of Sub-QR/Provenness approval. These are the system function tests, which have a major impact on the detailed system design & finalization of important engineering documents like configuration, functional grouping, BOM etc., but do not require a fully engineered system for conductance. Bidder shall identify these features & include detailed test procedures in the Sub-QR/Provenness proposal, which shall be finalized during discussions with the bidder. The developments and any augmentation of standard features undertaken by the Bidder to fulfill the various specification requirements, shall also be tested during these major design tests. This shall include but not be limited to the following. a) System accuracy tests of DDCMIS for the various type of inputs identified in Part-B. b) Loop reaction time for sample loops/ logics. c) SOE functionality tests. d) Server changeover.			
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	e) Various response times, having serious implication on operation & maintenance philosophy. f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load. g) Connectivity of Switchgear DDCMIS with Switchgear Relay Network. The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer. If any of the envisaged tests have been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this project & the previous NTPC project with respect to the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) test report.			
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING			
25.12.01	Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following. (i) Logics/Loops: a) Drive logics implementation for each type of binary drive along with its display in HMI. b) Sequence implementation along with its display in HMI. c) Single non-cascade controller implementation. d) Cascade loop implementation. e) Master slave implementation with different slave combination. f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable. (ii) HMI Functions: a) LVS Annunciation. b) Graphics.			
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	c) HSR d) Logs/Reports. e) Calculations (Basic & Performance Calculations).			
25.12.02	The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings. After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.			
25.12.03	During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.			
26.00.00	PRE-COMMISSIONING AND COMMISSIONING FACILITIES			
26.01.00	(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications. (b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant. (c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six			
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	months prior to the respective implementations. The Employer will approve final verification of cleanliness. (d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period. (e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer. (f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.			
26.01.00	Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain: (1.) Biodata including experience of the Commissioning Engineers. (2.) Role and responsibilities of the Commissioning Organisation members. (3.) Expected duration of posting of the above Commissioning Engineers at site.			
26.02.00	Initial Operation (a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests. (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 contractor shall conduct the trial run as per clause 26.05.00 to demonstrate the compliance to the requirements as stipulated in the CERC (Indian Electricity Grid Code) Regulations, 2023. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.			
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	The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect. (c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation. (d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.			
26.03.00	Guarantee Tests a) 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. b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee. c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points. d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost. e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.			
26.04.00	Before start of commissioning of critical equipment, Commissioning Clearance Certificate (CCC) to be submitted by Main contractor. List of the critical equipments and CCC format will be provided along with QA Coordination procedure.			
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26.05.00	Trial Run: Trial run shall be conducted during the initial operation of the unit(s). Definition and provisions related to “trial run” shall be governed by CERC (Indian Electricity Grid Code) Regulations, 2023. a. Contractor shall demonstrate the following as per the requirements of CERC (Indian Electricity Grid Code) Regulations, 2023: i) Operation at a load of fifty-five (55) percent of MCR as per the CEA Technical Standards for Construction for a sustained period of four (4) hours. ii) Ramp-up from fifty-five (55) percent of MCR to MCR at a ramp rate of at least one (1) percent of MCR per minute, in one step or two steps (with stabilization period of 30 minutes between two steps), and sustained operation at MCR for one (1) hour. iii) Demonstrate overload capability with the valve wide open as per the CEA Technical Standards for Construction and sustained operation at that level for atleast five (5) minutes. iv) Ramp-down from MCR to fifty-five (55) percent of MCR at a ramp rate of at least one (1) percent of MCR per minute, in one or two steps (with stabilization period of 30 minutes between two steps). v) Primary response through injecting a frequency test signal with a step change of ± 0.1 Hz at 55%, 60%, 75% and 100% load. Provision of injecting external frequency test signal in control system for primary frequency response testing shall be in the contractor's scope. vi) Reactive power capability as per the generator capability curve as provided by OEM considering over-excitation and under-excitation limiter settings and prevailing grid condition. These are the minimum test to be carried out as per the Indian Electricity Grid Code Regulations, 2023. Any other relevant clauses related to system performance or tests specified elsewhere in the specifications shall also be applicable. b. The contractor shall demonstrate the continuous operation capability of the Unit(s) at MCR as per regulations 22 of CERC (Indian Electricity Grid Code) Regulations, 2023.			
27.00.00	TAKING OVER Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.			
28.00.00	TRAINING OF EMPLOYER'S PERSONNEL			
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28.01.00	The scope of service under training of Employer's engineers shall include a training module covering the areas of Operation & Maintenance. Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer: (a) Training for Steam Generator & ESP Equipment, TG & Auxiliaries and related equipments. (b) Training for Electric Systems including VFD and Electric power supply system. (c) Training for other SG/TG related C&I systems/equipments including training on Flame Monitoring System, Furnace and Flame Viewing System , Turbine Supervisory System (TSS) including vibration analyzer, vibration monitoring system axial shift, eccentricity measurements etc. for Main Turbine, BFP Turbine etc. Burner management study, control loop study, misc. system for SG C&I, EHTC, Turbine stress control system, Turbine protection system, ATRS, instrumentation etc. - c1: Training on Engineering, Model building,pre-testing, Post -test fine tuning of Advance process control systems with faculty having experience of atleast 5 years in Model Process Control. (d) Training for special packages specified elsewhere in Technical Specification, Section-VI. (e) Training for various C&I systems/equipment supplied includes the following: i) DDCMIS - Human Machine Interface – Hardware & Operating System ii) DDCMIS-Human Machine Interface System Engineering & Application Software. iii) DDCMIS – Control System Hardware and Control system Application Software. iv) DDCMIS – Operator Training : Use of the system at Works + at site. v) DDCMIS – Specialized Network security. (f) Training for power cycle piping/critical piping. (g) Training for UPS systems Annunciation system, SWAS, PA system, flue gas analyzers, CCTV and 24 VDC system. (h) Training on following aspects of fieldbus (i) Hardware & Software features (ii) System design, diagnostic and testing (iii) maintenance, troubleshooting and fault analysis.		
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	(i) Training on Non-Intrusive hardwired Electric Actuator and Fieldbus based Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator (k) Training for numerical relays & networking systems supplied under MV & LT switchgear system. (l) Training courses on offered PLC system in the following areas: (a.) Operator training (b.) Hardware Maintenance training (c.) Software training (d.) Any other specialized training as required for system operation and maintenance. (m) Training for Ash Handling System & Coal Handling Plant Equipment and Auxiliaries <table><tr><th>Area</th><th>Topics</th><th>Mandays</th></tr><tr><td>Ash Handling Plant</td><td>Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ash handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Ash handling plant Visit to Manufacturer's Work - Manufacturing process of Ash handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization </td><td>300</td></tr><tr><td>Coal Handling Plant</td><td>Product design - Basic design features - Theory & principle of operation - Latest technological trends in Coal handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Coal handling plant Visit to Manufacturer's Work</td><td>150</td></tr></table>				Area	Topics	Mandays	Ash Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ash handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Ash handling plant Visit to Manufacturer's Work - Manufacturing process of Ash handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	300	Coal Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Coal handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Coal handling plant Visit to Manufacturer's Work	150
Area	Topics	Mandays											
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	<table><tr><td></td><td> - Manufacturing process of Coal handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization </td><td></td></tr></table>		- Manufacturing process of Coal handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization				
		- Manufacturing process of Coal handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization					
	n) Training for UF Membranes, RO membranes, Zero Liquid Discharge (ZLD) Chlorine Di-Oxide (ClO ₂) generation & dosing system, Condensate Polishing Plant (CPU) and CW Treatment System.						
	<table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td>UF Membranes</td><td> Product design -Basic design features -Theory & principle of operation -Latest technological trends in Ultrafiltration membranes and design -CIP & CEB of UF system Plant Visit -Operational feedback -O&M history/problems related to UF membranes Visit to Manufacturer's Work -Manufacturing process of UF membranes and equipment -Testing facilities Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization </td><td>7</td></tr></table>	Area	Topics	MANDAYS	UF Membranes	Product design -Basic design features -Theory & principle of operation -Latest technological trends in Ultrafiltration membranes and design -CIP & CEB of UF system Plant Visit -Operational feedback -O&M history/problems related to UF membranes Visit to Manufacturer's Work -Manufacturing process of UF membranes and equipment -Testing facilities Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	7
Area	Topics	MANDAYS					
UF Membranes	Product design -Basic design features -Theory & principle of operation -Latest technological trends in Ultrafiltration membranes and design -CIP & CEB of UF system Plant Visit -Operational feedback -O&M history/problems related to UF membranes Visit to Manufacturer's Work -Manufacturing process of UF membranes and equipment -Testing facilities Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	7					
<table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td>RO membranes</td><td>Product design</td><td>7</td></tr></table>	Area	Topics	MANDAYS	RO membranes	Product design	7	
Area	Topics	MANDAYS					
RO membranes	Product design	7					

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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		-Basic design features -Theory & principle of operation -Latest technological trends in RO membranes and design -Failure analysis, types of failures, causes & its evaluation, remedies -CIP of RO system Plant Visit -Operational feedback -O&M history/problems related to RO membranes Visit to Manufacturer’s Work -Manufacturing process of RO membranes and equipment -Testing facilities Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization		
	Zero Liquid Discharge (ZLD)	System Design - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant Plant Visit - Operational feedback - O&M history/problems related to plant	5	
	Chlorine Di-Oxide (ClO ₂) generation & dosing system	System/Product Design - Basic design features - Theory & principle of operation - Latest technological trends in Chlorine Di-Oxide (ClO₂) generation & dosing system and design aspects & Selection criteria. Plant Visit - Operational feedback - O&M history/ problems related to ClO₂ plant	5	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		Performance Test of generator - Generator capacity performance testing. Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization		
	Condensate Polishing Plant (CPU)	System/Product Design - Basic design features including Pre-filters - Theory & principle of operation - Latest technological trends in CPU & Pre-filters and design aspects & Selection criteria. Plant Visit - Operational feedback - O&M history / problems related to CPU plant Visit to Manufacturer's Work -Manufacturing process of pre-filters and major equipment -Testing facilities Operation & Maintenance of Plant -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	3	
	CW Treatment System	System/Product Design - Basic design features - Theory & principle of operation - Latest technological trends and design aspects & Selection criteria. Operation & Maintenance of Plant - Operational feedback - O&M history / problems related to plant - Trouble shooting and fault analysis Familiarization of special maintenance techniques - Special tool and tackles familiarization	3	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 51 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC					
	Note: One week shall constitute of five (5) man days.								
	(o) Training for Electrical System								
	<table><tr><th>Area</th><th>Topics</th><th>MANDAYS</th></tr><tr><td>Generator</td><td> Product design -Design aspects of associated auxiliary systems - Familiarisation with cooling medium and arrangements, winding and core support systems Plant Visit -Operational feedback -O&M history/problems related to Insulation system Visit to Manufacturer’s Work -Manufacturing process of core, winding bars, Assembly -Testing facilities Operation & Maintenance (Site) -Trouble shooting and fault analysis - Storage and Familiarization of special maintenance techniques -Special tool and tackles familiarization </td><td>60 (15+15+30)</td></tr></table>	Area	Topics	MANDAYS	Generator	Product design -Design aspects of associated auxiliary systems - Familiarisation with cooling medium and arrangements, winding and core support systems Plant Visit -Operational feedback -O&M history/problems related to Insulation system Visit to Manufacturer’s Work -Manufacturing process of core, winding bars, Assembly -Testing facilities Operation & Maintenance (Site) -Trouble shooting and fault analysis - Storage and Familiarization of special maintenance techniques -Special tool and tackles familiarization	60 (15+15+30)		
Area	Topics	MANDAYS							
Generator	Product design -Design aspects of associated auxiliary systems - Familiarisation with cooling medium and arrangements, winding and core support systems Plant Visit -Operational feedback -O&M history/problems related to Insulation system Visit to Manufacturer’s Work -Manufacturing process of core, winding bars, Assembly -Testing facilities Operation & Maintenance (Site) -Trouble shooting and fault analysis - Storage and Familiarization of special maintenance techniques -Special tool and tackles familiarization	60 (15+15+30)							
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 52 OF 119						

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Excitation systems including AVR	System Design - Design features of various sub systems, Exciter PMG - Excitation transformers, Controllers and different limiters - PSS and associated system studies Plant Visit - Operational feedback - O&M history/problems related to Excitation systems - Familiarization with various equipment functioning at reference plant Visit to Manufacturer's Work -Manufacturing process for various equipment of excitation systems -Testing facilities Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization Performance Test of generator - Generator capacity performance testing.	60 (15+15+30)	
	MV VFD (If applicable)	System/Product Design - Basic design features - Theory & principle of operation Plant Visit - Operational feedback - O&M history/ problems related to VFD - Familiarization with various equipment functioning at reference plant Operation & Maintenance (At Site) -Trouble shooting and fault analysis - Familiarization of special maintenance techniques -Special tool and tackles familiarization	90(15+15+60)	
	MV and LT switchgear	System/Product Design - Basic design features. - Relay configurations and hands on practices of logics and settings preparation - Preparation of CID/ICD/SCD files through	150 (45+15+90).	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		relay software tools and Goose configurations. - Interfacing/communication of relay with software. - Secondary injection testing of protection functions. - Familiarisation of IMCC and Interface with DCS Plant Visit - Operational feedback - O&M history / problems Visit to Manufacturer's Work -Manufacturing process of equipment -Testing facilities Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of Switchgear, IMCC and interface with DCS, relays and interfacing software. -Special tool and tackles familiarization		
	MDBFP, CW and BMCP Motors	System/Product Design - Basic design features of stator core and rotor core, winding insulation and cooling arrangements - Theory & principle of operation - Study of forces and Vibration. - Diagnostic and testing Plant Visit - Operational feedback - O&M history / problems Visit to Manufacturer's Work -Manufacturing process of equipment -Testing facilities Operation & Maintenance (At site) - O&M practices Familiarization of special maintenance techniques - Special tool and tackles familiarization	45 (15+15+15)	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Relays and Substation Automation System	System/Product Design - Basic design features. - Relay configurations and hands on practices of logics and settings preparation - Preparation of CID/ICD/SCD files through relay software tools and Goose configurations. - Interfacing/communication of relay with software. - Secondary injection/ Sampled value testing of protection functions. - Familiarisation of SAS and Cyber security Features. Plant Visit - Operational feedback - O&M history / problems Operation & Maintenance (At site) -Trouble shooting and fault analysis -Familiarization of relay configuration, settings and interfacing software. -Familiarization of SAS Hardware, software and Application software. - Secondary injection/ Sampled value testing of protection functions. - Familiarisation of cyber security features	75 (30+15+30)	
	AIS and bay equipment's	Operation & Maintenance (At site) -Erection, Storage and handling of bay equipment -Familiarization of special maintenance techniques -Special tool and tackles familiarization	30 (0+15+15)	
	Note: One week shall constitute of five (5) man days. (p) Training on Erection methodologies for all the Sub-packages, System and Equipments associated with the EPC Package, including a visit to power plant construction site. The exact details, extent and schedule for training shall be as finalized during detailed engineering and shall be subject to Employer's approval.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
28.03.00	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package. This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc.			
28.04.00	Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.			
28.05.00	Contractor shall provide training on application of PAUT (Phased array ultrasonic testing) and TOFD (Time of flight diffraction) techniques for two weeks (at least 80 Hours). The training shall be arranged at least six months prior to the start of erection works of SG & TG works.			
28.06.00	Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award.			
28.07.00	In all the above cases, the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.			
28.08.00	Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award. Note: - For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person. - The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage. - Duration of each module shall not be less than 10 (ten) working days out of which 20 % shall be for plant/manufacturers' works visits and 80% shall be classroom training. A) Location of classroom training for engineering shall be at Design/Engineering office. B) Classroom training for erection/O&M shall be at location of Manufacturers' works.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
28.09.00	TRAINING REQUIRED IN MAN MONTH			
	Area	Engineering (Man months)	Erection (Man months)	O&M (Man months)
	Steam Turbine Generator and its Auxiliaries	5.5	8.0	21
	Steam Generator and its Auxiliaries	5.5	8.0	20.5
	Station C&I (Control and Instrumentation)	3.5	5.5	10
	Ash Handling Plant	2.0	3.0	5.0
	Coal Handling Plant	1.0	1.5	2.5
	UF Membranes, RO Membranes, ZLD, Chlorine Di Oxide (ClO2) generation & dosing system, Condensate Polishing Plant (CPU), CW Treatment System	0.2	0.3	0.5
	Electrical systems consisting of generators, Excitation systems, VFD, Motors, MV/LV switchgears, relays, SAS and Switchyard	4.5	3.5	9
	Total	22.2	29.8	68.5
29.00.00	SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION			
	In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover: i) Working platforms should be fenced and shall have means of access. ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
30.00.00	NOISE LEVEL The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) meter horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA. ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA. iii) Mill noise which will be limited to 85-90 dBA. iv) TG unit in which case it shall not exceed 90 dBA. v) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 90 dBA. vi) For BFP Motor Noise level shall be within the limit of 90 dBA.			
31.00.00	PACKAGING, TRANSPORTATION AND STORAGE All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage at site due to improper packing and preservation. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation. In addition to above, the contractor shall take all necessary measures for storage of all electronic equipment / systems at site in a dust free Air conditioned space ensuring proper temperature & humidity.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
32.00.00	ELECTRICAL EQUIPMENTS/ENCLOSURES			
32.01.00	All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.			
33.00.00	INSTRUMENTATION AND CONTROL			
	All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.			
33.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.			
	All scales and charts shall be calibrated and printed in Metric Units as follows:			
	1. Temperature	-	Degree centigrade (deg C)	
	2. Pressure	-	Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	
	3. Draught	-	Millimetres of water column (mm wc).	
	4. Vacuum	-	Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).	
	5. Flow (Gas)	-	Tonnes/ hour	
	6. Flow (Steam)	-	Tonnes/ hour	
	7. Flow (Liquid)	-	Tonnes / hour	
	8. Flow base	-	760 mm Hg. 15 deg.C	
	9. Density	-	Grams per cubic centimetre.	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
33.02.00	All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.			
34.00.00	ELECTRICAL NOISE CONTROL The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).			
35.00.00	SURGE PROTECTION FOR SOLID STATE EQUIPMENT All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.			
36.00.00	INSTRUMENT AIR SYSTEM The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.			
37.00.00	TAPPING POINTS FOR MEASUREMENTS Tapping points shall include probes, wherever applicable, for analytical measurements and sampling. For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted. The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.			
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38.00.00	i) Temperature test pockets with stub and thermowell ii) Pressure test pockets			
	SYSTEM DOCUMENTATION The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification. The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.			
	38.01.00 Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.			
39.00.00	MAINTENANCE MANUALS OF ELECTRONIC MODULES The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc. as required to do the testing and maintenance of the electronic modules. Backup & Restoration Procedures of DDCMIS, Station LAN & Advance Process Control shall be provided.			
	40.00.00 MAKE IN INDIA REQUIREMENTS a) The bidder shall follow Indian laws, regulations and standards. There shall not be any restriction in terms of compliance to codes & standards of foreign origin only. The compliance to equivalent/better Indian as well as other codes & standards, wherever available, shall also be acceptable.			
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	b) The technologies/ products offered shall be environmentally friendly, consuming less energy, and safe, energy efficient, durable and long lasting under the prescribed operational conditions. c) The bidder/its sub vendor/supplier shall ensure supply of spares, materials and technological support for the entire life of the project. d) The bidder shall list out the products and components producing Toxic E-waste and other waste as specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled/ disposed of by the contractor and for this, the bidder has to establish recycling/disposal unit as specified. Bidder shall also comply with Plastic Waste Management Rules, 2016, as amended from time to time, and facilitate EPR (Extended Producer Responsibility) registration of Employer before import of plastic packaging product or products with plastic packaging or carry bags or multi-layered packaging or plastic sheets or like. e) The equipment/ material sourced from foreign companies will be tested in accredited labs in India before acceptance wherever such facilities are available. The testing shall be carried out in accordance with MOP extant order/guidelines. f) The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect. g) All applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier. h) Wherever required, the foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Employer. i) To protect the security, integrity and reliability of equipment in this package, it is essential to remove vulnerabilities arising out of the possibility of cyber-attack through malware/ Trojans etc. embedded in imported equipments. This requirement shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in this package. Contractor shall comply all the requirements of Order No 25-11/6/2018-PG, dated 02/07/2020 (attached as Appendix-I), issued by Ministry of Power, Government of India and its subsequent amendments/revisions. Contractor shall furnish declaration of compliance of MOP order dated 02/07/2020 requirements with dispatch of equipment/ item. Further, Contractor shall furnish back up testing certificates, whenever Employer asks the same. 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.			
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	Any violation w.r.t Make in India and minimum local content (MLC) requirements as specified shall be sole responsibility of the Bidder.			
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	Appendix-I No.25-11/6/2018-PG Government of India Ministry of Power Shram Shakti Bhawan, Rafi Marg, New Delhi – 110001 Tele Fax: 011-23730264 ***** Dated 02/07/2020 ORDER Power Supply System is a sensitive and critical infrastructure that supports not only our national defence, vital emergency services including health, disaster response, critical national infrastructure including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the entire economy and the day-to-day life of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is a strategic and critical sector. The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network in the country, the following directions are hereby issued :- (1) All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards. (2) All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MoP). (3) Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India (4) Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MoP). This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system. This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).  (Goutam Ghosh) Director Tel: 011-23716674 To: - All Ministries/Departments of Government of India (As per list) - Secretary (Coordination), Cabinet Secretariat - Vice Chairman, NITI Aayog - Comptroller and Auditor General of India - Chairperson, CEA - CMDs of CPSEs/Chairman of DVC & BBMB/MD, EESL/DG, NPT/DG, CPRI/DG, BEE/ - All ASs/JSs/EA, MoP Copy: - PS to Hon'ble PM, Prime Minister's Office - PS to Hon'ble MOS(IC) for Power and NRE - Sr. PPS to Secretary(Power)			
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	Appendix-II No. A-1/2021-FSC-Part(5) Government of India Ministry of Power Shram Shakti Bhawan, New Delhi Dated: 16th November, 2021 <u>ORDER</u> Subject: Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Power Sector. Reference: Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 16.09.2020. The Government of India, Department for Promotion of Industry and Internal Trade (DPIIT) issued Public Procurement (Preference to Make in India), Order 2017, for encouraging 'Make in India' and promoting manufacturing and production of goods and services in India with a view to enhancing income and employment. Subsequently, DPIIT vide order No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 and further vide order dated 16th September, 2020 have issued the revised Public Procurement (Preference to Make in India) Order 2017. 2. In light of the Public Procurement (Preference to Make in India) Order 2017, this Ministry had notified purchase preference (linked with local content) for Hydro and Transmission sectors vide Order No. 11/05/2018-Coord dated 20.12.2018, for Thermal sector vide Order dated 28.12.2018 and for Distribution sector vide Order dated 17.03.2020. Further, a combined order dated 04.04.2020 was also issued in supersession of all previous orders to indicate equipment/material/components for which there was sufficient local capacity and competition and also to indicate conditions for including suitably in the tenders to be issued by the procurers. In furtherance of Para 19 of the DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 04.06.2020, Ministry of Power (MoP) issued a revised comprehensive Order dated 28.07.2020 (Annexure-I amended by order dated 17.09.2020). 3. DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 has further revised its order dated 04.06.2020. Therefore, in supersession of all the aforementioned orders including order No.10/1/2019-St.Th. (Part-II) dated 20.03.2020 issued by this Ministry, the following has been decided: i. For the purpose of this order, the definitions of various terms used in the order, and provisions relating to (i) Eligibility of 'Class-I local supplier'/'Class-II local supplier'/'Non-local suppliers' for different types of procurement, (ii) purchase preference (iii) exemption to small purchases and (iv) margin of purchase preference shall be the same as in DPIIT order dated 16.09.2020, referred to above and extracts of the same is given at Appendix. ii. In procurement of all goods and services or works in respect of which there is sufficient local capacity and local competition as in Annexure-I, only "Class-I local supplier" shall be eligible to bid irrespective of purchase value. "Class-I local supplier" is a supplier or service provider whose goods, services or works offered for procurement meets the Minimum Local Content (MLC) as prescribed in Annexure-I of this order. "Class-II local supplier" means a 			
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supplier, as defined by DPIIT in its Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020.

- iii. In the procurement of all goods and services or works other than those listed in Annexure-I, only "Class-I local supplier" and "Class-II local supplier" as defined in the order of this Ministry herewith shall be eligible to bid in procurement undertaken by procuring entities, except when Global Tender Enquiry has been issued. In Global tender enquiries, "Non-local suppliers" shall also be eligible to bid along with "Class-I local suppliers" and "Class-II local suppliers". In procurement of all goods, services or works not covered by sub-para 3(ii) above, and with estimated value of purchases less than Rs. 200 crores, in accordance with Rule 161(iv) of GFR, 2017, Global Tender Enquiry(GTE) shall not be issued except with the approval of the competent authority as designated by Department of Expenditure.
- iv. For the purpose of this order, 'Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works', Engineering, Procurement and Construction (EPC) contracts and service contracts including System Integrator (SI) contracts.
4. The list of items, in respect of which, local capacity with sufficient competition exists as per **Annexure-I**, will be reviewed at regular intervals with a view to increase number of items in this list and also to increase the MLC for each item, wherever it is less than 100%.
5. Purchase preference shall be given to local suppliers in accordance with **para 3A** of DPIIT Order dated 16.09.2020, and extracts of the same are given at **Appendix**.
6. Further, it has been decided to constitute a committee for independent verification of self-declarations and auditor's / accountant's certificates on random basis and in the case of complaints. The composition of the committee is given below:

Member (Planning), Central Electricity Authority (CEA)	Chairperson
Chief Engineer (PSETD), CEA	Member
Chief Engineer (HETD), CEA	Member
Chief Engineer (TETD), CEA	Member
Chief Engineer (DP&R), CEA	Member
As may be co-opted by CEA	External Expert
Chief Engineer (R&D), CEA	Convener

7. Further, it has also been decided to constitute a committee to examine the grievances in consultation with stakeholders and recommend appropriate actions to the Competent Authority in MoP. The composition of the Committee is given below:

Chairperson, CEA	Chairperson
Member (Hydro), CEA	Member



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	<table><tr><td>Member (Power System), CEA</td><td>Member</td></tr><tr><td>Member (Thermal), CEA</td><td>Convener</td></tr></table> 8. The complaint fee of Rs. 2 Lakhs or 1% of the value of the local item being procured (subject to maximum of Rs. 5 Lakhs), whichever is higher, shall be paid in the form of Demand Draft, drawn in favour of PAO, CEA, New Delhi. In case the complaint is found to be incorrect, the complaint fee shall be forfeited. In case, the complaint is upheld and found to be substantially correct, the deposited fee of the complainant would be refunded without any interest. 9. All other conditions, not stipulated in this order, shall be as laid down in the DPIIT's order No. P-45021/2/2017-PP (BE-II) dated 16.09.2020. 10. This order shall be applicable in respect of the procurement made by all attached or subordinate offices or autonomous bodies under the Government of India including Government Companies as defined in the Companies Act, and /or the States and Local Bodies making procurement under all Central Schemes/ Central Sector Schemes where the Scheme is fully or partially funded by the Government of India. The aforesaid orders shall also be applicable in respect of projects wherein funding of goods, services or works is by Power Finance Corporation (PFC) /Rural Electrification Corporation (REC) and any Financial Institution in which Government of India/ State Government share exists. This order shall be applicable to Tariff Based Competitive Bidding (TBCB) projects also. Procuring entities as defined in the DPIIT's Order dated 16.09.2020 are advised to revise their tender documents to fully comply with the said DPIIT's Order and the subsequent Orders that would be issued in this regard by DPIIT/ this Ministry from time to time. 11. All tenders for procurement by Central Government Agencies or the States and Local Bodies, as the case may be, have to be certified for compliance of the Public Procurement (Preference to Make in India) 'PPP-MII' Order by the concerned procurement officer of the Government Organization before uploading the same on the portal. 12. Exemption from meeting the stipulated local content is allowed as per clause 13 and 13A of PPP-MII Order dated 16.09.2020, if the manufacturer declares that the item is manufactured in India under a License from a foreign Manufacturer who holds Intellectual Property Rights (IPRs) and there is Transfer of Technology (ToT) with phasing to increase Minimum Local Content. For such items, if any CPSE under the administration of Ministry of Power requests exemption for any item, it shall be considered by Ministry of Power, on case to case basis. 13. In order to further encourage Make in India initiatives and promote manufacturing and production of goods and services in India, general guidelines as enclosed at Annexure-II may be adopted in an appropriate manner according to the circumstances by the procuring entities in their tendering process. 14. The procurers may specify the higher values of MLC than those specified in this Order in respect of goods, services or works covered in their tenders and award the weightage to the product of higher MLC for which they have to specify the criteria beforehand in their tender. The values given in Annexure-I are the minimum prescribed values for becoming a class-I local supplier for the products indicated therein. 				Member (Power System), CEA	Member	Member (Thermal), CEA	Convener
Member (Power System), CEA	Member							
Member (Thermal), CEA	Convener							
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	15. This issues with the approval of Hon'ble Minister for Power and New & Renewable Energy.  (S. Majumdar) Under Secretary to the Government of India Tele No. 011- 23356938 To: 1. Secretary to Government of India (All Ministries/ Departments of Government of India) (As per list) 2. Secretary (Coordination), Cabinet Secretariat 3. CEO, NITI Aayog 4. Chief Secretaries of all States/ UTs 5. Comptroller and Auditor General of India 6. Secretary, DPIIT, Chairman of Standing Committee for implementation of Public Procurement Order, 2017 7. Director General, Bureau of Indian Standards (BIS) 8. Joint Secretary, DPIIT, Member-Convener of Standing Committee for implementation of Public Procurement Order, 2017 9. Chairperson, CEA 10. CMDs of CPSEs, CMD NLC, Chairman of DVC/ BBMB/ EESL, DGs of BEE/ CPRI/ NPTI 11. All Additional Secretaries/ JSs/ EA/ CE, Ministry of Power Copy to: Director (Technical), NIC with a request to publish the Order on the website of Ministry of Power			
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	APPENDIX <u>Extracts of important provisions contained in DPIIT Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020</u> 1. Definitions (Para 2 of DPIIT order): 'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent. 'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order. 'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for "Class-I Local supplier" under this Order. 'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order. 'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation. 'Margin of purchase preference' means the maximum extent to which the price quoted by a 'Class-I local supplier' may be above the L1 for the purpose of purchase preference. 'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works. 'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act. 'Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works'. 2. Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement (Para 3 of DPIIT order) (a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value. (b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by 3(a) above, and with estimated value of purchases less than Rs 200 crores, in accordance with Rule 161(iv) of GFR, 2017 Global tender enquiry shall not			
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	be issued except with the approval of competent authority as designated by Department of Expenditure. (c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts. 3. Purchase Preference (Para 3A of DPIIT order) (a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under. (b) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are divisible in nature, the "Class-I local supplier" shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure: - Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1. - If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder. - In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure: - Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1, - If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. - In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder. "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.			
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	4. Applicability in tenders where contract is to be awarded to multiple bidders (<i>Para 3B of DPIIT order</i>)- In tenders where contract is to be awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure: a) In case there is sufficient local capacity and competition for the items to be procured, as notified by the Nodal Ministry, only 'Class-I local supplier' shall be eligible to bid. As such, the multiple supplier who would be awarded the contract, should be all and only 'Class-I local suppliers'. b) In other cases, 'Class-II local suppliers' and 'Non-Local suppliers' may also participate in the bidding process along with 'Class-I local supplier' as per provisions of this order. c) If 'Class-I local supplier' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class-I local supplier' do not qualify for award of the contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class-I local supplier' over 'Class-II local supplier'/'Non-local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class-I local suppliers' taken in totality or considered for award of contract for at least 50% of the tendered quantity. d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference subject to its meeting the prescribed criteria for award of contract as also the constraints of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier' falling within 20% margin of purchase preference, and so on. e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulate in sub-para above. 5. Exemption of small purchases (<i>Para 4 in DPIIT order</i>): Procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order. 6. Minimum Local Content (<i>Para 5 in DPIIT order</i>): The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the local content requirement is minimum 20%. Nodal Ministry/Department may prescribe only a higher percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/'Class-II local supplier'. For the item for which Nodal Ministry/Department has not prescribed higher minimum local content notification under the order, it shall be 50% and 20% for 'Class-I local supplier'/'Class-II local supplier' respectively.			
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	7. Vide DPIIT OM No. P-45021/102/2019-BE-IIPart(1) (E-50310) dated 4.03.2021 services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. shall not be considered as local value addition. Bidders offering imported products will fall under the category of Non- local suppliers. They can't claim themselves as Class-I local suppliers/Class-II local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. as local value addition. 8. Margin of Purchase Preference (Para 6 of DPIIT order): The margin of purchase preference shall be 20%. 9. Specifications in Tenders and other procurement solicitations (Para 10 of DPIIT order): - Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports. - Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier. - Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above. Reciprocity Clause: - When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc. it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action. - Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all the items related to that nodal Ministry/Department, except for the list of items published by the Ministry/Department permitting their participation. - The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchase on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/Department. - State Governments should be encouraged to incorporate similar provisions in their respective tenders. - The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time. - Specifying foreign certification/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local			
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	suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/ or for any other reason, the same shall be done only after written approval of Secretary of Department concerned or any other authority having been designated such power by the Secretary of the Department concerned. f. "All administrative Ministries/Departments whose procurement exceeds Rs. 1000 Crore per annum shall notify/ update their procurement projections every year, including those of PSEs/PSUs, for the next 5 years on their respective website."			
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Annexure-I

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
(A) Common items for Transmission, Distribution and Generation Sector		
1	Power Transformers (up to 765 kV, including Generator transformers)	60
2	Instrument Transformer (up to 765 kV)	60
3	Transformer Oil Dry Out System (TODOS)	60
4	Reactors up to 765 kV	60
5	Oil Impregnated Bushing (up to 400 kV)	60
6	Resin Insulated Paper (RIP) bushings (up to 145 kV)	50
7	Circuit Breakers (up to 765 kV AC - Alternating Current)	60
8	Disconnectors/Isolators (up to 765 kV AC)	60
9	Wave trap (up to 765 kV AC)	60
10	Oil Filled Distribution Transformers up to & including 33 kV [Cold Rolled Grain Oriented (CRGO)/Amorphous, Aluminium/Copper wound]	60
11	Dry Type Distribution Transformer upto and including 33 kV (CRGO/Amorphous, Aluminium/Copper wound)	60
12	Conventional Conductor	60
13	Accessories for Conventional conductors	60
14	High Temperature/High Temperature Low Sag (HTLS) conductors (such as Composite core, GAP, ACSS, INVAR, AL59) and Accessories	60
15	Optical ground wire (OPGW) – all designs	60
16	Fiber Optic Terminal Equipment (FOTE) for OPGW	50
17	OPGW related Hardware and Accessories	60
18	Remote Terminal Unit (RTU)	50
19	Power Cables and accessories up to 33 kV	60
20	Control cables including accessories	60
21	XLPE Cables up to 220 kV	60
22	Substation Structures	60
23	Transmission Line Towers	60
24	Porcelain (Disc/Long Rod) Insulators	60
25	Bus Post Insulators (Porcelain)	60
26	Porcelain Disc Insulators with Room Temperature Vulcanisation (RTV) coating	50
27	Porcelain Longrod Insulators with Room Temperature Vulcanisation (RTV) coating	50
28	Hardware Fittings for Porcelain Insulators	60
29	Composite/Polymeric Long Rod Insulators	60
30	Hardware Fittings for Polymer Insulators	60
31	Bird Flight Diverter (BFD)	60
32	Power Line Carrier Communication (PLCC) System (up to 800 kV)	60
33	Gas Insulated Switchgear (up to 400 kV AC)	60
34	Gas Insulated Switchgear (above 400 kV AC)	50
35	Surge/Lightning Arrester (up to 765 kV AC)	60
36	Power Capacitors	60
37	Packaged Sub-station (6.6 kV to 33 kV)	60
38	Ring Main Unit (RMU) (up to 33 kV)	60
39	Medium Voltage (MV) GIS Panels (up to 33 kV)	60
40	Automation and Control System/Supervisory Control and data Acquisition (SCADA) System in Power System	50
41	Control and Relay Panel (including Digital/Numerical Relays)	50
42	Electrical Motors 0.37 kW to 1 MW	60
43	Energy Meters excluding smart meters	50
44	Control & power cables and Accessories (up to 1.1 kV)	60
45	Diesel Generating (DG) set	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
46	DC system (DC Battery & Battery Charger)	60
47	AC & DC Distribution Board	60
48	Indoor Air Insulated Switchgear (AIS) upto 33 kV	60
49	Poles (PCC, PSCC, Rolled Steel Joist, Rail Pole, Spun, Steel Tubular)	60
50	Material for Grounding/earthing system	60
51	Illumination system	60
52	Overhead Fault Sensing Indicator (FSI)	50
53	Power Quality Meters	50
54	Auxiliary Relays	50
55	Load Break Switch	50
(B) Hydro Sector		
56	Hydro Turbine & Associated equipment	
	a) Francis Turbine	60
	b) Kaplan Turbine	60
	c) Pelton Turbine	50
57	Main Inlet Valve & Associated Equipment	60
58	Penstock Protection Valve and Associated Equipment	60
59	Governing system & Accessories	60
60	Generator for Hydro Project & Associated Equipment	60
61	Static Excitation System	60
62	Workshop Equipment	60
63	Cooling Water System	60
64	Compressed Air System	60
65	Drainage/Dewatering System	60
66	Fire Protection System	60
67	Heating, Ventilation & Air Conditioning System (HVAC)	60
68	Oil Handling System	60
69	Mechanical Balance of Plant (BOP) Items	60
(C) Thermal Sector		
Boiler Auxiliaries		
70	Air Pre-Heater	60
71	Steam Coil Air Pre Heater (SCAPH)	60
72	Steam soot blowers [wall blowers & Long Retractable Soot Blower (LRSB)]	60
73	Auxiliary Steam Pressure Reducing & Desuperheating (PRDS)	60
74	Fuel oil system	60
75	Seal air Fan	60
76	Ducts and dampers	60
77	Duct expansion joints	60
78	Blowdown tanks	60
79	Coal burners and oil burners	60
80	Coal mills	60
81	Gear Box of Coal Mill	50
82	Coal feeders	60
83	Primary Air Fans	60
84	Forced Draft Fans	60
85	Induced Draft Fans	60
86	Forced Draft (FD)/Induced Draft (ID)/ Primary Air (PA) Fan Servo Motor Assembly	50
87	Tubes (Carbon Steel)	50
88	Steam pipes (Carbon Steel)	50
89	Steam drum	50
90	Separator	50
91	Selective Catalytic Reduction (SCR)	50

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
Electro-Static Precipitators (ESPs)		
92	Casing	60
93	Electrodes	60
94	Rapping System	60
95	Hopper Heaters	60
96	Transformer Rectifiers	60
97	Insulators	60
Turbine & Auxiliaries		
98	Turbine (High Pressure/Intermediate Pressure/Low Pressure)	50
99	Condensate Extraction Pumps	60
100	Condenser On line Tube Cleaning System (COLTC)	60
101	Debris filters	60
102	Deaerator	60
103	Drain Cooler and Flash Tank	60
104	ECW Pump	50
105	Plate Heat Exchanger	50
106	Self-cleaning filters	50
107	Condensate Polishing Units (CPUs)	60
108	Chemical Dosing System	60
109	Oil Filter	60
110	Gland Steam Condenser	60
111	Oil Purifying Centrifuge	50
112	Water Cooled Condenser	50
113	Boiler Feed Pumps (BFPs)	50
Generator and Auxiliaries		
114	Generator (including Seal Oil System, Hydrogen Cooling System, Stator water cooling system)	60
Electrical Works		
115	Control and metering equipment	60
Control & Instrumentation System (C&I System)		
116	Thermocouples	50
117	Measuring instruments [Resistance Temperature Detectors (RTDs)], Local gauges	50
118	Actuators (Pneumatic and conventional electric)	50
119	Interplant Communication/ Public Address (PA) system except IP based	50
Coal Handling Plant		
120	Conveyors	60
121	Wagon Tippler	60
122	Side Arm Charger	60
123	Paddle feeder	60
124	Crushers & Screens	60
125	Dust suppression (dry fog & plain water) system	60
126	Air Compressors	50
127	Magnetic separators & metal detectors	60
128	Coal Sampling System	60
129	Stacker cum reclaimer	60
130	Belt weighing & monitoring system	60
131	Wheel & axle assembly (without bearings) for Bottom Opening Bottom Release (BOBR) Wagons	60
Ash Handling System		
132	Clinker grinder	60
133	Water jet ejectors	60
134	Scraper chain conveyor	60
135	Dry fly ash vacuum extraction system	60
136	Pressure pneumatic conveying system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
137	Ash water & ash slurry pumps	60
138	Compressors, air dryers & air receivers	50
139	Ash water recovery system	60
	Raw Water Intake & Supply System	
140	Travelling water screens	60
141	Raw water supply pumps	60
142	Valves, RE joints etc.	60
	Water Treatment System and Effluent Treatment System	
143	Clarification plant	60
144	Filtration plant	60
145	Ultra filtration plant	50
146	Reverse Osmosis (RO) plant and its membrane	55
147	De-Mineralised water plant (DM Plant)	60
148	Chlorination plant	60
149	Chemical dosing system	60
150	Effluent Treatment Plant	60
	Circulating Water (CW) & Auxiliary Circulating Water (ACW) System	
151	CW & ACW Pumps	60
152	Butter Fly (BF) valves, Non-return Valves (NRVs) etc.	60
153	Rubber Expansion (RE) joints	60
154	Air release valves	60
	Cooling Towers (NDCT/ IDCT)-Natural-Draft and Induced Draft Cooling Tower	
155	Water Distribution System	60
156	Spray nozzles	60
157	Packing	60
158	Drift eliminators	60
159	Cooling Tower (CT) Fans (for Induced Draft Cooling Towers IDCT)	60
160	Gear boxes, shafts & motors (for IDCT)	60
	Air Conditioning & Ventilation System	
161	Split & window air conditioners	60
162	Chilling/ condensing unit (upto 500 ton of refrigeration(TR))	55
163	Air Handling Unit (AHU) and Fresh air unit	60
164	Cooling Towers	60
165	Air Washing Units (AWUs), axial fans, roof extractors	60
166	Ducts, louvers & dampers	60
	Flue Gas Desulphurization (FGD)	
167	Spray Nozzles,	50
168	Spray header	50
169	Oxidation Blowers	50
170	Limestone wet Ball Mill	50
171	Slurry Handling Pumps for FGD system	50
172	Booster Fans for FGD system	50
173	Carbon Steel Ducts and Dampers for FGD	60
174	Storage Tanks and Silos	60
175	Process Water Pump for FGD system	50
	(D) Other Common Items	
	Fire protection and detection system	
176	Motor driven fire water pumps	60
177	Diesel engine driven fire water pumps	60
178	Hydrant system for the power plant.	60
179	High velocity water spray system	60
180	Medium velocity water spray system	60
181	Foam protection system	60
182	Inert gas flooding system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
183	Fire tenders	60
184	Portable fire-extinguishers	60
185	Cranes, EOT cranes, gantry crane & chain pulley blocks etc.	60
186	Elevator	60

(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) Package Based Works	Minimum Local Content (%)
1	Boiler	60
2	TG System (Water Cooled Condenser)	60
3	Ash Handling Plant	60
4	Coal Handling Plant	60
5	Electro-static Precipitator (ESP)	60
6	Circulating Water (CW) System	60
7	Cooling Tower	60
8	Water Treatment System	60
9	Air Conditioning System (below 500TR)	60
10	Flue Gas Desulphurisation (FGD) System	60
11	Station Control & Instrumentation (C&I)	50
12	Hydro Power Projects (Electro-Mechanical Works)	60
	Gas based generation	
	Overall Gas Turbine Package (on finished Product basis)	
13	< 44 MW	60
14	44 –145 MW	50
	Overall Combined Cycle Gas Turbine (CCGT) Package (on finished Product basis)	
15	< 44 MW	60
16	44 – 145 MW	60
17	> 150 MW	60
	(2) Project as a whole	
1	Works and service contracts in Power Sector	60
2	Transmission Line with Conventional conductors (ACSR, AAAC, AL-59 etc.)	60
3	Transmission Line with High temperature Low Sag (HTLS) conductors	60
4	HVAC Substation Air Insulated (AIS)	60
5	HVAC Substation Gas Insulated (GIS)	60
6	HVDC Substation	60
7	Distribution Sector	60

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	Annexure-II General guidelines to be adopted selectively in an appropriate manner by the procuring entities in their tender documents. 1. The bidder shall have to be an entity registered in India in accordance with law. 2. The bids shall be in the language as prescribed by the tenderer/procurer. 3. The bids shall be in Indian Rupees (INR) (in respect of local content only). 4. Indian subsidiaries of foreign bidders shall have to meet the qualifying criteria in terms of capability, competency, financial position, past performance etc. 5. The bidder shall follow Indian laws, regulations and standards. 6. To be eligible for participation in the bid, foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India as may be specified by the tenderer/ procurer. 7. Similar or better technology than the technology offered in respect of material, equipment and process involved shall be transferred to India. Along with the transfer of technology, adequate training in the respective field shall also be provided. 8. Country of origin of the equipment/material shall be provided in the bid. 9. For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for more than _____ years (to be specified by the procurer). 10. The technologies/ products offered shall be environmental friendly, consuming less energy, safe, energy efficient, durable and long lasting under the prescribed operational conditions. 11. The supplier shall ensure supply of spares, materials and technological support for the entire life of the project. 12. The manufacturers/ supplier shall list out the products and components producing Toxic E-waste and other waste as may be specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ supplier and for this, the Manufacturer/supplier along with procurer has to establish recycling / disposal unit or as may be specified. 13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respective Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	14. The equipment/ material sourced from foreign companies may be tested in accredited labs in India before acceptance wherever such facilities are available. 15. The Tender fee and the Bank Guarantee (BG) shall be in Indian Rupees only. 16. The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect. 17. Applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier. 18. Statutory laws/regulations including the labour and environmental laws shall be strictly complied with during supply, storage, erection, commissioning and operation process. A regular compliance report shall be submitted to the procurer/appropriate Authorities. 19. Formation of new joint venture in India shall be permitted only with the Indian companies. 20. Tendering by the agent shall not be accepted. 21. In case local testing is not considered necessary by the procurer, the original test report in the language prescribed by the procurer may be accepted. The translated test report shall not be accepted unless it is notarised. 22. Certification/compliance as per the Indian Standards/ International Standards/ Indian Regulations/ specified Standards shall be mandatory, where ever applicable. 23. Quality assurance of the product shall be carried out by the procurer or an independent third party agency appointed by the procurer. Manufacturing Quality Plan as approved by the procurer shall be followed by the manufacturer/supplier. 24. Wherever required by the procurer, foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of utilities. 25. Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	LIST OF CODES AND STANDARDS			
	Indian Standards	Title	International and Internationally recognised standards	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)	
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
	IS:2825	Code for unfired vessels		
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water		
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose		
	IS:1601	Specification for performance of constant speed IC Engines for general Purpose		
	IS:1893	Criteria for earthquake resistant design of structures		
	IS1978-1971	Line Pipe April 1969.	API Standards 5L	
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954	
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968	
	IS:2312	Propellant type Ventilation fans		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963	
	IS:3354	Outline dimensions for electric lifts.		
	IS:3401	Silica gel		
	IS:3588	Specification for electrical axial flow fans		
	IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)		
	IS:3677	Unbonded rock and slag wool for thermal insulation		
	IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)	
	IS:3895	Specification for monocry-stallines semiconductor rectifier cells and stacks		
	IS:3963	Roof extractor unit		
	IS:3975	Mild steel wires, strips and tapes for armouring cables		
	IS:4503	Shell and tube type heat Exchanger		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 83 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:4540 IS:4671 IS:4736 IS:4894 IS:5456 IS:5749 IS:6392 IS:6524 Part-I IS:7098 IS:7373 IS:7938 ISO:1217 ASHRAE-33 and air heating coils. ASHRAE-52-76	Specification for monory-stallines rectifire assembly equipment Expanded polystyrene for thermal insulation purpose Hot dip zinc coating on steel tubes Centrifugal fans Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only) Forged ramshorn hooks Steel pipe flanges Code of practice for design of tower cranes Static and rail mounted Cross linked Polyethylene insulated PVC sheathed cables Specification for wrought aluminium and aluminium sheet and strips Air receivers for compressed air installation Displacement compressor-Acceptance test Methods of testing for rating of forced circulation air cooling Air cleaning device used in general ventilation for removing particle matter.	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958 BS 4504 : 1969 BS 2799 : 1956 Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524	
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	ASHRAE-22-72 Method of testing for rating of water cooled refrigerant condensers. ASHRAE 23-67 Methods of testing for rating of positive displacement refrigerant compressors. ARI-450-6 Standard for water cooled refrigerant condensers. ARI-550 Standard for centrifugal water chilling packages. ARI-410 Standard for forced circulation air cooling and air heating coils ARI-430/435 Central station AHU/Application of Central Station AHU BS:848 Fans (Part-1,2) BS:400 Low carbon steel cylinders for the storage & transport of permanent gases. BS:401 Low carbon steel cylinders for the storage & transport of liquified gases. CTI Code Acceptance test code for Water Cooling Tower. ACT-105 ANSI-31.5 Refrigerant piping ASME-PTC- Atmospheric Water Cooling Equipment 23-1958 AMCA A-21C Test Code for air moving devices API:618 Reciprocating Compressor for general refinery services. HYDRAULIC INSTITUTE STANDARDS. HYDRANT SYSTEM MANUALS OF TAC. TAC MANUALS OF SPRAY SYSTEM NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS. INDIAN EXPLOSIVES ACT. INDIAN FACTORIES ACT. STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 85 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	CODE AND STANDARD FOR CIVIL WORKS Some of the applicable Standards, Codes and references are as follows: Excavation & Filling IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc. IS: 4701 Code of practice for earth work on canals. IS: 9758 Guidelines for Dewatering during construction. IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. Properties, Storage and Handling of Common Building Materials IS: 269 Specification for ordinary Portland cement, 33 grade. IS: 383 Specification for coarse and fine aggregates from natural sources for concrete. IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement. IS: 455 Specification for Portland slag cement. IS: 702 Specification for Industrial bitumen. IS: 712 Specification for building limes. IS: 808 Rolled steel Beam channel and angle sections. IS: 1077 Specification for common burnt clay building bricks. IS: 1161 Specification of steel tubes for structural purposes. IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C. IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B. IS: 1367 Technical supply conditions for Threaded fasteners.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based. (Part-II) Calcined clay based. IS: 1542 Specification for sand for plaster. IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement. IS: 1786 Specification for high strength deformed bars for concrete reinforcement. IS: 2062 Specification for steel for general structural purposes. IS: 2116 Specification for sand for masonry mortars. IS: 2386 Testing of aggregates for concrete. (Parts-I to VIII) IS: 3150 Hexagonal wire netting for general purpose. IS: 3495 Methods of tests of burnt clay building bricks. (Parts-I to IV) IS: 3812 Specification for fly ash, for use as pozzolana and admixture. IS: 4031 Methods of physical tests for hydraulic cement. IS: 4032 Methods of chemical analysis of hydraulic cement. IS: 4082 Recommendations on stacking and storage of construction materials at site. IS: 8112 Specification for 43 grade ordinary portland cement. IS: 8500 Medium and high strength structural steel. IS: 12269 53 grade ordinary portland cement. IS: 12894 Specification for Fly ash lime bricks.		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Cast-In-Situ Concrete and Allied Works IS: 280 Specification for mild steel wire for general engineering purposes. IS: 456 Code of practice for plain and reinforced concrete. IS: 457 Code of practice for general construction of plain & reinforced concrete for dams & other massive structures. IS: 516 Method of test for strength of concrete. IS: 650 Specification for standard sand for testing of cement. IS: 1199 Methods of sampling and analysis of concrete. IS: 1791 General requirements for batch type concrete mixers. IS: 1838 (Part-I) Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type). IS: 2204 Code of practice for construction of reinforced concrete shell roof. IS: 2210 Criteria for the design of reinforced concrete shell structures and folded plates. IS: 2438 Specification for roller pan mixer. IS: 2502 Code of practice for bending and fixing of bars for concrete reinforcement. IS: 2505 General requirements for concrete vibrators, immersion type. IS: 2506 General requirements for concrete vibrators, screed board type. IS: 2514 Specification for concrete vibrating tables. IS: 2645 Specification for Integral cement water proofing compounds. IS: 2722 Specification for portable swing weigh batches for concrete. (single and double bucket type) IS: 2750 Specification for Steel scaffolding.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 88 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS: 2751 IS: 3025 IS: 3366 IS: 3370 (Part I to IV) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 IS: 5624 IS: 6461	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction. Methods of sampling and test waste water. Specification for Pan vibrators. Code of practice for concrete structures for the storage of liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating concrete. Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction of buildings. Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced concrete work. Specification for foundation bolts. Glossary of terms relating to cement concrete.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 89 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS: 6494 Code of practice for water proofing of underground water reservoirs and swimming pools. IS: 6509 Code of practice for installation of joints in concrete pavements. IS: 7861 Code of practice for extreme weather concreting. (Parts I & II) IS: 9012 Recommended practice for shot concreting. IS: 9103 Specification for admixtures for concrete. IS: 9417 Recommendations for welding cold worked steel bars for reinforced concrete construction. IS: 10262 Recommended guidelines for concrete mix design. IS: 11384 Code of practice for composite construction in structural steel and concrete. IS: 11504 Criteria for structural design of reinforced concrete natural draught cooling towers. IS: 12118 Specification for two-parts poly sulphide. IS: 12200 Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams. IS: 13311 Method of non-destructive testing of concrete. Part-1 Ultrasonic pulse velocity. Part-2 Rebound hammer. SP:23 Handbook of concrete mixes SP: 24 Explanatory Handbook on IS: 456-1978 SP: 34 Handbook on concrete reinforcement and detailing. Precast Concrete Works SP: 7(PartVI/ National Building Code- Structural design of prefabrication and Sec.7) systems building.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 90 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 10297 Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. IS: 10505 Code of practice for construction of floors and roofs using pre-cast reinforced concrete units. Masonry and Allied Works IS: 1905 Code of Practice for Structural Safety of Buildings-Masonry walls. IS: 2212 Code of Practice for Brickwork. IS: 2250 Code of Practice for Preparation and use of Masonry Mortar. SP: 20 Explanatory handbook on masonry code. Sheeting Works IS:277 Galvanised steel sheets (plain or corrugated). IS: 459 Unreinforced corrugated and semi-corrugated asbestos cement sheets. IS: 513 Cold-rolled carbon steel sheets. IS: 730 Specification for fixing accessories for corrugated sheet roofing. IS: 1626 Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings. IS: 2527 Code of practice for fixing rain water gutters and down pipe for roof drainage. IS: 3007 Code of practice for laying of asbestos cement sheets. IS: 5913 Methods of test for asbestos cement products. IS: 7178 Technical supply conditions for tapping screw. IS: 8183 Bonded mineral wool.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 91 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS: 8869 IS: 12093 IS: 12866 IS: 14246 Fabrication and Erection of Structural Steel Work IS: 2016 IS: 814 IS: 1852 IS: 3502 IS: 6911 IS: 3757 IS: 6623 IS: 6649 IS: 800 IS: 816 IS: 4000 IS: 9595 IS: 817	Washers for corrugated sheet roofing. Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). Specification for continuously pre-painted galvanised steel sheets and coils. Specification for plain washers. Specification for covered Electrodes for Metal Arc Welding for weld steel. Specification for Rolling and Cutting Tolerances for Hot rolled steel products. Specifications for chequered plate. Specification for stainless steel plate, sheet and strip. Specification for high strength structural bolts Specification for high strength structural nuts. High Tensile friction grip washers. Code of practice for use of structural steel in general building construction. Code of practice for use of Metal Arc Welding for General Construction. Code of practice for assembly of structural joints using high tensile friction grip fasteners. Code of procedure of Manual Metal Arc Welding of Mild Steel. Code of practice for Training and Testing of Metal Arc Welders.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 92 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).		
	IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.		
	IS: 9006	Recommended Practice for Welding of Clad Steel.		
	IS: 7215	Tolerances for fabrication steel structures.		
	IS: 12843	Tolerance for erection of structural steel.		
	IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.		
	SP: 6 (Part 1 to 7)	ISI Handbook for structural Engineers.		
	IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.		
	IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube		
	IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.		
	IS : 2595	Code of Practice for Radio graphic testing.		
	IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.		
	IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.		
	IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.		
	IS : 3658	Code of practice for Liquid penetrant Flaw Detection.		
	IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 93 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Plastering and Allied Works IS : 1635 Code of practice for field slaking of Building lime and preparation of putty. IS : 1661 Application of cement and cement lime plaster finishes. IS : 2333 Plaster-of-paris. IS : 2402 Code of practice for external rendered finishes. IS : 2547 Gypsum building plaster. IS : 3150 Hexagonal wire netting for general purpose. Acid and Alkali Resistant Lining IS : 158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. IS : 412 Specification for expanded metal steel sheets for general purpose. IS : 4441 Code of practice for use of silicate type chemical resistant mortars. IS : 4443 Code of practice for use of resin type chemical resistant mortars. IS : 4456 Method of test for chemical resistant tiles. (Part I & II) IS : 4457 Specification for ceramic unglazed vitreous acid resistant tiles. IS : 4832 Specification for chemical resistant mortars. Part I Silicate type Part II Resin type Part III Sulphur type IS : 4860 Specification for acid resistant bricks. IS : 9510 Specification for bitumasitc, Acid resisting grade.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 94 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Water Supply, Drainage and Sanitation IS : 458 Specification for concrete pipes. IS : 554 Dimensions for pipe threads, where pressure tight joints are made on thread. IS : 651 Specification for salt glazed stoneware pipes. IS : 774 Flushing cisterns for water closets and urinals. IS : 775 Cast iron brackets and supports for wash basins and sinks. IS : 778 Copper alloy gate, globe and check valves for water works purposes. IS : 781 Cast copper alloy screw down bib taps and stop valves for water services. IS : 782 Caulking lead. IS : 783 Code of practice for laying of concrete pipes. IS : 1172 Basic requirements for water supply, drainage and sanitation. IS : 1230 Cast iron rain water pipes and fittings. IS : 1239 Mild steel tubes, tubulars and other wrought steel fittings. IS : 1536 Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage. IS : 1537 Vertically cast iron pressure pipes for water, gas and sewage. IS : 1538 Cast iron fittings for pressure pipe for water, gas and sewage. IS : 1703 Ball valves (horizontal plunger type) including float for water supply purposes. IS : 1726 Cast iron manhole covers and frames. IS : 1729 Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 95 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS : 1742 IS : 1795 IS : 1879 IS : 2064 IS : 2065 IS : 2326 IS : 2470 (Part-I & II) IS : 2501 IS : 2548 IS : 2556 (Part 1 to 15) IS : 2963 IS : 3114 IS : 3311 IS : 3438 IS : 3486 IS : 3589 IS : 3989 IS : 4111 (Part I to IV) IS : 4127	Code of practice for building drainage. Pillar taps for water supply purposes. Malleable cast iron pipe fittings. Code of practice for selection, installation and maintenance of sanitary appliances. Code of practice for water supply in building. Automatic flushing cisterns for urinals. Code of practice for installation of septic tanks. Copper tubes for general engineering purposes. Plastic seat and cover for water-closets. Vitreous sanitary appliances (vitreous china). Non-ferrous waste fittings for wash basins and sinks. Code of practice for laying of cast iron pipes. Waste plug and its accessories for sinks and wash basins. Silvered glass mirrors for general purposes. Cast iron spigot and socket drain pipes. Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter). Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. Code of practice for ancillary structure in sewerage system. Code of practice for laying of glazed stone-ware pipes.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 96 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS : 4764 IS : 4827 IS : 5329 IS : 5382 IS : 5822 IS : 5961 IS : 7740 IS : 8931 IS : 8934 IS : 9762 IS : 10446 IS : 10592 IS : 12592 IS : 12701 SP: 35 - Doors, Windows and Allied Works IS : 204 Part-I Part-II	Tolerance limits for sewage effluents discharged into inland-surface waters. Electro plated coating of nickel and chromium on copper and copper alloys. Code of practice for sanitary pipe work above ground for buildings. Rubber sealing rings for gas mains, water mains and sewers. Code of practice for laying of welded steel pipes for water supply. Cast iron grating for drainage purpose. Code of practice for road gullies. Cast copper alloy fancy bib taps and stop valves for water services. Cast copper alloy fancy pillar taps for water services. Polyethylene floats for ball valves. Glossary of terms for water supply and sanitation. Industrial emergency showers, eye and face fountains and combination units. Specification for precast concrete manhole covers and frames. Rotational moulded polyethylene water storage tanks. Handbook on water supply and drainage. Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 97 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
		IS : 208 Door Handles. IS : 281 Mild steel sliding door bolts for use with padlocks. IS : 362 Parliament Hinges. IS : 420 Specification for putty, for use on metal frames. IS : 1003 Specification for timber panelled and glazed shutters- Part-I door (Part-I) shutters. IS : 1038 Steel doors, windows and ventilators. IS : 1081 Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators. IS : 1341 Steel butt hinges. IS : 1361 Steel windows for industrial buildings. IS : 1823 Floor door stoppers. IS : 1868 Anodic coatings on Aluminium and its alloys. IS : 2202 Specification for wooden flush door shutters (solid core type); (Part-II) particle board face panels and hard board face panels IS:2209 Mortice locks (vertical type). IS:2553 Safety glass IS:2835 Flat transparent sheet glass. IS:3548 Code of practice for glazing in buildings. IS:3564 Door closers (Hydraulically regulated). IS : 3614 Fire check doors; plate, metal covered and rolling type. IS:4351 Steel door frames. IS:5187 Flush bolts. IS:5437 Wired and figured glass		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C		GENERAL TECHNICAL REQUIREMENTS PAGE 98 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:6248 IS:6315 IS:7196 IS:7452 IS:10019 IS:10451 IS:10521	Metal rolling shutters and rolling grills. Floor springs (hydraulically regulated) for heavy doors. Hold fasts. Hot rolled steel sections for doors, windows and ventilators. Mild steel stays and fasteners. Steel sliding shutters (top hung type). Collapsible gates. Roof Water Proofing and Allied Works IS:1203 IS:1322 IS:1346 IS:1580 IS:3067 IS:3384 Floor Finishes and Allied Works IS:1237 IS:1443 IS:2114 IS:2571 IS:3462 IS:4971	Metal rolling shutters and rolling grills. Floor springs (hydraulically regulated) for heavy doors. Hold fasts. Hot rolled steel sections for doors, windows and ventilators. Mild steel stays and fasteners. Steel sliding shutters (top hung type). Collapsible gates. Methods of testing tar and bitumen. Specification for bitumen felts for water proofing and damp proofing. Code of practice for water proofing of roofs with bitumen felts. Specification for bituminous compound for water proofing and caulking purposes. Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings. Specification for bitumen primer for use in water proofing and damp proofing. Specification for cement concrete flooring tiles. Code of practice for laying and finishing of cement concrete flooring tiles. Code of practice for laying in-situ terrazzo floor finish. Code of practice for laying in-situ cement concrete flooring. Specification for unbacked flexible PVC flooring. Recommendations for selection of industrial floor finishes.	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 99 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:5318 IS:8042 IS:13801 Painting and Allied Works IS:162 IS:1477 Part-I Part-II IS:1650 IS:2074 IS:2338 Part-I Part-II IS:2395 Part-I Part-II IS:2524 Part-I Part-II IS:2932 IS:2933 IS:4759 IS:5410	Code of practice for laying of flexible PVC sheet and tile flooring. Specification for white portland cement. Specification for chequered cement concrete flooring tiles. Specification for fire resisting silicate type, brushing, for use on wood, colour as required. Code of practice for painting of ferrous metals in buildings. Pretreatment. Painting. Specification for colours for building and decorative finishes. Specification for red oxide-zinc chrome, priming, ready mixed paint air drying. Code of practice for finishing of wood and wood based materials. Operations and workmanship Schedules Code of practice for painting concrete, masonry and plaster surfaces. Operations and workmanship. Schedule. Code of practice for painting of nonferrous metals in buildings. Pretreatment. Painting. Specification of synthetic enamel paint, exterior, under-coating and finishing. Specification enamel paint, under coating and finishing. Code of practice for hot dip zinc coating on structural steel and other allied products. Specification for cement paint		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 100 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:5411 Specification for plastic emulsion paint-for exterior use (Part-I) IS:6278 Code of practices for white washing and colour washing. IS:10403 Glossary of terms relating to building finishes. Piling and Foundation IS:1080 Code of practice for design and construction of simple spread foundations. IS:1904 Code of practice for design and construction of foundations in Soils; General Requirements. IS:2911 Code of practice for designs and construction of Pile foundations (Relevant Parts). IS:2950 Code of practice for designs and construction of Raft (Part-I) foundation. IS:2974 Code of practice for design and construction of machine (Part-I TO V) foundations. IS:6403 Code of practice for determination of Allowable Bearing pressure on Shallow foundation. IS:8009 Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part-I Shallow foundations. Part-II Deep foundations. IS:12070 Code of practice for design and construction of shallow foundations on rocks. DIN:4024 Flexible supporting structures for machines with rotating machines. VDI:2056 Criteria for assessing mechanical vibrations of machines. VDI:2060 Criteria for assessing rotating imbalances in machines. Stop Log and Trash Rack IS:4622 Recommendations for fixed - wheel gates structural design. IS:5620 Recommendations for structural design criteria for low head slide gates. IS:11388 Recommendations for design of trash rack for intakes. IS:11855 General requirements for rubber seals for hydraulic gates. Roads		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 101 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 			
	IRC:5 IRC:14 IRC:16 IRC:19 IRC:21 IRC:34 IRC:36 IRC:37 IRC:56 IRC:73 IRC:86 IRC:SP:13 IRC - Publication IS:73 Loadings IS:875 (Pt. I to V) IS:1893 IS:4091 IRC:6 M.O.T. Safety IS:3696 (Part I & II) Standard specifications and Code of practice for road bridges, section-I general Features of Design. Recommended practice of 2cm thick bitumen and tar carpets. Specification for priming of base course with bituminous primers. Standard specifications and code of practice for water bound macadam. Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). Recommendations for road construction in waterlogged areas. Recommended practice for the construction of earth embankments for road works. Guidelines for the Design of flexible pavements. Recommended practice for treatment of embankment slopes for erosion control. Geometric design standards for rural (non-urban) highways. Geometric Design standards for urban roads in plains. Guidelines for the design of small bridges & culverts. Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works. Specification for paving bitumen Code of practice for design loads other than earthquake) for buildings and structures. Criteria for earthquake resistant design of structures. Code of Practice for design and construction of foundation for transmission line towers & poles. Standard specifications & code of practice for road bridges, Section-II Loads and stresses. Deptt. of railways Bridge Rules. Safety code for scaffolds and ladders.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 102 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	IS:3764 Safety code for excavation work. IS:4081 Safety code for blasting and related drilling operations. IS:4130 Safety code for demolition of buildings. IS:5121 Safety code for piling and other deep foundations. IS:5916 Safety code for construction involving use of hot bituminous materials. IS:7205 Safety code for erection on structural steelwork. IS:7293 Safety code for working with construction machinery. IS:7969 Safety code for handling and storage of building materials IS:11769 Guidelines for safe use of products containing asbestos. - Indian Explosives Act. 1940 as updated. Architectural design of buildings SP:7 National Building Code of India SP:41 Handbook on functional requirements of buildings (other than industrial buildings) Miscellaneous IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers. IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. IS:10430 Criteria for design of lined canals and liner for selection of type of lining. IS:11592 Code of practice for selection and design of belt conveyors. IS:12867 PVC handrails covers. CIRIA Design and construction of buried thin-wall pipes. Publication			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 103 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents. Temperature Measurements - Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). - Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. - Temperature measurement by electrical Resistance thermometers - IS:2806. - Thermometer - element - Platinum resistance - IS:2848. Pressure Measurements - Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). - Electronic transmitters BS:6447. - Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. - Process operated switch devices (Pr. Switch) BS-6134. Flow Measurements Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II. Measurement of fluid flow in closed conduits - BS-1042. Electronic Measuring Instrument & Control Hardware/ Software - Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. - Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. - Compatibility of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. - Dynamic response testing of process control instrumentation ISA - S 26 (1968).		
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 104 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472. 6. Printed circuit boards - IPC TM - 650, IEC 326 C. 7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973. 8. Edge socket connectors - IEC 130-11. 9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2. 10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980). 11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R). 12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990. 13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989. 14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985. 15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988. 16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985. 17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985. 18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984. 19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983. 20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978. 21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987. 22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 105 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Instrument Switches and Contact 1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. 2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. Enclosures 1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). 2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). 3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. Apparatus, enclosures and installation practices in hazardous area 1. Classification of hazardous area - NFPA 70 - 1984, Article 500. 2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. 3. Intrinsically safe apparatus - NFPA 493 1978. 4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. 5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977. Sampling System 1. Stainless steel material of tubing and valves for sampling system - ASTM 296-82, Grade 7 P 316. 2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. 3. Water and steam in power cycle - ASME PTC 19.11. 4. Standard methods of sampling system - ASTM D 1066-99. Annunciators 1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. 2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 3. Damp heat cycling test - IS:2106			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 106 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78 Protections 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991. UPS System 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991. 6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. Control Valves 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973. 3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). 4. Codes for pressure piping - ANSI B 31.1 5. Control Valve leak class - ISA RP 39.6			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	Process Connection & Piping - Codes for pressure piping "power piping" - ANSI B 31.1. - Seamless carbon steel pipe ASTM - A - 106. - Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. - Material for socket welded fittings - ASTM - A - 105. - Seamless ferritic alloy steep pipe - ASTM - A - 335. - Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. - Composition bronze of ounce metal castings - ASTM - B - 62. - Seamless Copper tube, bright annealed - ASTM - B - 168. - Seamless copper tube - ASTM - B - 75. - Dimension of fittings - ANSI - B - 16.11. - Valves flanged and butt welding ends - ANSI - B - 16.34. Instrument Tubing - Seamless carbon steel pipe - ASTM - A 106. - Material of socketweld fittings - ASTM - A105. - Dimensions of fittings - ANSI - B - 16.11. - Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. Cables - Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. - Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815. - Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorough 2/83. - Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). - Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. - Rules for Testing insulated cables and flexible cables : VVDE - 0472 - Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS	PAGE 108 OF 119	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81. 9. Oxygen index and temperature index test - ASTM D - 2863. 10. Smoke density measurement test - ASTM D - 2843. 11. Acid gas generation test - IEC - 754 - 1. 12. Swedish Chimney test - SEN - 4241475 (F3). 13. Teflon (FEP) insulation & sheath test - ASTM D - 2116. 14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784. 15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I). Cable Trays, Conduits 1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984. 2. -do- Test Standards. NEMA VE-1-1979. 3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78. Public Address System 1. Specifications for loud speakers - IS:7741 (Part-I, II and III) 2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301 3. Specification for Public Address Amplifiers - IS:10426. 4. Code of practice for outdoor installation of PA system - IS:1982. 5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881. 6. Basic environmental testing procedures for electronic and electrical items - IS:9000. 7. Characteristics and methods of measurements for sound system equipment - IS:9302 8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II) 10. Fittings for rigid steel conduits for electrical wiring - IS:2667 11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147. Vibration Monitoring System 1. API 670 - 1994 2. BS : 4675 Part-2			
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ANNEXURE-III

	Project :	Stage ::	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL						DOC. NO.:	
	Package :								REV. NO.:	
	Supplier :		SUB-SYSTEM :						DATE :	
	Contractor No. :								PAGE : OF	
S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for NTPC review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with “NOTED.”

QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

FORMAT NO.: QS-01-QAI-P-1/F3-R0

1/1

Engg. Div. / QA&I

SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-C	GENERAL TECHNICAL REQUIREMENT	PAGE 110 OF 119

ANNEXURE-IV

	Project :	Stage ::	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL						DOC. NO.:			
	Package :								REV. NO.:			
	Contractor :								DATE :			
	Contractor No. :								PAGE : OF			
S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	
FORMAT						1/1	Engg. Div. / QA&I					

ANNEXURE-V

		Project :		Stage :		FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code:							DOC. NO.:			
		Contractor :											REV. NO.:			
		Contractor No. :				DATE :		PAGE :		OF						
		System :														
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1						Engg. Div. / QA&I				

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
	S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
	1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
		First submission and submission with major changes		
		▪ Layout (A0&A1 sizes)	3	-
		▪ Other Drawings/Documents (A0 & A1 sizes)	3	-
		▪ P&ID (All sizes)	3	-
		a) Final drawings/documents (Directly to site)	3	2
		b) “As Built” Drawing/Documents (Directly to site)	3	2
	c) Analysis reports of Equipments / piping / structures components/system employing software packages as detailed in the specifications.	2	2	
	2	Erection Manual (Directly to site)	3 sets	2
	3	Operation & Maintenance manual i) First Submission	0	--
		ii) Final Submission (Directly to site)	3 sets	2
	4	Plant Hand Book i) Final Submission	1	1
	5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
		ii) Final Submission (Directly to site)	3 sets	2
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C	GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 113 OF 119

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)				
	S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk	
	6	Performance and Functional Guarantee Test Report i) First Submission	1 sets	—	
		ii) Approved Copies (Direct to Site)	3 sets	2	
	7	Project Completion Report (Directly to site)	3 sets	2	
SIPAT SUPER THERMAL POWER PROJECT STAGE-III (1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-C		GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 114 OF 119

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट ANNEXURE-VII	

Ref No: संदर्भ सं.:		Date: तिथि:	
i.	Main Contractor मुख्य संविदाकार		
ii.	Project परियोजना		
iii.	Package Name पैकेज का नाम	Package No पैकेज सं.	
iv.	Proposed Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का प्रस्तावित मद/ दायरा		
v.	Item covered under निम्नलिखित के अंतर्गत शामिल मद	Schedule-1 /अनुसूची- 1	As per contract clause No- अनुबंध के अनुसार खंड सं.--
		Schedule-2 अनुसूची- -2	
vi.	If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled /यदि मद अनुसूची -1 है और प्रस्तावित उप-विक्रेता स्वदेशी है, तो मुख्य संविदाकार को स्पष्ट करना होगा कि संविदा/अनुबंध के प्रावधान कैसे पूरे किए जाएंगे		
vii.	Name and Address of the proposed Sub-vendor's works /प्रस्तावित सब-वेंडर का नाम तथा पता		
viii.	PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network पीओ नियोजन की तिथि / एल- 2 नेटवर्क के अनुसार विनिर्माण (यदि स्व-निर्मित है) की शुरुआत		
ix.	Item Description (Type/Size/Rating/Scope of Sub-Contracting) मद का विवरण (प्रकार / आकार / रेटिंग / उप-अनुबंध का दायरा)	Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc) इस पैकेज में परिकल्पित प्रस्तावित मद की कुल मात्रा (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि)	Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc) प्रस्तावित उप-विक्रेता (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि) से खरीदी जाने वाली मात्रा
			Timeline for quantity requirements as per project schedule & whether the proposed Sub-vendor equipped with adequate capacity to supply proposed order quantity in time / परियोजना समय सूची के अनुसार मात्रा आवश्यकताओं के लिए समय-सीमा और क्या प्रस्तावित उप-विक्रेता समय पर प्रस्तावित मांग की मात्रा की आपूर्ति करने में पूरी तरह से सक्षम है
x.	Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (Note:- Only relevant experience details w.r.t. proposed item/scope of subcontracting to be brought out here) पिछले 3 वर्षों के लिए उप-अनुबंध के समान मद / दायरे के लिए प्रस्तावित सब-वेंडर (मुख्य संविदाकार हेतु		

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन	
	MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT	
	मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट ANNEXURE-VII	

	आपूर्ति, यदि कोई हो, सहित) का आपूर्ति अनुभव (नोट: - उप-अनुबंध के प्रस्तावित मद / दायरे के संबंध में केवल प्रासंगिक अनुभव के विवरण का उल्लेख हो								
	Project/Package परियोजना/पैकेज	Customer Name ग्राहक का नाम	Supplied Item (Type/Rating/Model /Capacity/Size etc) आपूर्ति मद् (प्रकार/रेटिंग /मॉडल /क्षमता/आकार आदि)	PO ref no/date पीओ संदर्भ सं. /तिथि	Supplied Quantity आपूर्ति की मात्रा	Date of Supply आपूर्ति की तिथि			
We confirm that as per our physical assessment, the proposed sub-vendor has requisite capabilities & supply experience and is suitable for supplying the proposed item/scope of sub-contracting/हम अपने भौतिक आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता के पास अपेक्षित क्षमता और आपूर्ति करने का अनुभव है और उप-अनुबंध के दायरे /प्रस्तावित मद की आपूर्ति के लिए उपयुक्त है।									
Name: नाम:		Desig: पद:		Contact No: दूरभाष सं.:		Sign: हस्ताक्षर:		Date: तिथि:	

Company's Seal/Stamp:- कंपनी का मुहर:-

	CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली

i.	Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का मद/ दायरा			
ii.	Address of the registered office पंजीकृत कार्यालय का पता 	Details of Contact Person संपर्क व्यक्ति का विवरण (Name, Designation, Mobile, Email) (नाम, पदनाम, मोबाइल, ईमेल) 		
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured प्रस्तावित उप-विक्रेता के कार्यों का नाम और पता, जहां मद का निर्माण किया जा रहा है 	Details of Contact Person: संपर्क व्यक्ति का विवरण (Name, Designation, Mobile, Email) (नाम, पदनाम, मोबाइल, ईमेल) 		
iv.	Annual Production Capacity for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए वार्षिक उत्पादन क्षमता			
v.	Annual production for last 3 years for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए पिछले 3 वर्षों का वार्षिक उत्पादन			
vi.	Details of proposed works प्रस्तावित कार्यों का विवरण			
1.	Year of establishment of present works वर्तमान फैक्टरी की स्थापना का वर्ष			
2.	Year of commencement of manufacturing at above works उपरोक्त फैक्टरी में निर्माण कार्य शुरू होने का वर्ष			
3.	Details of change in Works address in past (if any) पूर्व में फैक्टरी स्थल में परिवर्तन का विवरण (यदि कोई हो)			
4.	Total Area कुल क्षेत्र			
	Covered Area शामिल क्षेत्र			
5.	Factory Registration Certificate फैक्टरी पंजीकरण प्रमाण पत्र	Details attached at Annexure – F2.1 विवरण अनुलग्नक-एफ 2.1 पर संलग्न है		
6.	Design/ Research & development set-up डिजाइन / अनुसंधान और विकास सेटअप (No. of manpower, their qualification, machines & tools employed etc.) (श्रमिकों की संख्या, उनकी योग्यता, मशीन और उपलब्ध उपकरण आदि)	Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2 (if applicable) लागू / लागू नहीं, अगर विनिर्माण मुख्य संविदाकार / खरीददार के डिजाइन के अनुसार है) विवरण अनुलग्नक –एफ 2.2 पर संलग्न है। (यदि लागू हो)		
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc) मैनपावर विवरण के साथ समग्र संगठन का चार्ट(डिजाइन / विनिर्माण / गुणवत्ता आदि)	Details attached at Annexure – F2.3 विवरण अनुलग्नक – F2.3 में संलग्न है।		
8.	After sales service set up in India, in case of foreign sub-vendor(Location, Contact Person, Contact details etc.) भारत	Applicable / Not applicable लागू / लागू नहीं		

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली

	में बिक्री सेवा की स्थापना के बाद, विदेशी उप-विक्रेता के मामले में(स्थल , संपर्क व्यक्ति, संपर्क विवरण आदि)	<i>Details attached at Annexure – F2.4</i> विवरण अनुलग्नक -2.4 पर संलग्न है।			
9.	<i>Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any</i> फ्लोचार्ट सहित विनिर्माण प्रक्रिया निष्पादन योजना , जिसमें आउटसोर्स प्रक्रिया, यदि कोई हो, सहित कच्चे माल से तैयार उत्पाद तक विनिर्माण के विभिन्न चरणों को दर्शाया गया हो,	<i>Details attached at Annexure – F2.5</i> विवरण अनुलग्नक - F2.5में संलग्न है।			
10.	<i>Sources of Raw Material/Major Bought Out Item</i> कच्चे माल के स्रोत / खरीदे हुए मुख्य मद	<i>Details attached at Annexure – F2.6</i> विवरण अनुलग्नक - F2.6में संलग्न है।			
11.	<i>Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing</i> कच्चे माल / खरीदे हुए मद, प्रक्रियाबद्ध, अंतिम परीक्षण, पैकिंग करते समय गुणवत्ता नियंत्रण	<i>Details attached at Annexure – F2.7</i> विवरण अनुलग्नक - F2.7 पर संलग्न है			
12.	<i>Manufacturing facilities (List of machines, special process facilities, material handling etc.)</i> विनिर्माण सुविधा(मशीनों की सूची , विशेष प्रक्रिया सुविधाएं, सामग्री रख-रखाव आदि)	<i>Details attached at Annexure – F2.8</i> विवरण अनुलग्नक - F2.8में संलग्न है।			
13.	<i>Testing facilities (List of testing equipment)</i> परीक्षण सुविधाएं(परीक्षण उपकरण की सूची)	<i>Details attached at Annexure – F2.9</i> विवरण अनुलग्नक – F2. 9 में संलग्न है।			
14.	<i>If manufacturing process involves fabrication then-</i> यदि निर्माण प्रक्रिया में फेब्रिकेशन की गई है तो-	<i>Applicable / Not applicable</i> लागू / लागू नहीं			
	<i>List of qualified Welders</i> पात्र वेल्डर की सूची	<i>Details attached at Annexure – F2.10</i> विवरण अनुलग्नक - F2.10में संलग्न है।			
	<i>List of qualified NDT personnel with area of specialization</i> विशेषज्ञता के क्षेत्र सहित पात्र एनडीटी कार्मिकों की सूची	<i>(if applicable)</i> लागू / लागू नहीं			
15.	<i>List of out-sourced manufacturing processes with Sub-Vendors' names & addresses</i> सब-वेंडर द्वारा बाह्य स्रोतों (उनके नाम और पते सहित)से करवाएं गए निर्माण प्रक्रियाओं की सूची	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure. –F2.11</i> विवरण अनुलग्नक - F2.10में संलग्न है। <i>(if applicable)</i> (यदि लागू हो)			
16.	<i>Supply reference list including recent supplies</i> नवीनतम आपूर्ति सहित आपूर्ति संदर्भ सूची	<i>Details attached at Annexure – F2.12</i> विवरण अनुलग्नक - F2.12 में संलग्न है। <i>(as per format given below)</i> (नीचे दिए गए प्रारूप के अनुसार)			
<i>Project/ package परियोजना /पैकेज</i>	<i>Customer Name</i> ग्राहक का नाम	<i>Supplied Item (Type/Rating/Model /Capacity/Size etc)</i> आपूर्ति की गई वस्तु (प्रकार / रेटिंग / मॉडल / क्षमता / आकार आदि)	<i>PO ref no/date पीओ संदर्भ सं. / तिथि</i>	<i>Supplied Quantity</i> आपूर्ति की मात्रा	<i>Date of Supply</i> आपूर्ति की तारीख
17.	<i>Product satisfactory performance feedback letter/certificates/End User Feedback</i> उत्पाद के संतोषजनक प्रदर्शन संबंधी फीडबैक पत्र / प्रमाण पत्र / अंतिम उपयोगकर्ता फीडबैक		<i>Attached at annexure - F2.13</i> अनुलग्नक F2. 3पर संलग्न है		
18.	<i>Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product</i>		<i>Applicable / Not applicable</i> लागू / लागू नहीं		

	CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली

	<i>(similar or higher rating)</i> प्रस्तावित उत्पाद (एक समान या उच्च रेटिंग वाले) के लिए टाइप टेस्ट रिपोर्ट (टाइप टेस्ट विवरण, रिपोर्ट संख्या, एजेंसी, जांच की तारीख) का सारांश नोट: - रिपोर्ट प्रस्तुत करने की आवश्यकता नहीं है <i>Note:- Reports need not to be submitted</i>	<i>Details attached at Annexure – F2.14</i> विवरण अनुलग्नक - F2.1 4 में संलग्न है <i>(if applicable)</i> (यदि लागू हो)				
19.	<i>Statutory / mandatory certification for the proposed product</i> प्रस्तावित उत्पाद के लिए वैधानिक / अनिवार्य प्रमाणीकरण	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure – F2.15</i> <i>(if applicable)</i> (यदि लागू हो)				
20.	<i>Copy of ISO 9001 certificate</i> आईएसओ 9001 प्रमाण पत्र की प्रति <i>(if available)</i> (यदि उपलब्ध हो)	<i>Attached at Annexure – F2.16</i> अनुलग्नक में संलग्न - F2.1 6 है				
21.	<i>Product technical catalogues for proposed item (if available)</i> प्रस्तावित मद के लिए उत्पाद तकनीकी कैटलॉग (यदि उपलब्ध हो)	<i>Details attached at Annexure – F2.17</i> विवरण अनुलग्नक - F2.1 7 में संलग्न है				
<table border="1" style="width: 100%;"> <tr> <td style="width: 25%;"> <i>Name:</i> नाम: </td> <td style="width: 25%;"> <i>Desig:</i> पद: </td> <td style="width: 25%;"> <i>Sign:</i> हस्ताक्षर: </td> <td style="width: 25%;"> <i>Date:</i> तिथि: </td> </tr> </table>			<i>Name:</i> नाम:	<i>Desig:</i> पद:	<i>Sign:</i> हस्ताक्षर:	<i>Date:</i> तिथि:
<i>Name:</i> नाम:	<i>Desig:</i> पद:	<i>Sign:</i> हस्ताक्षर:	<i>Date:</i> तिथि:			

Company's Seal/Stamp:- कंपनी की मुहर / मोहर:-

1.0 Sub-Contractors/ Sub-Vendors/ Sub-Suppliers:

- 1.1 Any sub-vendor (in addition to Indicative Vendor List E-60 part of bid document) suggested by bidder except the sub-vendor from land border sharing countries shall be treated under DR (Details Required) category, if required. But the number of sub-vendors in DR category shall be decided on mutually agreed basis during post award discussions. For the approval of any new sub-vendor, please refer clause no.22.17.00. For the proposal of sub-vendors from land border sharing countries, Bidder shall ensure the compliance of GOI circulars and shall submit such sub-vendor proposal to NTPC for review & acceptance. (Please refer GTR clause no 40.00.00). In addition to above, for certain System/ Items covered in Technical Specifications, where Sub-QR (Qualifying requirements) are specified, bidder shall confirm that firm purchase order to the Sub Vendors selected/ shortlisted by them for these items/ systems, will only be placed after acceptance by NTPC of the concerned Sub Vendors meeting the specified qualifying requirements.
- 1.2 For the proposals where status of proposal is in “DR” category (details required), as NTPC does not have any past experience with them) in the above mentioned list, Bidder shall furnish the complete details of such proposals, in NTPC Formats , in time bound manner, so as not to impede the progress of the Project/ Works. For details please refer clause no 22.17.00.
- 1.3. Bidder shall furnish the required details, as detailed out in 2.3 above, of the proposed Manufacturer/ Sub-Vendor, along with their own detailed recommendations, in the NTPC-formats. proposals/ details shall be received only up to 3 months prior to ordering date of the concerned item (L-2 Network/ BOI Schedule), for NTPC review and assessment. Bidder may accordingly plan the submissions.
- 1.4 Bidder to confirm that the list of Items/ BOI includes all major Items/ BOIs required in their scope of work/ supply. If any Item/ BOI is left out or gets included during detailed engineering, Bidder shall propose the Manufacturers/Sub-Vendors, prior to initiating the procurement action. In such cases also, proposals, with details given in 2.3 above, shall be forwarded in time bound manner, within time limits given in 2.1 & 2.4 above.
- 1.5 It is understood that in terms of provisions of Cl. 19.1 of GCC (General Conditions of Contract), in case bidder opts for additional Sub - Vendor proposals, over & above the indicative sub vendor list herein (part of bid document), may be given, within sufficient time, so as not to impede the progress of the work. Accordingly, all such proposals along with required details (as given in 2.3 above), shall be received only up to 3 months prior to ordering date of the concerned item/ Scheduled start of the Manufacture of Self Manufactured Item, for NTPC review and assessment.
- 1.6 It is agreed that wherever “Main Contractor approved Sources” have been mentioned in the Indicative Vendor List (part of bid document), Bidder shall submit to NTPC, the copies of unpriced Purchase Order, on the specific Manufacturer, from whom supply is intended to be made, to enable NTPC to plan for Surveillance Audit of the manufacturer, if desired, prior to issue of Dispatch Clearance of the concerned item.
- 1.7 Bidder has to furnish System Supplier proposals for various Sub-Systems which are termed as Level-I Vendors. Further, Manufacturer/ Sub-vendor proposals for major items/ components under these systems, are not yet furnished, as the same would

depend on Level-I vendor shortlisted by bidder for such systems. It is agreed that sub vendor proposals for such items/ components (Level-II vendors) shall be made by bidder to NTPC with complete sub vendor details, in such a manner that the proposals can be finalised after award of contract by bidder on Level-I Vendor. It is understood that schedule of such Sub-vendor proposals shall be in accordance with the Project schedule (L-2 Network/ BOI Schedule) taking into consideration the time required for processing sub vendor approvals, by NTPC, enumerated above.

- 1.8 In the Indicative Sub Vendor List (part of the bid document), against each Item/ Sub-Vendor, the Category of Inspection is also indicated. NTPC reserves the right to conduct Surveillance Inspection/ Audit of the material, which are identified in Cat-II/ Cat-III, to verify the effectiveness of Quality System of bidder and conformance of the offered lot, to the applicable Standards/ requirements.

2.0 Welding:

Bidder to ensure that they will submit to NTPC, their approved List of Make/ Brand of Electrodes/ Welding Consumables, to be used during welding at Site.

- 3.0 Bidder to ensure that for Schedule-I/ Schedule-II supplies, orders shall be placed suitably on approved Sub-Vendors' manufacturing location (Foreign/ Indigenous), keeping the Contractual requirements in view.
- 4.0 Bidder to ensure the requirements of QA Documentation as per GTR clause no.23.00.00 for its completeness and only thereafter submit to NTPC.
- 5.0 Bidder shall furnish duly filled, below mention QA coordination procedure (QACP) during post award.

QACP (QA Coordination Procedure)

1. SCOPE OF WORKS:

- a) **QUALITY ASSURANCE:** Review of main contractor's (and their proposed major sub-contractor's) detailed quality plan (MQP and FQP) including customer hold points for inspection. Review of manufacturer's test /inspection report and test certificates as per approved QP.
- b) **INSPECTION SERVICES:** Witness of stage and final shop inspection /verification of documentation/ performance testing of major equipment as per approved QP and issuance of CHP and MDCC.
- c) **VENDOR/SUB-VENDOR APPROVAL:** Review and approval of major sub-contractors proposed by the Contractor shall be done by Employer QA&I Finalization of inspection category of items being manufactured and supplied by Main Contractor and sub-vendors shall be done by Employer QA&I

2. SCOPE OF PROCEDURE:

- a) The scope of this procedure is to explain and elaborate the scope of work of quality assurance & inspection, during the execution of service between employer (QA & Regional Inspection Offices), and bidder for project
- b) Items not covered in Quality Plan are CAT-III items. Such items & items identified as Cat-III in vendor list, shall be treated as non-inspection items and Certificate of Conformance (COC) shall be submitted to employer (QA & Regional Inspection Offices) for review.

3. DOCUMENTATION TO BE PROVIDED BY bidder:

- a) Master list of items requiring QP and Type test approval: shall be prepared by main contractor and approved by Employer QA&I Approved Drawings, Data-sheet, Specifications, etc. shall be provided to Employer QA&I by bidder for inspection purpose.

4. SUBMISSION OF QUALITY PLAN FOR REVIEW, COMMENTS AND APPROVAL:

- a) Transmittal (In soft) shall indicate the following:
 - i. Name of the item/equipment & QP/Document Number as per master list.
 - ii. Remarks / Special notes along with reference documents and norms.
 - iii. QPs shall be submitted in the prescribed formats of Employer QA&I
- b) All correspondence and submission of Quality Plan, Field Quality Plan and other documents shall be submitted in soft form i.e. Adobe Acrobat file (pdf format) through Dreams 2.0 indicating the identical Name & Number of QP as per 'Master List of Documents' (MDL). Coordinator of Main Contractor shall arrange submission of Master list of QP documents (In Soft – Dreams 2.0) for various equipment, plant & systems to the Employer QA&I coordinator
- c) On review/ comments / approval of QP, QA&I Coordinator shall forward in PDF form (soft) only, to bidder's coordinator in two weeks.
- d) On review of each QP/document shall be categorized in one of the following:
 - i. Category-I Approved
 - ii. Category-II Approved subject to incorporation of comments and to be resubmitted after incorporation of comments.
 - iii. Category-III Disapproved. See comments.

- e) Considering the criticality of the project requirement, all out efforts shall be made to re-submit the QPs/documents as early as possible but not later than 2 (two) weeks from the date of receipt of commented QP/documents from Employer QA&I
- f) For MQPs and FQPs approved in Cat-II, the work can be proceeded subject to taking care of comments furnished on documents. However, these comments will be taken care of by Main Contractor while submitting the revised QP/documents for final approval in Cat-I along with their explanation, if any (highlighting all the changes).
- g) Final inspection & clearance shall only be issued on approved drawings, Data sheets & QP (in Category-I).

5. COORDINATORS FOR COMMUNICATION:

- a) Bidder's Coordinator, & Employer QA&I Coordinator shall be the focal points for ensuring smooth execution and monitoring of the contract.
- b) Bidder OVER ALL COORDINATOR:

	Main Coordinator	Alternate Coordinator
Name		
Designation		
Address		
Contact No		
Email		

- c) Employer QA&I Coordinator:

	Main Coordinator	Alternate Coordinator
Name		
Designation		
Address		
Contact No		
Email		

- 6. EMPLOYER QA&I PROGRESS REPORTING:** Bidder's coordinator shall furnish on or before 12th of every calendar month progress report, highlighting QA&I activities in the reporting month, which shall contain the summary of QP/ documents submission and approval status for QP/ documents under approval to Employer QA&I Coordinators for information. Major QA&I hold-ups shall be highlighted in the progress report.

7. CUSTOMER CO-ORDINATION MEETING:

- a) To resolve and sort out various QA&I matters and outstanding issues structured contract co-ordination meeting (CCM) shall be held periodically as per notice of bidder /Employer QA&I
- b) Bidder may arrange for the participation of his sub-vendors also, if required for the meeting to resolve their respective issues.
- c) The venue for the meeting will be the office of Employer/Bidder as decided on case-to-case basis
- d) Minutes of Meeting (MOM) will be drafted by the agency at whose office the meeting is held and the same will be finalized and signed by all parties before close of the meeting.

8. CORRESPONDENCE:

- a) All correspondences related to this project shall be among coordinators of, QA&I & bidder as indicated in point no: 5.0.

- b) **EMPLOYER QA&I CONSULTANT's Regional Inspection Offices:** The list of Inspection Offices along with names and contact / communication details of the Heads of RIOs and the areas of their jurisdiction is placed at. <http://qains.ntpc.co.in/inspection/>

9. DEVIATION / NON-CONFORMITY DISPOSITIONING:

- a) If deviations are observed during inspection, same shall be recorded by Employer inspector in the CHP.
- b) Classification of deviations: It would be required to classify a particular deviation as Major or Minor, which shall be done by Employer QA&I applying following criteria:
- i) **MAJOR Non-conformities:** non-conformity is a "Major" non-conformity which prima-face is likely to have bearing on the Performance, Reliability, Safety, Interchangeability, Maintainability, Working life of the material, equipment or service.
 - ii) **MINOR Non-conformities:** A non-conformity not categorized as 'Major' is considered as "Minor", i.e. deviation is with respect to the applicable drawings/applicable standards.

c) Dispositioning of Deviation / Non-Conformity:

i) MAJOR:

Any deviation is characterized as "Major", the bidder to submit a justification as to why the same can be accepted with due corrective and preventive action plan. Such justification shall be submitted to the employer/, enabling it (Employer QA&I) to comment on the bidder's justification/proposal for acceptance/rework.

ii) MINOR:

Dispositioning of MINOR deviations shall be done by employer QA&I

Complete details of bidder design dispositioning of the deviation shall be sent by bidder to employer QA&I for proceeding further. QA&I would review the bidder design's dispositioning and either proceed further with acceptance decision or return the dispositioning to bidder for reclassifying it as Major for dispositioning by the CQA.

Format for "Non- Conformity Report for Manufacturing & Inspection Stages" is attached at Annexure VIII.

- 10. Type Tests (wherever applicable as per specification or approved QPs / Drawings):** Bidder shall ensure that type tests (wherever applicable) are duly approved/accepted by NTPC Engg (Engg Consultant) before offering such item for inspection as per QP. Evidence of Type Test approval in such cases shall be furnished by bidder, while raising inspection call.

11. RESPONSIBILITY FOR ISSUING MDCC:

Employer QA&I shall issue MDCC in case of Cat-I and Cat-II items and for Cat-III items Employer QA&I shall issue MDCC directly based on COC of bidder. MDCC shall be issued after checking of vendor approval status, BBU approval, and Type Test (if applicable).

12. INSPECTION PROCEDURE: Inspection shall be carried out as detailed:

For Cat-I & II items: where physical inspection (Cat-I) and documents review (Cat-II) envisaged in approved QP by Employer QA&I:

a) INDIGENOUS SUPPLIES:

- For items under inspection Category Cat-I, the concerned Regional Inspection Office under whose jurisdiction the manufacturer is located. Inspecting Engineer or reviewing engineer (in case of waiver of presence of NTPC engineer) shall issue the MDCC/dispatch clearance.

- In case, only review of Vendor's inspection report / test certificates by NTPC has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be submitted to the concerned NTPC-RIO, in whose jurisdiction manufacturer is located.
- In case where QP has not been envisaged (inspection category III), all such materials shall be cleared on the basis of Certificate of Conformity (COC) in attached format from bidder, which shall be submitted concerned NTPC-RIO, in whose jurisdiction vendor (main contractor) is located.

b) FOREIGN SUPPLIES:

- For items (inspection Category Cat-I) directly dispatchable to site from foreign manufacturer, the MDCC/dispatch clearance shall be issued by NTPC's inspecting engineer. In case of waiver of presence of NTPC engineer or Cat-II/III, the MDCC shall be issued by CQA Engineer on satisfactory review of test/inspection reports.

For items to be brought to Bidder's works from foreign manufacturer, before final dispatch to site, MDCC shall be issued by relevant Resident Inspector/RIO after satisfactory activities at works and on review of CHP report of NTPC's Inspecting Engineer for inspection at foreign manufacturer's works or on verifying acceptance report of CQA, in case of waiver of presence of NTPC Engineer for inspection at foreign source.

NOTE:

- I. Material inspection by RIO-A at the works of sub-contractor in their respective jurisdiction and dispatched to the works of the other sub-contractor for assembly or otherwise in the jurisdiction of RIO-B before final dispatch to project site, shall be accorded dispatch clearance on a CHP clearance report by RIO-A and the CHP of the completed item / equipment will be issued by RIO-B as per the approved BBU.
- II. In case, only review of Vendor's inspection report / test certificates by Employer QA&I has been envisaged as per approved QP (inspection Category Cat-II), such reports shall be duly reviewed by employer (QA&I) for all documents as per approved QP
- III. In case of items where QP has not been envisaged at all (inspection category Cat-III), such material shall be cleared and MDCC shall be issued by Employer QA&I -RIO/CQA (for foreign supplies) on the basis of Certificate of Conformity.

- 13. DOCUMENTATIONS / INPUTS BY Bidder:** Bidder shall ensure availability of duly approved documents / inputs (e.g. Drawings / Data-Sheets, / Type Test Procedures / Type Test Approvals, Quality Plan, Routine Test Procedures, Reference documents Codes, Standards, Specifications and Acceptance norms, etc.) at the place and time of inspection for reference of Inspection Engineers. Master list of Drawings, Datasheet, etc. shall also be made available.

- a) **THREE MONTHLY ROLLING INSPECTION PLAN :** To facilitate advance planning of inspection of supplies, in addition to giving inspection notice at identified *CHP stages as per approved QP, Main Contractor Coordinator shall furnish three monthly rolling inspection program every month, indicating schedule dates of inspection at identified CHP stages. Such a program shall be updated each month. Such program shall be confirmed by specific inspection calls in accordance with Clause 12.
- b) ***Definition of C.H.P.:** CHP "Customer Hold Point" ('W') is a stage identified by customer in Quality Plan, which is to be offered to customer or its authorized representative by the Vendors, Supplier / Sub-supplier Contractor for witnessing, verification or review, beyond

which work will not proceed without written consent of the Inspecting Authority. The report prepared by the Inspector is called "CHP Report".
Above three-monthly rolling inspections plan for Shop manufactured & BOIs shall be furnished directly to the respective Employer QA&I

- c) **INSPECTION AT PACKAGE CONTRACTOR'S SUB-SUPPLIER:** Bidder's coordinator shall ensure that unpriced purchase order for the identified BOI where in Employer QA&I Inspection is required, as per the approved Quality Plan, the unpriced Purchase Order shall be suitably tied-up with their suppliers so that the suppliers offer the identified equipment for Employer QA&I inspection for identified tests / checks. Purchase Order, with detailed Purchase Specification, Delivery conditions QP & reference codes and standards shall be made available at the place of inspection.
- d) **Inspection Calls:** Bidder shall give inspection call to the respective Employer QA&I RIO in Windsor-X system. For foreign inspection calls Main Contractor shall give inspection call to Employer QA&I (in Windsor-X system) Coordinators and through email as well, as per following schedule:-
- i. Supplier of Indian origin : 15 working days
 - ii. Supplier of Foreign origin : Call will be raised in two stages
 - iii. Preliminary Inspection call : 45 days
 - iv. Final Inspection call : 15 days

Inspection call format is placed at website <http://qains.ntpc.co.in/inspection/>

- e) **Inspection Call Entry on Employer QA&I Inspection Website on Internet:** Bidder can enter the call to the respective RIO on internet on Employer QA&I inspection website named as <http://qains.ntpc.co.in/inspection/> through a user ID & password under the menu "Main Supplier". User ID and password has already been known to various Main Contractor units. Bidder will be allotted user ID and password.

f) **Co-ordination for Inspection Call:**

- Main Contractor shall raise inspection call mentioning all reference documents to the respective Employer QA&I and in Windsor-X system. For foreign inspection calls bidder shall give inspection call to QA&I (in Windsor-X system) Coordinators
- The list of various Employer QA&I RIOs and their address along with their area of jurisdiction is placed at <http://qains.ntpc.co.in/inspection/> The call shall include copy of relevant approved QP and Data Sheet, internal test / inspection report, as applicable etc.
- Bidder representative / their authorized TPA (duly accepted to Employer QA&I) shall involve in inspection activity as per agreed documents.

14. Issue of Final CHP/MDCC/Inspection Report by Employer QA&I: The concerned Regional Inspection Office under whose jurisdiction the manufacturer is located, shall issue the Final CHP/MDCC after successful completion of testing / shop assembly including stage Inspection /Type tests, as required by the approved documents (approved Quality Plan, drawing / data sheet, as applicable), etc. at manufacturer's/ their sub-vendor's works.

METHODOLOGY FOR SAMPLING FOR TESTING OF REPAIRED WELD JOINTS :

Whenever the quantum of check in any NDT is other than 100%, the following guidelines for sampling/resampling procedure for NDT to be followed :

1) The group of welds for sampling shall be based on welding done by a welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.

2) From the above weld group, the selection of weld joint/weld spot shall be done by NTPC as per the quantum of check specified.

3) For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) beyond acceptance norms, the following actions shall be taken:

3.1: Rectification of defective welds and re-testing of the repair.

3.2 Re-sampling by NTPC from the same group of welds, with quantum of NDT being double the originally specified quantum (with minimum 2 welds for every defective weld). In case of RT on T-joints, if the defect is found on L-seam done at manufacturing works of pipe produced as per IS 3589, pipe defects shall be rectified, and no re-sampling is envisaged.

4) In case of any weld from the re-sample as per 3.2 above found beyond acceptable norms, the following action shall be taken:

4.1) NDT of all welds of the group which were not tested in first and second samples.

4.2) Repair and re-testing of all defective welds.

4.3) Necessary action on process control and on welder for preventing recurrence.

5) For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/pipes (or small welds on structures) while for very large diameter pipes e.g., CW piping or for vessels/long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of number of weld joints or length of weld.

6) From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).

Illustration: Radiography of welds: Welding completed on Day-1 should be tested by Day-2 and repair and re-sampling, of the group should be done by Day-3 and further testing/repair should be done by Day-4.

7) Sampling and re-sampling procedure shall be applicable for all NDT viz RT,UT,DPT,MP.

Note: In case of RT of tube welds with double wall image (elliptical view), number of exposures shall be as per relevant code/ plant standard and will not be less than 2 exposures for each weld.



NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES

FOR NTPC USE ONLY

NC NO. (REFER NOTE 7):

DATE:

PAGE : 1 OF 2

(This page to be filled in by Main Contractor)

CONTRACT NO :
PACKAGE UNIT NO :
MAIN CONTRACTOR :
SUB-CONTRACTOR :
PLACE OF MANUFACTURE:.....

CATEGORY OF NON-CONFORMITY
(AS PER NOTE-2) A ☐

B ☐

DETAILS

ITEM DESCRIPTION: _____ IDENTIFICATION NO. _____

RANGE/SIZE/TYPE: _____ QUALITY PLAN: _____ CHP NO:
& CLAUSE NO. _____

STAGE OF NON-CONFORMITY:

DESIGN (I) / RAW MATERIAL (II) / ASSEMBLY (III) / IN PROCESS (IV) - (SPECIFY) _____

STORAGE (V) / HANDLING (VI) / TESTING (VII) / ANY OTHER (VIII) - (SPECIFY) _____

NON-CONFORMITY-DESCRIPTION WITH CAUSE (Attach Relevant Drgs/Details)

PROPOSED DISPOSITION WITH JUSTIFICATION - (FOR CORRECTION)

(Attach details including design calculation, recommendations of qualified designer, if required)

DISPOSITIONING CODE

☐

(AS PER NOTE-6)

STEPS TO PREVENT RECURRENCE-(FOR CORRECTIVE ACTION)

NAME & DESIGN
ENCL:

SIG. OF MAIN CONTRACTOR

DATE _____ (SEAL)



NON- CONFORMITY REPORT FOR MANUFACTURING & INSPECTION STAGES

FOR NTPC USE ONLY

NC NO. (REFER NOTE 7) :

DATE:

PAGE : 2 OF 2

NOTES

1. Please read these notes carefully before filling up and attach separate sheet wherever required.
2. Category 'A' non-conformity is a major non-conformity which directly or indirectly adversely affects the performance, reliability, safety, interchangeability, erection, commissioning or working life of the items, equipment or system. All other non-conformities shall be treated as category 'B'.
3. Acceptance of dispositioned non-conformity is without prejudice to NTPC rights under the contract to claim commercial compensation and does not absolve main contractor from his contractual obligations.
4. Obtaining approval of statutory authority, if any, w.r.t. above non-conformity is the responsibility of main contractor.
5. Dispositioning of this non-conformity is for this specific case only and not to be regarded as a precedence.
6. The non-conformance shall be proposed main contractor (Give code at appropriate boxes) and is subjected to review & acceptance by NTPC.
(01) NC-Rejected (02) NC-Conditionally accepted (specify condition) (03) NC-accepted as it is (04) NC-Accepted with repair
7. NC number - this NC no. shall be allotted by regional inspection office in such a way to have project, package, RIO code, followed by running serial no. of that contract.

Responsibilities of main contractor

1. Ascertain exact nature of non-conformity in consultation with qualified designer (if required) and supporting drawing/details with which non-conformity exists.
2. Identify the cause of non-conformity.
3. Decide on code of Dispositioning as per Note-6 above.
4. Ensure and certify that the product quality, performance, reliability and working life is not affected for minor non-conformities and quantify the extent to which it is affected in the case of category 'A' non-conformities.
5. Implement agreed corrective action in a time-bound program.

Responsibilities of RIO

1. Identify the product appropriately.
2. Finalize the cause of non-conformity and propose corrective action.
3. Interlink with the corresponding CHP.

CLAUSE NO.	TECHNICAL REQUIREMENT				एनटीपीसी NTPC
D-1-12(G)	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				
	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		24 Hours			
SIPAT SUPER THERMAL POWER PROJECT STAGE-III(1X800 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART B BID DOC NO.		SUB SECTION D-1-12(G) 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.				
					</