WBPDCL

1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT, PHASE-III, UNIT 5

TECHNICAL SPECIFICATION

FOR

MISC. TANKS – SITE FABRICATED

SPECIFICATION NO.: PE-TS-445-167-A001

BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

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INTENT OF SPECIFICATION

1.0 **SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION**

1.1 This specification includes, but not limited to Supply part, Services part comprising of design (i.e. Preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles(as applicable) along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, final painting at site, minor civil work and carrying out Performance guarantee / Functional / Demonstration tests at site (as applicable) and handover in flawless condition of **Miscellaneous Tanks-Site Fabricated** turnkey package specified above for **1X660MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT** complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of **Miscellaneous Tanks** within quoted price.

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded and notwithstanding that they may have been omitted in drawings / specifications or schedules.

1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.

1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.

1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the

specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule, otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

1.12 BHEL's Customer's representative shall be given full access to the shop in which the equipment's are being manufactured or tested and all test records shall be made available to him.

1.13 Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.

1.14 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.

1.15 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA

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SECTION-III

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The West Bengal Power Development Corporation Limited (WBPDCL) proposes to extend their on-going Phase-II extension project of 2x500 MW at Sagardighi by adding one super critical unit of 660 MW as Phase-III extension unit. Sagardighi TPS is located in the village Manigram in Murshidabad district of West Bengal, India. The West Bengal Power Development Corporation Limited, a Company fully owned by the Government of West Bengal formed in the year 1985, have commissioned 2x300 MW Thermal Power Plant together with all other infrastructure at Sagardighi Thermal Power Project. Presently WBPDCL is also working on their under-construction Phase- II extension project of 2x500 MW at Sagardighi.

The Bidder shall acquaint himself, by visiting the site, with the conditions prevailing at site. The information given here in under is for general guidance only.

2.00.00 APPROACH TO SITE

Sagardighi Super Thermal Power Station site is located at Manigram village, 13 KM north of Sagardighi town by the side of the SMGR (Sagardighi-Manigram-Gankar-Raghunathganj) Road at a distance 20 KM from National Highway 34 in Murshidabad District, West Bengal and around 240 KM from Kolkata, India. The nearest rail station is Manigram adjacent to the site on Bandel - Barhawara branch line and 6.5 KM from Sagardighi Railway Station on Sainthia - Azimgunj line of Eastern Railway. From Sagardighi railway station a railway line will branch off to the site for material unloading and coal marshalling. The equipment will be normally transported by rail only and under exceptional cases by road. The material consignments shall be as per the restrictions of rail and road transportation prevailing in the country.

Nearest Airport – Kolkata.

Nearest Seaport –Haldia.

3.00.00 LAND

The total land available for the Power Station and Plant auxiliaries will be generally as per the Site Location Plan (12A05-DWG-M-002) enclosed and flexibility will remain to make the final equipment layout based on equipment sizes.

All construction material, heavy equipment, over dimensioned consignments (ODC) for the station during construction may be transported through road/rail access. During operation stage, coal would be transported through rail access.

The total land, approximately 706 hectares, has already been acquired for the present and proposed extension. The locations of various facilities and plant auxiliaries for Unit 1 & 2 under Phase-I and Units 3 & 4 in Phase-II and the space provision for extension unit no. 5 (660 MW) will be as per the General Layout enclosed. About 456 acre of land has been kept for disposal of ash. The Bidder shall accommodate equipment offered under this specification generally within the spaces allocated for such equipment in the General Layout. Specific approval from Owner/Consultant shall be taken by the contractor prior to any revision or relocation.

Except where stated otherwise, the plinth levels of all buildings shall be 300 mm above the corresponding developed grade level and the road level shall be 150 mm above the developed grade.

4.00.00 SOURCE OF COAL

The Power plant shall receive coal from ECL mines. Coal is planned to be transported in rake loads through the existing Pakur- Tildanga-Dhulian-Monigram broad gauge line or through Pakur- Nalhati (proposed)–Takipara-Gosaingram-Poradanga-Monigram broad gauge line. The coal would be carried in rake loads of BOBR/BOX-N wagons.

It is considered that coal would be received from the same source as the plant under Phase-I and Phase-II station with similar characteristics and a new mine at Pachwara (north) in Jharkhand being developed by WBPDCL. These sources being connected by B.G. rail track, coal would be transported by rail only. For coal unloading, crushing and storage facility it is proposed that a new Wagon tippler along with crusher houses, conveyors will be installed in addition to existing coal handling plant of Phase-II station with suitable extension from the end of Transfer Point (TP-19).

5.00.00 SOURCE OF WATER

The source of water for this project is the River Bhagirathi (5 km) through the proposed intake pump house under implementation for Phase-II station. The water from the River Bhagirathi will be transferred and stored in the five (5) nos. Plant Raw Water Reservoirs by augmentation of the Intake water transportation system for phase - II for meeting the requirement of Phase-III Sagardighi TPS.

The Power station will operate on semi open recirculating condenser cooling system using cooling towers. In addition all water conservation and recycling measures will be adopted to minimize requirement of make up water. The proposed project will adopt zero effluent discharge philosophy.

6.00.00 ASH DISPOSAL AREA

Bottom Ash (BA) shall be extraction in wet form and conveyed to the disposal area in lean slurry form. Whereas Fly Ash (FA) shall be extracted in dry form and stored in dry form for onward usage. However, arrangement shall be also

made to dispose fly ash in lean slurry form to ash dump yard located within 1 km from Plant boundary under exigency..

7.00.00 DETAILS OF EXISTING FACILITIES OF PHASE-II

INTRODUCTION

The proposed phase-III, Unit No. 5 is an extension project with many auxiliary systems being common and shared with the Phase-II units (Unit Nos. 3 & 4). It is not the intent to describe all systems in details. Facilities being shared by both Phase-II & Phase-III units and which have a common terminating and control philosophy are outlined below:

MAIN & AUXILIARY COOLING WATER SYSTEMS & ACCESSORIES

Condenser cooling water and auxiliary cooling water system of Phase-III will be independent of Phase-II. Separate pump house and pumping system shall be installed for Phase-III. Only CT make-up system of Phase-II will be shared for Phase-III. However, DMCW system of boiler of Phase-II has excess capacity, which can be utilized for phase-III. The detail of excess cooling water capacity is furnished below:

Provision kept of miscellaneous BOP coolers in DMCW (SG) pump capacity of Phase-II:

i) AHP compressor coolers – 2X300 = 600 m^3/hr (for 2X500 MW units)
ii) MRS compressor coolers - 2X30 = 60 m^3/hr (for 2X500 MW units)
iii) Plant air compressor coolers - 2X175 = 350 m^3/hr (for 2X500 MW units)

Cooling water consumption for miscellaneous BOP coolers (both working and standby) of Phase-II:

i) AHP compressor coolers 158 m^3/hr (for 2X500 MW units)
ii) Fluid Coupling of Ash slurry pumps = 40 m^3/hr (for 2X500 MW units)
iii) BA overflow pumps = 30 m^3/hr (for 2X500 MW units)
iv) MRS compressor coolers - 30 m^3/hr (for 2X500 MW units)
v) Plant air compressor coolers - = 185 m^3/hr (for 2X500 MW units)

The following excess capacity of DMCW(SG) system of Phase-II is available, which can be shared by miscellaneous BOP coolers of Phase-III (except BAOF pump and vacuum pumps), by suitable extension of existing supply and return header of Phase-II :

i) AHP system coolers- 372 m^3/hr
ii) MRS compressor coolers - 30 m^3/hr
iii) Plant air compressor coolers - = 165 m^3/hr

Bidder to check and confirm that excess available capacity of DMCW (SG) system of Phase-II would be adequate for satisfactory operation of the above mentioned BOP systems of Phase-III. With this consideration, the capacity of DMCW (SG) can be optimized for Phase-III.

Condensate Storage Tanks & Transfer System:

In addition to two (2) nos. installed Condensate storage tanks of Phase-II, One (1) no. similar capacity Condensate storage tank (CST) of capacity 750 m^3 shall be installed for Phase-III.

Inside CST pumps, the following horizontal centrifugal pumps are installed for Phase-II:

a) Three (3) nos. (2W+1S) cycle make-up (DMSW)pumps of capacity 120 m^3/hr and TDH 50.0 MWC at rated capacity

b) Two (2) nos. (1W+1S) boiler fill(SG Fill) pumps of capacity 190 m^3/hr and TDH 140.0 MWC at rated capacity

c) Two (2) nos. (1W+1S) CPU Regeneration pumps

In addition to these, installed pumps, the CST pump house have the provision for the following pumps of Phase-III:

a) One (1) no cycle make-up pump

b) One (1) no boiler fill pump (though no additional pump is considered for Phase-II, as the capacity of boiler fill pumps of Phase-II is envisaged to be sufficient for requirement of Phase-III).

c) Two (2) nos. (1W+1S) CPU Regeneration pumps

The proposed pumps of Phase-III shall be selected and interconnected such that the aggregate pumping capacity of Phase-II & III can be shared by all the units of both Phase-II & III.

WATER & WASTEWATER TREATMENT SYSTEMS

Pre-Treatment System-.

A Pre-Treatment Plant for Phase-II (Unit Nos. 3 & 4) have been envisaged which shall cater the requirement for Phase-III (Unit 5). As per the WBD developed for 3,4 & 5 the total clarified water requirement works out as 4789 m^3/hr. therefore the requirement of construction of additional PT Plant is not called for. However the detail of the Pre-Treatment System is given below.

Raw water will be taken through a flow control station to Aerator where raw water will be aerated and then led to Stilling Chamber where its turbulence will be broken.

To inhibit incidental growth of organic matters in raw water, pre chlorination of raw water in Stilling Chamber shall be carried out by use of gaseous chlorine.

Water will then flow to three (3) nos. Distribution Chambers through three (3) nos. Parshall Flumes. From Distribution Chambers, water would be directed to three (3) nos. proposed High Rate Solids Contact Clarifiers. Chemicals such as Ferric Chloride, Lime solution & Polyelectrolyte will be added at the inlet of each of the High Rate Solids Contact Clarifiers.

Clarified water from Clarifiers will flow through channel and be stored in a Clarified Water Reservoir for further use.

The sludge generated from Clarifiers as addressed above will be collected in a common Sludge Sump. Sludge will be pumped from Sludge Sump by means of three (3) nos. Sludge transfer Pumps to the Effluent Treatment Plant. An arrangement for sludge recirculation to Clarifiers shall be provided to aid flocculation in case of low turbidity in raw water.

All chemicals required for the entire plant will be stored in the ground floor of a two-storied Chemical House. Chemicals will be unloaded from the trucks and thereafter be stacked in the respective storage space at ground floor by means of an Electrically Operated Monorail Hoist. However, preparation of chemical solution of Ferric Chloride, lime and polyelectrolyte for injection to raw water shall be carried out in the first floor of the Chemical House. Chemicals will be lifted from ground floor to first floor by means of another Electrically Operated Monorail Hoist. The water required for preparation of solutions is supplied from Overhead Clarified Water Tank to be located above Chemical House or directly from the Service Water Line.

The Chlorination System will be complete with Electrically Operated Monorail Hoist, Chlorine Ton Containers, Booster Pumps, Strainers, Pipe Works and Diffuser Systems up to points of injection, Emergency Chlorine Leak Absorption System and all other necessary accessories and auxiliaries.

The Chlorinators will be connected with Chlorine Ton Containers. The water to the Booster Pumps will be supplied from Overhead Clarified Water Tank located above Chemical House. All the necessary equipment (Chlorinators, Chlorine Ton Containers, etc.) will be located indoor at ground floor of the Chemical House as addressed above.

The water to the booster pumps will be supplied from Overhead Clarified Water Tank.

De-mineralization System

A De-mineralization Plant for Phase-II (Unit Nos. 3 & 4) have been envisaged which shall cater the requirement for Phase-III (Unit 5), considering 500 MW sub-critical unit. In view that Unit #5 is now rated to 660 MW super-critical technology, the requirement of DM water has been reduced as evident from attached WBD. Therefore the requirement of construction of additional DM Plant is not called for. However the detail of the De-mineralization System is given below.

Clarified Water will be pumped from Clarified Water Reservoir (located in Raw Water Treatment Plant area) by three (3) nos. DMF Feed Pumps to UF-RO-MB Exchanger Plant.

Clarified Water will enter the Dual Media Filters and suspended solids present in it will be removed.

From the Dual Media Filters, water shall flow to UF Modules through Pre-Filter. The UF Modules shall be backwashed automatically as per the requirement. Permeate from UF Modules shall be stored in 'UF Permeate Water Storage Tank' for further treatment by Reverse Osmosis. Reject from UF Modules shall be collected to Backwash Collection Pit and feed to the Waste Water Treatment System.

Ultrafiltered water from UF Permeate Storage Tank shall be pumped to Cartridge Filter for further filtration, prior to RO Modules.

Required quantity of antiscalant shall be dosed before Cartridge Filters in order to reduce scale formation tendency of feed water on the surface of the RO Membranes. Sodium Bi Sulphite shall be dosed to de-chlorinate the water and acid shall be dosed to maintain the pH.

After Dosing, filtered Water from Cartridge Filter shall be passed through RO High Pressure Pump to deliver water at desired pressure to the inlet on RO Modules.

The entire RO System shall be designed to achieve minimum 85% recovery. Permeate shall be passed through Degasser Tower to reduce the dissolved CO2 content in the water. Water from Degasser Towers shall be collected to the Degassed Water Storage Tank.

Degassified RO Permeate, finally be pumped to MB Exchanger for further reduction of TDS, to get desired quality of Water.

For chemical cleaning of UF System, One (1) no..UF Cleaning Solution tank, two (2) nos. UF Cleaning Chemical Pumps and one (1) no. 5 micron cartridge filter along with necessary piping and instrumentation as addressed in the P&I Diagram shall be provided.

A full-fledged chemical cleaning system comprising One (1) no. chemical cleaning tank, one (1) no. chemical solution circulating pumps and one (1) no. 5 micron cartridge filter along with necessary piping and instrumentation as addressed in the P&I Diagram shall be provided for RO Skid.

The entire UF-RO-MB Exchanger System along with Chemical Dosing / Cleaning Systems shall be located indoor within DM Plant Building.

EFFLUENT TREATMENT SYSTEM

An Effluent Treatment Plant is already under construction for the Treatment of liquid waste to be generated from Unit# 3, 4 & 5. The wastewater streams from different sources of the Power Plant will be collected, treated and then reused to the maximum extent possible within the Plant. Various waste waters are to be handled and treated for reuse.

However few items have been envisaged for Phase-III (Unit 5) which is described below.

One (1) no. Retention pit and two (2) nos. transfer pumps for service oily waste from Power House Area which will pump the effluent from Power House Area to the existing Waste water Treatment Plant.

One (1) no. Retention pit and two (2) nos. transfer pumps oily effluent from Transformer Yard area which will pump the effluent from Transformer Yard area to the existing Waste water Treatment Plant.

COAL HANDLING SYSTEM

The Existing Coal Handling Plant has been designed to cater the requirement for Phase-II & III stations together. One (1) track hopper for Phase-I, one (1) additional track hopper (Capacity: 5100T) and one (1) wagon tippler (Rated capacity 20 Tips/Hour and Design capacity 25 tips/Hour) along with one (1) side arm charger (Rated / Design capacity 29 Loaded wagons of 140 T) in Phase-II are provided. These are adequate for Phase-III extension unit#5 also. Further two (2) nos. of stacker-cum-reclaimers having 2000 / 2200 TPH rated / design capacity for Phase-II station are adequate for both Phase- II & III units. In the existing crushers, coal would be sized to (-) 20 mm. Crushed coal would thereafter be led either to the boiler bunkers or to the stack yard. In the main route, coal will be directly taken to the powerhouse via TP # 19. Existing four (4) nos. in-line magnetic separators, two (2) nos. metal detectors, two (2) nos. suspended magnets, four (4) nos. belt weighers, two (2) nos. coal sampling units will be commonly used for phase-II & phase-III units.

New set of 2000 / 2200 TPH rated / designed capacity twin stream conveyors as per the same for existing CHP would be installed under Phase-III beyond Transfer Point 19 of unit #4 upto unit #5 bunkers.

New set of 1650 / 1500 TPH, 1200 / 1320 TPH (rated / designed) capacity twin stream conveyors considered from New Wagon Tippler to TP-20. This conveyor stream will also feed to conveyor 22A & 22B for Stacking on the Existing Stock Pile.

Existing system facilities to be commonly used for Phase-II & III and new dedicated system facilities for Phase-III

The major equipment for the coal handling plant installed for Phase-II & shall serve Phase III also is listed below :-

1. a) Track Hopper	:	5100T with paddle feeders to twin stream conveyors
b) Wagon Tippler	:	One (1) no (Rated capacity 20 Tips/ Hr and Design capacity 25 ips / hr.).
c) Side Arm Charger	:	One (1) no
2. Conveyors	:	Twin stream conveyor line of 2000 / 2200 TPH rated / design capacity.
3. Crushers	:	**Type:** Ring granulator. **Number:** Four (4) (2 working + 2 standby) **Capacity:** 1200 TPH (Rated) / 1320 TPH (Design) **Input coal size:** (-) 300 mm **Output coal size:** (-) 20 mm
4. Vibrating Screen	:	**Type:** Roller screen type. **Number:** Four (4) (2 working + 2 standby) **Capacity:** 1200 TPH (Rated) / 1320 TPH (Design)
5. Paddle Feeder	:	Capacity 1200 TPH rated / 1320 TPH design x 2 in each stream of conveyors.
6. Stacker-cum-reclaimer	:	**Type:** Hydraulic motor-driven rail-mounted unidirectional having slewing and adequate lifting arrangement. **Stacking Capacity:** 2000 TPH (Rated) / 2200 TPH (Design) **Reclaiming Capacity:** 2000 TPH (Avg.) / 2200 TPH (Peak)

Quantity: Two (2)
Coal size: (-) 20 mm

7. Apron feeder : 2000 / 2200 TPH rated / design capacity

ASH HANDLING SYSTEM

BAHP Water System

Six (6) nos. (4W+2S) BAHP water pumps (Make- Flowmore& Model - 5822 (HS) / 350 X 300) with drive, each of capacity 1000 CMH and discharge pressure of 70 MWC, are already installed in existing ash water sump & pump house (common for Phase-II & III). Space for two (2) nos. BAHP water pumps (one shall cater the HP water requirement of bottom ash system and the other for wet fly ash system) with drive for Unit#5, had been kept in the existing ash water sump & pump house.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash water sump & pump house (Dwg. No I-5034-M-GA-002).

BALP Water System

Three (3) nos. (2W+1S) BALP water pumps (Make – Flowmore & Model - 5821A / 300 X 250) with drive, each of capacity 757 CMH and discharge pressure of 25 MWC, are already installed in existing ash water sump & pump house. Space for one (1) no BALP water pump with drive for Unit#5, had been kept in the existing ash water sump & pump house.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash water sump & pump house (Dwg No I-5034-M-GA-002).

Eco Water System

Three (3) nos. (2W+1S) Eco water pumps (Make – Flowmore & Model - F5824A / 100 X 75) with drive, each of capacity 48 CMH and discharge pressure of 45 MWC, are already installed in existing Boiler area for Phase-II i.e. Unit #3 & #4. Space for one (1) no eco water pump for Unit # 5, had been kept in the existing Boiler area (Phase-II).

Ash Conditioning Water System

Two (2) nos. (1W+1S) ash conditioning water pumps (Make – Flowmore & Model - F5824 / 100 X 75) with drive, each of capacity 106 CMH and discharge pressure of 50 MWC, are already installed in existing silo utility building. Space for one (1) no ash conditioning water pump for the proposed silo of Unit#5, had been kept in the existing silo utility building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of silo utility building (Dwg No I-5034-M-BE-016).

Seal Water System

Two (2) nos. (1W+1S) seal water pumps (Make – Flowmore & Model - M5972 / 150 X 100) with drive, are already installed in existing ash slurry pump house for Phase-II i.e. Unit #3 & #4. Space for Two (2) nos. (1W+1S) seal water pumps for Unit # 5, had been kept in the existing ash slurry pump house.

Civil foundations for the proposed pumps have already been constructed in the existing slurry pump house. The base plate of the proposed pumps shall be matched with the foundation.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash slurry sump & pump house (Dwg No I-5034-M-GA-001).

Ash Slurry Disposal System

Four (4) nos. (2W+2S) ash slurry pump (Make – Indure & Model - A-918-401) chain (each slurry pump chain consists of 2 nos. pumps in series and there is space provision for future series pump also) with drive, each of capacity 1270 CMH, are already installed in existing ash slurry sump & pump house for Phase-II i.e. Unit #3 & #4. Space for one (1) no ash slurry pump chain for Unit # 5, had been kept in the existing ash slurry sump & pump house.

Civil foundations for the proposed pumps have already been constructed in the existing slurry pump house. The base plate of the proposed pumps shall be matched with the foundation.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash slurry sump & pump house (Dwg No I-5034-M-GA-001).

Silo

Three (3) nos silos, each of capacity 2400 Tons, are already installed in existing silo area for Phase-II i.e. Unit #3 & #4. Space for one (1) no silo for Unit # 5, had been kept in the existing silo area.

For details and disposition of existing silos of Phase-II and space provision for proposed silo of phase-III, please refer layout of ash compressor house (Dwg No I-5034-M-GA-015).

Silo Fluidizing Air System

Five (5) nos. (3W+2S) water cooled silo aeration blowers (Make - Swam & Model - RH-250 WC) with drive and heater, each of capacity 1860 CMH and discharge pressure of 10 MWC, are already installed in existing silo utility building for Phase-II i.e. Unit #3 & #4. Space for one (1) no silo aeration blower and heater for Unit # 5, had been kept in the existing silo utility building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of silo utility building (Dwg No I-5034-M-BE-016).

Instrument Air System

Four (4) nos. (2W+2S) oil free, water cooled screw compressor (Make - Atlas Copco & Model ZR 110) with drive and heat of compression (HOC) dryer (Make - Atlas Copco), each of capacity 900 CMH (FAD) and discharge pressure of 8 Kg/cm2 (g), are already installed in existing ash compressor house for Phase-II i.e. Unit #3 & #4. Space for one (1) no instrument air compressor & HOC dryer for Unit # 5, had been kept in the existing ash compressor building.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer layout of ash compressor house (Dwg No I-5034-M-GA-018).

Recycle Water System

Space for two (2) nos. (1W+1S) recycle water pump with drive for phase-III, had been kept in the existing ash clarifier area.

Space for one (1) no ash slurry disposal pipe (450 NB x 9.52 MM Thk.) for Unit # 5, had been kept in the existing slurry piping corridor of Phase-II. Please refer Dwg No I-5034-M-BE-015 & I-5034-M-BE-025 for layout of existing ash slurry disposal piping & ash dyke.

MILL REJECT SYSTEM (COMPRESSED AIR SYSTEM)

Two (2) nos. (1W+1S) oil free, water cooled screw compressor (Make - ELGI and Model No. - EG110 - 5.5 WC) with drive, each of capacity 20 m3/min (FAD) and discharge pressure of 5.0 Bar (g), are already installed in existing Plant Compressor House (Common for Phase-II & III) for Phase-II i.e. Unit #3 & #4. Space for one (1) no conveying air compressor for Unit # 5, had been kept in the existing plant compressor building.

Civil foundation for the proposed MRS Compressor has already been constructed in the existing plant compressor house. The base plate of the proposed compressor shall be matched with the foundation.

For details and disposition of existing equipments of Phase-II and space provision for proposed equipment of phase-III, please refer layout compressor house (Dwg. No.PE-V0-373-160-505).

Cooling water requirements for conveying air compressor shall be met from existing DMCCW system. The supply and return lines shall be connected at the tie in points from the existing DMCCW system.

PLANT COMPRESSED AIR SYSTEM

Plant air compressor house will be common for Phase-II & III. Instrument air and service air compressors, dryer, receivers and interconnecting piping system for phase-II are installed in the compressor house. Provision of one (1) no. Instrument air Compressor and one (1) no. Service air Compressor, with dryer, receivers and interconnecting piping system are kept in the compressor house for Phase-III. The brief details of existing facilities of Phase-II are indicated below:

a) Instrument Air Compressors- Three (3) nos. (2W+1S) Motor driven oil free screw compressors with air dryer, each of capacity 36 Nm^3/min (FAD-46.53 m^3/min) and discharge pressure of 8.0 kg/cm^2(g)at after cooler outlet at rated capacity.

b) Service Air Compressors- Two (2) nos. (2W+0S) Motor driven oil free screw compressors with air dryer, each of capacity 36 Nm^3/min (FAD-46.53 m^3/min) and discharge pressure of 8.0 kg/cm^2(g)at after cooler outlet at rated capacity.

c) Air Receivers- Five (5) nos., each of capacity 10m^3.

For details and disposition of existing equipment of Phase-II and space provision for proposed equipment of phase-III, please refer P&ID & layout Compressor house of Phase-II (Dwg. no. PE-V0-373-555-A002 & PE-V0-373-555-A001 respectively).

The proposed compressors of Phase-III shall be selected and interconnected such that the aggregate compressed air capacity of Phase-II & III can be shared by all the units of both Phase-II & III.

FIRE PROTECTION SYSTEM

Two (02) nos. inter-connections with isolation valves for hydrant system and Two (02) nos. inter-connections with isolation valves for spray system shall be considered at site for proposed integration with the hydrant and spray network of Phase-III with Phase – II. Please refer Composite piping layout of hydrant and spray network of Phase-II (Dwg. no. PE-V0-373-522-A0013) for locations of inter connection points.

LP PIPING (PIPE RACK)

Existing pipe rack of Phase-II shall be utilized to carry pipe lines from new pumps/ compressors of Phase-III to be installed in existing pump/compressors

houses of Phase-II. Suitable augmentation/ modification/strengthening of existing pipe racks of Phase-II shall carried out by the bidder.

FUEL OIL HANDLING SYSTEM

No further extension of unloading and storage capacity is envisaged for installed fuel oil handling system, which is sufficient for requirement of Phase-I, II& III units.

Pressurizing pumps will supply oil from the HFO/LDO storage tanks to the burner. Three (3) nos.HFO (2 W+ 1S) & two (2) nos. LDO (1W +1S) pressurizing pumps (each having capacity equivalent of 2X500 MW units) are installed under Phase-II system.

There is provision for one additional HFO pressuring pump along with HFO Heater to be installed in pressurizing pump house to cater the requirement of Phase-III. Installed LDO forwarding pumps of Phase-II can also cater requirement of Phase-III. HFO & LDO Pressurizing pump discharge lines, which has been extended up to Unit #4 of Phase-II, shall be further extended by bidder to feed Phase-III.

HFO supply and return lines to and from boiler of phase-III to be extended from existing HFO supply and return header respectively (terminated with isolation valve) of Phase-II. Similarly, LDO supply line to boiler of phase-III to be extended from existing LDO supply header (terminated with isolation valve) of phase-II.

The proposed HFO pressurizing pump with heater of Phase-III shall be of identical capacity with the existing equipment to utilize existing equipment foundations at site.

ELECTRICAL EQUIPMENT & ACCESSORIES

Necessary power supply for Phase-III Fuel oil pump will be arranged from existing FO Switchboard. Accordingly existing FO switchboard shall be modified as specified elsewhere.

If the new equipment of Phase-III 400kV air insulated switchyard can be accommodated in the existing switchyard control building, same needs to be modified if required.

For further details regarding the existing facilities of Phase – II, please refer Volume – II F1 and F2: Technical Specifications for Electrical Equipment and accessories.

CONTROL & INSTRUMENTATION

The following are the existing Stage-II facilities which shall be used for Unit #5 C&I works.

	System	Existing Facilities to be used
a)	Fuel Oil Pressurizing & Heating System	Existing spare I/O cards and spare I/O slots of Unit #3 & Unit #4 DCS [Stage-II] shall be used for augmentation of the new Fuel Oil Pressurizing & Heating System of Unit#5 of Stage-III. Relevant control shall be implemented in the existing DCS processors.
b)	Compressed Air System	New Instrument Air Compressor and Service Air Compressor shall share the existing serial network of Compressors of Unit#3 & Unit#4 DCS [Stage-II] for DCS soft communication. The new Instrument Air Compressor shall also be interfaced with the existing electronic sequencer module (ES-6) provided for the existing Instrument Air compressors of Unit#3 & Unit#4 DCS [Stage-II] for group interlocks.
c)	Mill Reject Handling System	The control shall be implemented in the existing MRHS PLC of Unit#3 & Unit#4 [Stage-II], located in the existing CPU regeneration Area control room. The new MRH System shall use the existing processor of the PLC. New IO panel for additional IO cards for the new system shall be installed in the assigned location of the existing control room for Future IO Panel. The UPS for the new MRH system PLC IO Panel shall be derived from the existing UPS ACDB located in the existing CPU Regeneration Building Control Room (Stage-II).
d)	Ash Handling System	The operation and control of new Unit#5 AHP facilities shall be through the existing PLC of Stage-II (located in the Compressor House Control room). Existing PLC processor (PLC-1), shall cater to the control of the common systems including Ash Water & Ash Slurry System, Fly Ash Unloading System, Instrument Air System & various sump draining systems. Additional IO panels shall be installed in the locations assigned for future IO panels in the Compressor House Control Room, Ash Water Pump House RIO Room and Silo Utility Building RIO Room of Stage-II units.

		One new redundant processor shall be installed in the existing Processor Panel located in the Compressor House Control room to cater the new Unit#5 Bottom Ash & Fly Ash Evacuation System. Extended RIO of the new processor shall be procured for the Unit#5 systems. For new PLC CPU/ IO at existing (Stage-II) Compressor House Control Room, existing UPS system in the Existing [Stage-II] Compressor House Control Room shall be considered. New Energy Meter, Numerical Relays, Air Compressor etc. shall share the existing serial network for interface with existing PLC for Unit#3 & Unit#4 [Stage-II].
e)	Coal Handling System	Spare IOs cards at Remote IO Unit of existing Stage-II CHP PLC near TP-17 of Stage-II shall be used for the augmentation of new CHP system of Unit#5 (Stage-III). The control shall be implemented in the existing PLC processor. However, for Wagon Tippler & Crusher separate new PLC based system with connectivity with existing PLC at HMI network level shall be envisaged. Existing “3D Level Mapping Software” loaded in the CHP PLC for Unit#3 & #4 of Stage-II shall be used for the new Unit#5 Bunker Level indication System. The existing Fiber Optic network for CHP PLC interface with Bunker Level indication System of Stage-II shall also be used by the new Bunker Level indication System for CHP PLC interface.
f)	GPS Master Clock System	All the microprocessor based control systems like DCS, PLC based systems, CCTV, TSI & Rotating machine condition monitoring system etc of unit#5 shall be time synchronized with the Existing GPS Master clock of Phase-II.
g)	Fire Alarm System	Existing Fire Alarm Panel at Fire Station of phase II shall be used to display parameters / Alarms of new Fire Alarm System of unit#5. Main FAP of unit#5 shall be connected to the phase II FAP located at existing fire station.

CIVIL, STRUCTURAL AND ARCHITECTURAL WORK (BUILDINGS CONSTRUCTED WITH SPACE FOR PHASE III)

Necessary Walkway connection between operating floors of Power House of Phase – II (Existing) and Phase – III shall be considered by Bidder.

Few civil foundations have already been constructed for future equipment. Such existing foundation details including bolts, inserts etc. to be studied in detail before procurement of specific equipment for respective purposes so that the same can safely be placed over the existing foundations complying all technical compatibility. In case this is not at all possible, new foundations need to be constructed after complete demolition of existing foundations.

For further details regarding the existing facilities of Phase – II, please refer Volume – II G1, G2 and G2: Technical Specifications for Civil, Structural and Architectural..

8.00.00 SALIENT DESIGN DATA

8.01.00 For implementation of the project, the Bidder shall consider the following Site and Meteorological data:-

a)	Location	:	Manigram village, Sagardighi, Raghunathganj sub-division, Murshidabad District, West Bengal.
b)	Latitude and Longitude	:	24^0 22’ 13.7” N, 88^0 6’ 15.8” E (Topo sheet No.78/D/3)
c)	Nearest Towns	:	Ajimganj, Jangipur, Raghunathganj.
d)	District Head Quarters	:	Berhampore - 40 km.
e)	Approach Road	:	20 km from National Highway (NH-34)
f)	Nearest Railhead	:	Manigram railway station on Bandel-Barhawara branch line 1 km from site.
g)	Source of Water	:	Bhagirathi River - 5 km
h)	Source of Coal	:	Pachwara (North) mine block in Jharkhand.
i)	Fuel Transportation	:	By rail in rake loads of BOBR/BOX-N wagons.
j)	Surrounding Habitations	:	Villages - Manigram, Chhamugram, Karaia, Thakurpara on the south; Bhumhar, Khasittor, Ekrakhi on the west;

Dhalo, Bagpara, Santoshpur on the north and Harirampur, Chandparam, Dogachhi on the east.

k) Level : Within 34.5 m contour. Land is above HFL (highest flood level) of the area.

l) Soil : Less fertile alluvial soil.

m) Land Use : Within existing plant boundary of WBPDCL.

Meteorological data of site is given below:

a) Design ambient dry bulb temperature : 50 ºC maximum
5 ºC minimum

b) Highest wet bulb temp : 26.9 ºC

c) Maximum relative humidity : 84%

d) Average relative humidity : 73%

e) Average annual Rainfall : 1389 mm

f) Wind load : In accordance with IS-875 for a basic wind speed of 47 m/sec, up to a height of 10 metres above mean ground level.

g) Seismic Zone : Zone III as per IS: 1893 latest edition.

h) Altitude : 34M above MSL

SUB SECTION-C1

SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE OF SUPPLY

1.1 Misc. tanks -site fabricated (**1 No. Condensate storage tank**) under this specification shall be as per enclosed DATA SHEET-A and SKETCH for Miscellaneous tanks (Sub Section-D, Section-I, Annexure-III). Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.

1.2

a) The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in the enclosed DATA SHEET-A and SKETCH for Miscellaneous tanks (Sub Section-D, Section-I, Annexure-III).

b) The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).

c) The inside piping shall be adequately supported and shall be provided with adequately sized vent (anti-siphoner) connection at pipe top.

d) Weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.

e) Pad plates along with 1.0 m suitable ISA on the tanks for supporting outside piping shall be provided by the bidder.

f) Fabrication and supply of all flanges and counter flanges for all nozzles and valves of tank connections shall be included in the scope of work of the bidder. Necessary bolts, nuts and gaskets for these connections shall also be supplied by the bidder.

g) The manhole shall be of hinged and bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 600 mm.

1.3 The scope of works shall also include supply and installation of special accessories as indicated in DATA SHEET-A and sketch for Miscellaneous tanks. The necessary fixtures and other accessories for mounting these special fittings shall be included in the scope of work of the bidder.

1.4 Level gauge / indicator for each tank shall be provided by the bidder along with all fittings & accessories as required for mounting the level gauge / indicator on the tanks. Float and board type level gauge / indicator shall be provided unless otherwise specified in DATA SHEET-A and SKETCH for Miscellaneous tanks.

1.5 Required number of tapings with 25NB instrument root valves shall be provided by the bidder for mounting instruments like level switches, level transmitters etc. The number of tapings shall be as indicated in the DATA SHEET-A and SKETCH for Miscellaneous tanks.

1.6

a) Sampling Connection with isolation valve of size 50 NB for each tank.

b) Drain valve of size 100 NB for Condensate storage tank shall be provided by the bidder unless otherwise indicated in the DATA SHEET-A and SKETCH for Miscellaneous tanks.

c) Quantity and size of spare nozzles and valves shall be supplied by the bidder as per DATA SHEET-A and sketch for Miscellaneous tanks.

1.7 NaOH / KOH breather and seal pot shall be provided with necessary drain valve of size 25 NB with stainless steel construction unless otherwise specified in the DATA SHEET-A and sketch for Miscellaneous tanks. Two (2) nos. NaOH / KOH breather shall be provided by the bidder for each tank out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.

1.8 Pipes, fittings, nozzles, flanges and counter flanges shall be supplied by the bidder. The minimum requirement like quantity, size, type etc. are indicated in the DATA SHEET-A and sketch for Miscellaneous tanks and may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL. Material of construction of all pipes, fittings, nozzles, flanges and counter flanges shall be as per DATA SHEET-A and sketch for Miscellaneous tanks.

1.9 All valves shall be of stainless steel construction for Condensate Storage Tank.

1.10 NaOH / KOH breather and seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH / KOH breather shall be provided through 200 NB SS pipe for condensate storage tank.

The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.

1.11 Bidder to provide minimum 24 nos., M30 anchor bolts for Condensate Storage Tank. However, any additional anchor bolts of higher size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication.

1.12 Bidder to provide minimum one wind girder of size 150 mm×75mm×10mm for Condensate Storage Tank. However, any additional wind girder/higher size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication.

1.13 Painting of the tanks is included in bidder's scope of work. Painting specifications of storage tanks / seal pot / NaOH / KOH breather are given under GA drawings of Misc. tanks. Painting requirement specified under GA drawing are minimum requirement. Any modification in painting requirement found applicable during detained engineering, shall be under bidder's scope without any commercial implication.

1.14 Commissioning spares as required for commissioning of the tanks / NaOH breathers / seal pots are in bidder's scope.

1.15 Platforms, monkey ladder inside tank, staircase (hand railing, knee guard and toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice (as indicated in the DATA SHEET-A and SKETCH for Miscellaneous tanks) shall be included in bidder's scope of work. All stair tread and platforms shall be made from 8 thk. chequered plate. Roof level interconnection between condensate storage tanks shall be done.

1.16 Suitable structural items like channels and saddle supports shall be provided for fixing the tank with foundation for each of rectangular tank and horizontal cylindrical tank respectively.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

2.1 Design, engineering, preparation of detailed fabrication drawings, bill of material, tag and piece numbers, welding procedures etc. Stiffeners and other structural framing for supporting the tank shall be designed by the fabricator and properly shown in the fabrication drawings.

2.2 Erection & Commissioning of Tanks.

2.3 Erection of all foundation bolts / anchor bolts etc. as required for any equipment/ foundation / concrete.

2.4 Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of pockets, excavation & filling of earth for buried MS pipes if and as required.

2.5 Inspection & testing and carrying out demonstration test.

2.6 Painting of tank and other equipment within the battery limit.

2.7 Any other equipment / material / services as required to make the installation complete in all respects shall be deemed to be included in bidder's scope of work whether mentioned above or not.

3.0 DESIGN CONSIDERATIONS

3.1 The successful bidder shall furnish design calculations to BHEL during detailed engineering stage for approval along with the Xerox copies of relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. Calculation shall be necessarily done in **SI UNITS** only for the followings: -

a) Tanks shall be designed as per IS – 803 / API – 650 / AWWA – D 100 / IS –2825 / BS – 2594 / Good engineering practice as applicable and referred code shall be of latest edition. However, requirement of codes and standards shall be as indicated in the Datasheet for Condensate Storage Tank & DM water storage tank

b) Weight calculation of plates, appurtenances & structures separately shall be included in the Design calculation.

c) Design of roof and roof structures for vertical storage tanks shall be designed based on guidelines given in the book titled "Process equipment design" by Brownell and Young.

d) Tank stability calculation (wind load / seismic / overturning stability) shall be done as per API – 650, latest edition. However, factors / coefficients as required for the design of tank shall be obtained from BHEL by the bidder after placement of order.

d) Vent sizing calculation shall be done as per API – 2000, latest edition

e) Sizing calculation of NaOH / KOH breather, seal pot and breather valve.

3.2 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650

and as per the design code indicated in DATA SHEET-A for Condensate Storage Tank & DM Tank.

3.3 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties.

3.4 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.

3.5 Vessels seams shall be so positioned that they do not pass though vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.

3.6 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.

3.7 For the tanks being of diameter larger than 3.75 m added structural supports in the form of rafter shall be provided.

3.8 Reinforcement in tanks shall be provided as per design code for Condensate Storage Tank and DM water storage tank. The reinforced connection shall be completely pre - assembled into shell plate.

3.9 Staircase / access ladder and hand railing shall be provided as per the relevant codes and standards.

3.10 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for bolts and nuts shall be SA 193 & 194 respectively.

3.11 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the GA drawing attached with the data sheets are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.

3.12 Bidder shall furnish the STAAD calculations and/or other suitable calculation during detailed for the following:

a. Roof structure calculations for checking the stability of roof.

b. Shell buckling under Roof & structure loading.

3.13 Provision shall be made by the bidder to minimise the air ingress in the tank through float & board type level gauge and details of the same shall be furnished during detail engineering stage for BHEL's approval and approved arrangement shall be provided by the bidder without any commercial implication.

3.14 The tank shall be designed for filled water head / atmospheric pressure and design temperature for the tank shall be as specified in the DATA SHEET-A and sketch for Miscellaneous tanks

3.15 Bidder to note that surface cleaning shall be of Blast clean type. However, Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL.

3.16 All materials, furnished shall conform to the latest editions of America National Standard Code for Pressure piping, Power piping, ANSI B311.1, ANSI B16.11, ASME Boiler and Pressure.

Vessel Codes, IBR and other applicable ASME, ANSI and Indian Standards. Schedule numbers, sizes and dimensions of all carbon steel, stainless steel and alloy seamless steel pipe shall confirm to ANSI B.36.10 and of stainless steel pipe shall confirm to ANSI B 36.19 unless otherwise specified.

4.0 WELDING

4.1 Welding shall be in accordance with the requirement of IS: 803, 816, 817 and 823 or equivalent.

4.2 Welding sequence shall be adopted in such a way so as to minimize the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

4.3 All welders shall be BHEL / customer / consultant qualified as per the approved quality plan / field quality plan which will be submitted by the successful bidder during detail engineering stage. WPS and PQR shall be submitted by the successful bidder to BHEL / customer / consultant for review and approval.

5.0 TEST AND INSPECTION

5.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant's approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial implication.

5.2 DPT / MPI on all welds (100%).

5.3 All cross / Tee joints and butt welds to be 10% Radio graphed.

5.4 For the offered tanks, fill test shall be carried out for at least 24 hours. Atmospheric storage tanks on inside surface shall be leak tested before painting.

5.5 All quality plans / checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.

6.0 MANDATORY SPARES:

Mandatory spares shall be supplied by bidder as indicated below:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	Level gauges (Float & Board type) for Condensate Water Storage tank	1 no.

7.0 LIST OF COMMISSIONING SPARES:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	CAF Gasket of size 1.5m X1.5m X 3 mm thk	2 nos.
2	Nuts, bolts & washers of each size (nos. of bolts, nuts & washers as required for each nozzle) as per approved Drg.	1 lot
3	Any other item required for successful commissioning of the tanks (to be specified clearly by bidder)	

8.0 TERMINAL POINTS

- Matching counter flanges for all nozzles mounted on the tank and its accessories. However, counter flanges for all nozzles and valves of tank shall be provided by the bidder.
- Drain pipe of seal pot and NaOH breather pots.

9.0 EXCLUSIONS

Tank foundation & associated civil works, Level Transmitters are excluded from bidder's scope of work.

10.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The bidder must submit the drawings / documents as mentioned under "CHECK LIST FOR DOCUMENT TO BE SUBMITTED" (In Section-III) along with their bid in 4 sets. In absence of any of these documents, BHEL reserves right not to evaluate the offer of the concerned bidder.

11.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under SECTION-I, Sub-Section-D, Annexure-IV during detail engineering for approval / information / reference (as the case may be).

12.0 OTHER TECHNICAL REQUIREMENTS

1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.

2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.

3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

4) Commercial implication includes price implication as well as delivery implication.

5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).

6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code.

7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.

8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.

9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

10) All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.

11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.

12) Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.

SUB SECTION-C2

CUSTOMER SPECIFICATION

2.01.00 **Large Diameter Piping**

2.01.01	Material of pipe	:	IS-2062 - Code for Structural Steel
2.01.02	IS-817	:	Code of practice for Training and testing of metal arc welders
2.01.03	IS-1367	:	Technical supply conditions for threaded steel fasteners

2.02.00 **Steel Storage Tanks**

The design, manufacture and testing of tanks shall comply with the requirements of one or more of the following standards as applicable.

2.02.01	IS - 803	:	Code of practice for design, fabrication, and erection of vertical mild steel cylindrical welded oil storage tank.
2.02.02	IS - 804	:	Rectangular pressed steel tank
2.02.03	IS - 805	:	Code of practice for use of steel in gravity water tank.
2.02.04	IS - 816	:	Code of practice for use of metal arc welding for general construction in mild steel.
2.02.05	IS - 823	:	Code of procedure for manual metal arc welding of mild steel.
2.02.06	IS-2825	:	Code for unfired pressure vessels.
2.02.07	API-12D	:	Large welded production tanks
2.02.08	API-12F	:	Small welded production tanks
2.02.09	API-620	:	Recommended rules for design and construction of large welded, low pressure storage tanks.
2.02.10	API-650	:	Welded steel tank for oil storage.
2.02.11	BS-1564	:	Pressed steel tank
2.02.12	BS-2594	:	Carbon steel welded horizontal cylindrical tank
2.02.13	AWWA-C-504	:	Butterfly valve

2.03.00 **Rubber Expansion Joints**

The design, material requirement, manufacture, testing and performance requirements of the Expansion Joints shall generally conform to one or more of the following codes and standards/ documents:

4.02.00 **Miscellaneous Steel Tanks**

The miscellaneous steel tanks to be designed, supplied, fabricated and erected under this specification are listed in Annexure-I of this section.

4.02.01 The connections, accessories and fittings to be supplied with each tank shall be as indicated in the respective drawings, specification and as required. The piping material required inside or outside up to the flanged terminal shall be supplied by the Bidder.

Tank connections shall be provided with suitable counter flanges with necessary bolts, nuts & gaskets by the Bidder.

4.02.02 The tank, where applicable, shall be complete with supporting structure, legs or pedestals, base plate, anchor bolts, nuts & sleeves etc. as required.

4.02.03 The special fittings, e.g. conservation vent valves, level indicators etc. shall be supplied by the Bidder.

4.03.00 Preparation of detailed design, fabrication drawings, bill of materials, tag and piece numbers, welding procedure, etc. Stiffeners where not specified and other structural framing for supporting tank shell shall be designed by the Bidder including supply of materials for the same.

General layout showing pipe routing, location of expansion joints, butterfly valves, etc. shall be furnished by the Bidder.

4.04.00 This specification covers supply of steel plates, structural steel, pipes etc. as required for complete installation.

4.05.00 The scope of work under this specification shall include excavation and backfilling work required for installation of pipes running underground.

4.06.00 Minor concrete works like pipe supports, thrust blocks, etc. as required will be supplied and erected by the Bidder at his own cost. Necessary steel work at supports shall also be supplied, fabricated and erected by the Bidder.

4.07.00 The final fixing grout over the concrete support or through the opening left in the concrete work shall be done by the Bidder.

4.08.00 **Rubber Expansion Joints**

The scope of supply under this specification shall be as below. Items not mentioned but deemed necessary by the Bidder for making the system completely reliable and efficient shall also be included.

4.08.01 Expansion joints with retaining rings and requisite nos. of fixing bolts, nuts, washers gaskets connection, bellow with the companion/equipment flange.

4.08.02 Various accessories like companion flanges, control rod/unit assembly including stretcher plates, limit rods, washers nuts, bolts etc.

4.09.00 Required number of spring supports as detailed shall be supplied.

5.00.00 **DESIGN AND CONSTRUCTION**

5.01.00 **Large Diameter Piping**

5.01.01 The pipe sizes chosen shall be the next higher size to that calculated by taking velocity of water does not exceed 2.5 m/s. Underground CW & ACW piping shall be concrete encased (min. 300 mm thickness) with appropriate protective coating.

5.01.02 All piping to be fabricated under this section shall be made of tested quality mild steel plates having thickness not less than that stated below:

Pipe Dia. (O.D)	**Plate Thickness (Minimum)**
Upto 800 mm	10 mm
Above 800 mm	12mm (min). However, Bidder to determine as per design code, subject to approval by owner's engineer/consultant

5.01.03 All plates used will be of mild steel quality conforming to IS-2062 Gr B (latest revision) or equivalent.

5.01.04 Flanges should be machined on both faces. Fabrication of flanges from segment plates should be avoided. However, if under special circumstances flanges from segment plates are to be provided, on specific instructions of the Owner/Consultant, such flanges should be completely stress relieved after welding and all welds shall be subject to dye penetration test. These flanges should also be machined.

5.01.05 All welds are to be continuous single V butt with finished head of size equal to thickness of plate. All welding shall be as per IS- 817 (latest revision).

5.01.06 The pipe circumferential weld shall be done in such a way that the longitudinal welds become staggered in any two consecutive sections.

5.01.07 Pipe sections in straight lengths delivered at erection site shall be of suitable length to minimise field joints as far as possible. End preparations shall be done at the fabrication yard to facilitate site welding.

5.01.08 The piping shall be prepared cold rolled to true cylindrical shapes in a number of passes in a plate bending machine so that no undue stresses are developed.

5.01.09 Manholes shall be provided wherever required and the sizes shall conform to the requirement. All manholes shall be provided with flanged covers with handle, gasket, bolts, nuts etc. Manhole pits shall be provided for buried

piping at regular intervals of 100 m. Valve pit, if required shall be provided for buried piping system for accessibility and maintenance of the valves. The design of the valve pit shall be approved at the detail Engineering Stage.

5.01.10 Gaskets shall be 3 mm thick full-face rubber.

5.01.11 Bolts and nuts shall be hexagonal head conforming to IS-1367 (latest revision).

5.01.12 The pipe sections shall be carefully placed on the sand bed prepared as specified before and then welded. The method of holding the pipe sections in position for welding during erection shall be approved by the engineer. All joints before welding shall be thoroughly cleaned and requisite welding gap maintained.

5.01.13 Welding shall be carried out as per provisions laid down in IS-816 (latest revision). Welding shall be done by experienced and good operators who have been qualified by tests as specified in IS-817 (latest revision).

5.01.14 Welding sequence shall be done in such a way so as to minimise the distortion due to welding shrinkage. Any distortion will be duly rectified by the Bidder.

5.01.15 Welding shall not be carried out when the surface of the parts to be welded are wet for any cause and during periods of rain and strong winds unless the welder and work are properly shielded.

5.01.16 The unpainted ends of pipe surface shall be painted after completion of jointing. Precaution shall be taken to prevent any crack or damage in the external coating during installation. Pipes shall be laid in trenches excavated along the route and the overground portion shall be installed as per final layout drawings furnished to the Bidder.

5.01.17 On completion of all welding in the pipe lines, the same shall be tested hydrostatically and after successful testing, shall be covered by sand wrapping and backfilling with earth as specified elsewhere in this specification.

5.01.18 Installed pipe shall be closed up at both ends at the end of each day by watertight plug or other means approved by the Owner to prevent debris/ animals/human beings from entering the pipe.

5.02.00 **Steel Storage Tanks**

5.02.01 Tanks shall be suitably constructed for safe, proper and continuous storage of liquid described. The design code, material standard, minimum plate thickness, size and other details shall be as per the specified Codes and Standards as applicable.

5.02.02 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature. For rectangular pressed steel tank, the plates shall be heated uniformly in a furnace and

formed in a press, each of which is capable of taking the whole part at a time. Alternatively, the plates may be pressed cold, the flanges made by V-die and the corners welded provided no cracks are developed.

5.02.03 Vessel seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessels consisting of more than two sections, longitudinal seams shall be offset.

5.02.04 Where possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.

5.02.05 For vessels with dished ends, Bidder shall submit in his quotation details of the proposed dished ends. The details shall comprise of the following:

a) The method of manufacture.

b) Knuckle and crown radii and length on straight portion.

c) Whether dished ends are fabricated in one piece or segmented.

d) A sketch showing number of segments and seam arrangement, if segmented ends are proposed.

5.02.06 Proper means shall be provided against the chance of over-turning effect of wind on an empty vertical cylindrical tank.

5.02.07 Due consideration for wind load and/or earthquake effect shall be given by the Bidder in the design of tanks. Data for wind load and earthquake shall be taken as indicated in the Vol. IIA. Maximum allowable stresses for design loadings combined with wind or earthquake shall not exceed 133% of stress permitted for the design loading condition but in no case shall exceed 80% of specified minimum yield strength of the material.

5.02.08 Except where otherwise indicated in the Owner's drawings/ specifications, if the stiffening of the shell and/or roof is necessary the same shall be stiffened from outside.

5.02.09 Reinforcement pads in tank connections shall be provided as per applicable code & the reinforced connection shall be completely preassembled into a shell plate. The completed assembly including the connection shall be thermally stress relieved as per API Standard 620 if specified.

5.02.10 All welding shall be done as per IS: 803, 817, 823 and IS:816, latest revision as applicable. All welds are to be continuous welds. Bidder shall clearly state in his offer the make and type of welding rods proposed by him for fabrication. Inspection of welding shall be carried out in accordance to IS-822, IS-823. Welding sequence shall be adopted in such a way so as to minimise the distortion due to welding shrinkage, Bidder shall indicate in his Drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

5.02.11 **Tank Connections**

a) Bidder shall furnish all piping material required for the tank connections.

b) Unless otherwise specified, for all flanged connections Bidder shall furnish suitable counter flanges and the necessary nuts, bolts, gasket.

c) Flange faces of all nozzles shall be machined and square with the vessel centrelines.

d) Unless otherwise stated bolts and nuts shall be of hexagonal head conforming to IS:1367, latest revision.

The material and thickness of gaskets shall be suitable for the specified service. On completion of hydraulic test, Bidder shall replace the gaskets used during testing at his own cost.

e) All tanks shall be provided with connections for drains, vent and overflow. Condensate storage tank shall be provided with pump recirculation connections. Blank flanged spare inlet and outlet- 2 (two) each shall be provided for condensate storage tank and one (1) each for others. Each of the above spare connections shall be provided with isolating valves.

5.02.12 **Accessories**

The tanks shall be provided with accessories as indicated in the Specification. All the accessories shall conform to relevant Indian Standard. The following broad guidelines are given for some of the accessories.

a) **Conservation Vent Valve/Breather**

Where continuous venting to atmosphere directly is not permitted for the stored liquid, a conservation vent valve or a breather of approved make & design shall be provided on each of the vent/overflow connection of the condensate storage tank. The conservation vent valves where provided, shall be designed to relieve the pressure or vacuum corresponding to plus or minus 55mm water gauge in the space above liquid in the tank. Detail cross-sectional drawing indicating materials of construction shall be submitted along with the proposal.

b) **Level Indicator**

Float operated or tubular gauge glass type indicator of high-grade workmanship shall be provided on each tank. Tank of height not exceeding 3m shall have tubular gauge glass and others float operated level Indicator. For tubular gauge glass, isolating valves and protective guards against mechanical shock shall be provided.

c) **Level Switch**

Where specified level switch of approved make & type shall be furnished along with instrument root valves. Repeat accuracy of operation shall be ± 1% of the full range. At least two level switches one for High-level actuation and other for Low Level actuation shall be provided for each tank to motor operated gate valves at inlet lines of specified tank.

d) **Dip Hatch**

Each large dia cylindrical tank shall be fitted with one dip hatch. Dip hatch shall have screwed end and shall be fitted with brass cap and chain.

e) All tanks shall be provided with vertical rung ladder. In addition to this, internal vertical ladder is to be provided in all tanks where the tank height exceeds 3M, vertical ladder is to be provided with cage.

f) Top Manhole shall be provided in all tanks. Besides manhole at the side of tank shall be provided in case of condensate storage. Manhole size shall be 600mm NB(min.).

5.02.13 For installation of tank , the recommendation regarding installation in IS : 803 shall be followed in general. In addition to those recommendations, the following shall also be taken care of.

5.02.14 The finished tank grade for cylindrical tank shall be crowned from the outer periphery to the centre with a slope. The sloping factor shall be taken as 1:36 unless otherwise specified.

Sufficient number of plugged holes shall be provided in the bottom plate of the vertical tanks for bottom testing as specified in IS-803.

5.02.15 Welding shall be done in accordance with IS-803, IS-817 & IS-823.

5.02.16 Welding sequence shall be adopted in such a way so as to minimise the distortion due to welding shrinkage. Bidder shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

5.03.00 **Rubber Expansion Joints**

Design of the Expansion Joint shall take care of the axial, angular or rotational movement of the bellow and/or the equipment vibration. Axial compression or elongation of RE joint under design pressure from free condition shall be 10 mm (max.). Lateral deflection of RE joint under design pressure from free condition shall be 10-mm. Lateral deflection with simultaneous axial elongation and compression shall be 10 mm. These figures shall be confirmed based on the final details of condenser and C.W. pumps. Pressure compensating expansion bellow shall be designed to suit the requirement of condenser.

6.03.07 **Disposal of Surplus Spoil**

Surplus material from excavation, which is not required for backfilling, will be disposed of in designated disposal areas. The spoils shall be dumped in a systematic manner and spread in layers not exceeding 150 mm thick and consolidated with the help of compacting equipment.

7.00.00 **CIVIL WORKS**

All Plain and Reinforced Concrete work covered in this section shall generally conform to Specification for Cement Concrete (Plain & Reinforced):

Please refer section-II of Vol-IIG/1 unless noted otherwise.

8.00.00 **TESTING AND INSPECTION**

8.01.00 **Large Diameter Piping**

8.01.01 After complete pipe lines have been laid and joined, the same shall be tested hydrostatically as specified in Vol.-IIA, for hydrostatic test pressure of circulating water piping, Auxiliary Cooling Water Piping.

8.01.02 All the longitudinal and circumferential welded seams shall be subjected to chalk and kerosene test prior to hydraulic testing of the complete pipe line. This shall be done at the presence of the Owner/Consultants. In addition to this, test coupons shall have to be provided for each longitudinal seams for mechanical tests (tensile and bend), if considered necessary by the Owner. The test coupons are to be broken in presence of the Owner. Bidder shall satisfy the Owner that work is being carried out in accordance with the specification drawings and other conditions. Owner shall have full access to the Bidder's working area.

8.02.00 **Performance Tests for Steel Storage Tanks**

8.02.01 Vertical Cylindrical Storage Tanks shall be tested generally as per IS:803 (latest edition) including the following :

a) Spot radiography if joint efficiency factor of 0.85 is specified.

b) Bottom plate testing by air or vacuum box.

c) Shell testing by filling with water.

d) Fixed roof testing by air.

8.02.02 Horizontal cylindrical tanks manufactured in accordance with BS:2594 shall be tested hydraulically at 0.7 bar at the top of tank, unless otherwise specified.

8.02.03 Pressed steel tanks shall be hydraulically tested by filling with water up to the top of tank as per IS:804.

8.02.04 Radiography & hydrostatic tests shall be guided by IS:2825 for pressure vessels.

8.02.05 Hydraulic & other performance tests shall be conducted on all accessories of the tank as per applicable standard.

8.02.06 All tanks shall be leak tested twice, after completion of fabrication and after application of anti-corrosion painting/ lining. The tanks shall be filled up with water in stages as directed by the Engineer. The duration of leakage test shall not be less than eight (8) hours.

8.03.00 **Shop Inspection and Testing for Expansion Joints**

8.03.01 The manufacturer shall conduct all tests requirement to ensure that all the component parts of the Expansion Joints offered conform to the requirements of applicable codes and standards.

8.03.02 Dimensional inspection

Each Expansion Joint shall be inspected for dimensional accuracy acceptance limits of which shall be mutually agreed upon.

8.03.03 Hydrostatic pressure test & leakage test

All Expansion bellows shall be subjected to internal hydrostatic pressure test at a value of one and a half (1.5) times the design pressure for a period of 10 min. under each of the following conditions :

a) Free position of the bellow

b) With permitted (design) elongation & lateral deflections and

c) With design contraction and lateral deflection.

Inspection for leakage from the bellow shall be carried out during pressure test.

After the hydro test is over, the bellow shall be dimensionally inspected to check deformation, if any.

During the test, the control assembly shall be suitably adjusted to obtain the test conditions of the bellow.

8.03.04 **Vacuum Test**

All Expansion Joints shall be subjected to vacuum test at a pressure of 700 mm of Hg for a period of 10 min. under each of the three conditions mentioned in clause 8.03.03 above.

ANNEXURE-I

SPECIFICATION OF MISCELLANEOUS STEEL TANKS

Sl. No.	Description	Shape	Size	Nominal Capacity (Cu.M) Minimum	Nos. Reqd.
1.	DM Water make up Tank in DMCW system	Horizontal Cylindrical With flat ends	Bidder to indicate	10	1
2.	Potable water Tank	Rectangular/ Cylindrical with flat roof	Do	25	1
3.	Service Water Tank	RCC Over head tank	Do	150	1
4.	Condensate Storage Tank	Vertical Cylindrical	Do	750	1

welding, by bolting or by beam clamps. Bolt holes shall be drilled not burned. Support components may be bolted to concrete using approved concrete anchors.

4.05.00 **Valves and Accessories**

4.05.01 General Requirements

a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure II & III. The valves shall be provided with electric motors/solenoids and actuators as required.

b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs should be avoided as far as possible.

c) All valves shall, unless otherwise stated, have the internal diameter same/as the internal diameter of the pipes to be joined.

d) All valves shall receive tests at manufacturer's or bidder's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Purchaser.

e) Gate valve and Ball valve have been specified with the intention of achieving isolation and tight shut-off. In full open condition, these valves should offer minimum of resistance to fluid flow.

f) Globe valves have been specified with the intention of achieving good control of fluid passing. The plug and seat will have therefore suitable profiles for obtaining such controlling action.

g) Check valves have been specified in order to prevent reverse flow through them.

h) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate.

i) Material, design, manufacture, testing etc. for all valves and specialties along with the accessories shall conform to the latest editions of codes.

j) By pass valves shall be provided for larger size valves as per standards followed and as felt necessary for smooth and easy operation, even though not specifically mentioned in the specification.

k) All flanged valves and specialties to be supplied under this section shall be provided with two (2) counter flanges, bolts, nuts, washers, gaskets etc.

l) All valves shall be of approved design and manufacture. Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Purchaser's approval.

m) All valves shall have outside screwed spindles and screwed thread of spindle shall not pass through or into the stuffing box. Where valves are exposed to the weather, protective covers shall be provided for the spindles, which shall be subject to approval.

n) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items:

i) Hand wheel with embossed open and shut directions.
ii) Local position indicator.
iii) Motorised operation as specified by Engineer.

o) Gate valves, in addition shall be provided with following extra features

i) Bypass valve for valves of 300 mm size and above.

ii) Draining arrangement

iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation.

iv) Motorised operation as specified by Engineer.

p) All gate and globe valves shall be rising stem type.

q) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also.

r) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties.

s) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position.

t) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided.

u) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction.

v) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.

w) Plastic or bakelite valve hand wheels will not be accepted.

x) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers.

y) Wherever practicable heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500 kg. shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable.

z) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.

aa) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.

bb) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction.

cc) All sampling and root valves shall be of integral body bonnet type.

4.05.02 For Design Requirements for different valves refer Annexure-II & III.

4.06.00 **Safety/Relief Valves**

Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.

ANNEXURE-I

SPECIFICATION OF PIPES FOR DIFFERENT SERVICES

	A		B		C	D
Services	**1. Clarified Water piping**		**1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)**		**1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB**	**1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB**
1.00.00 Material of Pipe	Carbon Steel IS-1239 Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm.		Carbon Steel as per IS-1239 Heavy Grade for sizes upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm. The pipes shall be galvanized as per IS-4736		Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 40S, ANSI B36.19	Stainless Steel as per ASTM A-312 Gr. 304. Thickness- as per schedule 10S, as per ANSI B36.19
2.00.00 Construction	ERW / Seamless		ERW / Seamless		Seamless	ERW
3.00.00 Joints	Slip-on Flange and butt weld for size 65 NB and above and Socket weld joint for size 50 NB and below.		Screwed flange for sizes 65 NB and above and screwed for size 50 NB and below. Pipe to pipe joint shall be with union as per IS:1239, Part-II.		Socket welded for size 50 NB and below	Slip-on flange and butt weld joint.
4.00.00 Fittings	Pipe Sizes > = 65 NB	Pipe Sizes < = 50 NB	Pipe Sizes > = 65 NB	Pipe Sizes < = 50 NB		

	A		B		C	D
Services	**1. Clarified Water piping**		**1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)**		**1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB**	**1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB**
4.01.00 Materials	ASTM-A-234 Gr. WPB	ASTM-A-105	ASTM-A-234 Gr. WPB galvanized as per IS-4736	ASTM-A-105 galvanised as per IS-4736	ASTM-A-182 F304	ASTM-A-351-CF8 or ASTM-A-403 WP304
4.02.00 Construction	Welded/ Seamless	Forged	Welded/ Seamless	Forged	Forged	Welded/Seamless
4.03.00 Standard	ANSI-B-16.9 for Butt welding fittings and fabricated fitting AWWA-C-208	ANSI-B-16.11 or IS:1239, Part-II	ANSI-B-16.9	ANSI-B-16.11 or IS:1239, Part-II	ANSI-B-16.11	ANSI-B-16.9
4.04.00 End details	Pipe size >=65 NB Bevel ended as per ANSI-	Pipe size <=50 NB Socket welded as per ANSI-B-	Pipe size >=65 NB Screwed Flanged	Sizes <=50 NB Screwed socketed as per ANSI-B-16.11.	Socket welded as per ANSI-B-16.11	Bevel ended as per ANSI-B-16.25

	A		B		C	D
Services	**1. Clarified Water piping**		**1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)**		**1. Demineralised Water, DMCW piping, Service and Instrument Air Piping less than and equal to 50 NB**	**1. Demineralised Water, 2. DMCW piping, Service and Instrument air piping for sizes equal to greater than 65 NB**
	B-16.25	16.11				
5.00.00 Flanges	150 lb (min) class as per ANSI-B-16.5 complete with nuts, bolts and gaskets		As per ANSI-B-16.5 pressure class 150lbs (min) - galvanised-complete with nuts, bolts and gaskets.		As per ANSI-B-16.5 pressure class 150lb (min) complete with nuts, bolts and gaskets. Material as per class 4.01.00.	150lb (min) class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets.
Pipes which fall under IS:1239 shall be hydrostatically tested according to the said code, for others refer Vol.: II-A.						

ANNEXURE-II

SERVICES OF VARIOUS CATEGORIES OF VALVES

Valve Classification		Service	
A.	Cast iron body Gate/Globe/Check Valve	i) Service Water ii) Clarified Water iii) Drinking/ Potable Water	For sizes 65 NB and above.
B.	Stainless steel body/ Gate/Globe /Check/Ball Valve	i) For Demineralised water ii) Service and Instrument Air iii) Inhibited Demineralised Water	For all sizes For all sizes. Ball valves to be used in air line. For all sizes
C.	Steel Body valves	i) Service Water ii) Clarified Water iii) Drinking/ Potable Water	For sizes less than and equal to 50 NB
D.	Cast Iron body butterfly valve	i) Service Water ii) Clarified Water iii) Filtered Water	For butterfly valve specification refer Annexure II, Sec.V of Vol. II-J1.

ANNEXURE-III

SPECIFICATION OF VALVES

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
1.00.00	Valve Classification Code	CIGC	SSGC	STGC
2.00.00	Basic Design Code			
	a) Gate	a) i) IS 780 for 50 mm - 300 mm NB ii) IS2906 for 350 mm NB and above or as per MSS-SP-70	a, b, c) ANSI-B-16.34	i) API 600 for 50mm ii) API 602 for size
	b) Globe	b) MSS - SP - 85		b) BS-1873/ANSI-B-16.34
	c) Check	c) IS-5312/MSS - SP -71		c) BS-1868/ANSI B16.34
	d) Ball		d) BS-5351	
3.00.00	Pressure Class	To be suitably chosen considering the pressure requirement. Refer Clause No. 4.01.08 in this regard.		
4.00.00	Construction	Cast body and bonnet / cover	Forged body up to 50 NB	Forged body up to 50 NB and

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
			and Cast body above that	Cast body above that
5.00.00	Material			
5.01.00	Body & Bonnet/ cover	IS 210 Gr. FG 260 or ASTM A216 Class B.	ASTM-A-182 F304 for Ball Valves: A351 CF8M for cast body, A 182 F304 for forged body.	ASTM-A-216 Gr. WCB for cast body & ASTM-A-105 for forged body
5.02.00	Trim / Disc.	IS-210 Gr. FG 260 or ASTM A216 Class B.	ASTM-A-182 F304 for Gate, Globe, Check valves and 351CF8M for Ball valves. For DKW system : ASTM-A-182 F6A (min. 250 HB)	13% Cr Steel as per ASTM-A-182 Gr. F6 heat treated and hardened (min 250 NB) for cast body and ASTM-A-105 Hard faced with Stellite (min 350 HB) for forged body
5.03.00	Seating surface	13% Cr steel as per IS 1570	For Ball valves PTFE seats and seals.	13% Cr. Steel as per ASTM-A-182 Gr. F6
6.00.00	End Preparation	Socket welded for size equal to and below 50 NB and flanged with counter flanges for 65 NB and above.		

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
7.00.00	Testing			
	a) Gate	i) As per IS - 780 for 50 mm - 300 mm NB		API-598
		ii) IS-2906 for sizes equal to and above 350 mm NB	As per ANSI B-16.34	
	b) Globe	Hydrostatic Test as per MSS-SP-85		BS-1873
	c) Check	IS-5312/MSS-SP-71		BS--1868

SECTION-V

GENERAL TECHNICAL REQUIREMENTS

CONTENTS

SECTION-V

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Successful Bidder.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Successful Bidder proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Successful Bidder to advise Owner of the resulting effect.

2.00.00 RESPONSIBILITY FOR DESIGN

2.01.00 The Bidder shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Successful Bidder was directly involved in the design work.

2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.

2.03.00 The Bidder shall carry out optimization studies for selection of pipe size and equipment wherever required. The result of such studies shall be included as part of bid proposal.

The successful Bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.

2.04.00 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.

2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feedback, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.

3.00.00 NAME PLATES (RATING PLATES)

3.01.00 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.

3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.

3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.

3.04.00 The size and location of nameplates shall be subject to Approval of the Owner/Owner's Engineer.

4.00.00 SAFETY AND SECURITY

4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

4.02.00 Ready and safe access with clear headroom shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.

4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The Plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.

4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

5.00.00 **GUARDS**

5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure handhold must be provided on each side of the opening or doorway.

6.00.00 **LOCATION AND LAYOUT REQUIREMENTS**

The majority of plant and equipment shall all be of indoor installation. A broad list of buildings housing such equipment is given In Vol-II-G2 Section I. Layout shall facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings enclosed in Vol-II-L show the location of major installations and auxiliary buildings. The Bidder

shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's acceptance alter the same to suit the space requirement of the equipment offered.

While developing the layout of buildings the following criteria shall be given effect:

a) The minimum width of clear access corridors around equipment shall be 1.2 meters.

b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as required.

c) The plinth level with respect to the existing grade level shall be as indicated elsewhere in Vol-II-A Section-V/Annexure-II.

d) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of 2.2 meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.

e) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.

f) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces shall be as specified in Vol-II-A Section-V/Annexure-II.

g) All rail/road crossings for pipe/cable racks shall be constructed with minimum 8 meters headroom from top of rail/road to bottom of rack. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II of this section.

h) Cubicle for operating personnel shall be located at safe place near the equipment.

i) Pipe rack, cable rack and Pipe cum Cable rack shall have hand railings (not less than 1200 mm high) in walkways (min. 800 mm wide) on both sides at appropriate heights.

7.00.00 OPERATION AND MAINTENANCE CONSIDERATIONS

7.01.00 Space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.02.00 Lifting devices i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling of any equipment and/or part having weight in excess of 100 Kg during erection and maintenance activities. Suitable beams, hooks etc. for this purpose shall be provided in the buildings and clear space provided below to a platform or floor which will allow normal risk free transport means to be used.

Lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall also be provided by the Bidder for lifting the various equipments and accessories covered under this specification.

7.03.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.00.00 MATERIALS

8.01.00 In selecting materials of construction of equipment, the Bidder shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled.

All materials shall be new and shall be of the quality most suited to the proposed application.

8.02.00 Materials used for various components shall be those which have already proven operating experience in similar type of applications.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

8.04.00 Prohibited Materials

The use of the following materials is prohibited:

a) High alumina cement in structural elements

b) Wood wool slabs in permanent framework to concrete

c) Calcium chloride in mixtures for use in concrete works

d) Naturally occurring aggregate for use in reinforced concrete that does not comply with the applicable codes and standards.

e) Cast iron for any oil service

f) Carcinogenic material and suspected carcinogenic materials by World Health Organization.

g) Asbestos or any other fibrous form of hydrated magnesium silicate

h) Any other material generally known to be deleterious if used or incorporated in such project like the facility.

9.00.00 **LUBRICATION**

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant, which may drop, from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Bidder shall supply grease gun equipment suitable to service each type of nipple fitted.

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10.00.00 **LUBRICANTS, SERVO FLUIDS AND CHEMICALS**

10.01.00 The Bidder shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Successful Bidder for initial commissioning, first fill and till completion of facilities and handing over of respective units.

10.02.00 The Bidder shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Successful Bidder shall endeavor to reduce the verities and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily

obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 PLANT LIFE AND MODE OF OPERATION

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty as specified in relevant sections of the specification.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations. (Details are specified in the Volume IIB – Specification of Steam Generator and Auxiliaries and Volume IIC – Specification of Steam Turbine and Auxiliaries and)

The units would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

12.00.00 PACKAGING & MARKING

All the equipment 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 the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Bidder shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

Bidder shall conduct his own route survey and transportation logistics for transportation of the equipments to project site by road/rail/sea and indicate the same in his proposal.

Each package shall have identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Bidder shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Bidder, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

13.00.00 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other suitable covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other suitable protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs shall be sealed and taped. Male threaded openings shall be closed with rough usage covers or plugs shall be sealed and taped. Female threaded openings shall be closed with forged steel plugs.

Returnable containers and special shipping devices shall be returned by the Bidder.

14.00.00 PAINTING

14.01.00 General

All exposed metallic and wooden surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the acceptance of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the prior notification and specific acceptance of the Owner. The quality and vendor of the paints shall require acceptance of the Owner.

Procedure for painting of any item, if not indicated in the relevant specification, shall be developed by the Bidder. This procedure and quality of paint shall be subject to Owner’s acceptance

All paints shall be applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be properly applied on to the surface and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the spray painting equipment.

If the drying interval between successive coats of paint or primer exceeds the manufacturer’s recommendations, the paint already applied shall be completely and uniformly abraded with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not be done indoors, without the prior notification and specific acceptance of the Owner. Spray guns shall not be used outdoors in windy weather nor near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment or unprotected humans.

The Bidder shall provide suitable protection for adjacent plants from air borne materials during cleaning and spraying to the satisfaction of Owner

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. For detail please refer relevant electrical sub-section Volume II F1 & F2.

The Bidder shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35°C shall be selected by the Bidder, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C.

The colour scheme shall be submitted during execution of contract for acceptance by the Owner.

14.02.00 **Surface Preparation**

The grade of surface preparation shall be classified as indicated in Annexure-I of this section.

Sl. No.	Type of Preparation	Reference Standards		
		SSPC	SIS	BS 4232
1.	Solvent cleaning	SP1	-	-
2.	Hand Tool Cleaning	SP2	St-2	-
3.	Power Tool Cleaning	SP3	St-3	-
4.	Flame cleaning of new steel	SP4	-	-
5.	White metal blast cleaning	SP5	Sa-3	First Quality
6.	Commercial blast cleaning	SP6	Sa-2	Third Quality
7.	Brush-off blast cleaning	SP7	Sa-1	-
8.	Pickling	SP8	-	-

9.	Weathering followed by blast cleaning	SP9	-	-
10.	Near white blast cleaning	SP10	Sa-2.5	Second Quality

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

The abrasive to be used shall be metal grit.

The surface preparation of all steel surfaces to be coated shall be free from all mill scales, rust corrosion products, oxides, paints, oil or other foreign matter.

All welded areas and appurtenances shall be given special attention for removal of welding flux in crevices. Welding splatter, slivers, laminations and underlying mill scale exposed during shot blasting shall be removed or repaired.

No acid/solvents/other cleaning solutions shall be used on surfaces after they have been blasted.

14.03.00 **Application of Primer and Paint**

Primer shall be applied immediately after surface preparation has been completed.

Brushing, spraying, roller coating or other suitable method shall be adopted for application of primer and paint and the work shall be carried out strictly as per the recommendation given by the paint manufacturer.

Primarized surfaces shall be faultless and shall not have mudcracking, dripping over thickness and dry sprays.

Before application of paint/primer, the following shall be particularly checked for conformance to this specification and recommendation of the paint manufacturer:

a) Surface preparation profile.

b) Catalysis ratio for two component paints.

c) Pot life.

d) Minimum and maximum top coating times.

e) Type and quantity of thinners (if required)

f) Viscosity

g) Soundness of previous coating.

h) Ambient conditions (temperature, humidity, etc)

Depending on the degree of contamination by foreign matters, the surfaces primed at shop shall be washed as follows to the satisfaction of the Owner:

a) With clean water under a pressure of a least 7 Kg/cm2 (g) using suitable nozzles. During washing broom of corn brushes shall be used.

b) With suitable solvents, (such as Carbon Tetrachloride, Trichloroethylene etc.) if necessary, to remove traces of grease, oil etc.

Coated parts shall be carefully handled using hemp ropes, cloth belts, pendulum conveyors or suitable means as instructed by the Owner.

Surfaces which cannot be painted after fabrication shall be primed and provided with suitable rust preventive oil before boxing up.

Paints shall be stored in well-ventilated rooms, far away from heat sources, open flames, sparks and protected from sun. Outdoor storage is not permitted. Storage life shall be clearly indicated on the container. Paints, which have thickened or gelled or contained in non-original containers or in unsealed containers shall not be used. Owner's decision in this regard shall be final and binding.

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as per Table I & II of this section.

For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

14.04.00 **Damaged Paintwork**

Any damaged paintwork shall be made good as follows:

a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.

b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.

c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

14.05.00 Surface preparation and painting work shall not be carried out under the following weather conditions:

a) When the surface is wet or expected to become wet before the paint/primer has dried up due to impending rain, fog or mist.

b) High winds.

c) Ambient temperature below 5deg.C or surface temperature less than 3 deg.C above dew point.

d) Relative Humidity is more than 85%.

14.06.00 **Inspection and Testing of Painting**

The following inspection and testing shall be performed during and on completion of paint systems.

- Shot blasting profile shall be checked using a suitable profile-meter. Acceptable profile shall be 25-30 microns.

- Check of time of top coating and drying, in accordance with the recommendation of paint manufacturer.

- Check of Dry Film thickness by suitable Non Destructive Equipment. The painting shall be rejected if any of the spot measurement shows thickness to be less than 80% of the specified thickness.

- Check of adhesion of Paint Material by "Chequering" or another suitable method.

- Check of porosity of coating for internals, by the use of a suitable instrument.

- Visual inspection of appearance and uniformity of the surfaces painted.

If during above inspection, painting defects are observed, the Bidder shall carry out rectification to bring the faulty surface to the acceptable degree.

The areas where defective or damaged coatings have been repaired or replaced shall be re-inspected to the original requirements.

Surface temperature and humidity readings shall be taken prior to application of each coat. The work shall not proceed if the ambient temperature parameters are outside the requirements of this specification. If more stringent, the coating manufacturer's requirement shall dictate.

The dry film thickness shall be tested with a micro test film gauge or an accepted equivalent. The testing method shall be in accordance with SSPC – PA 2.

15.00.00 **COLOUR CO-ORDINATION & FINISH**

15.01.00 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

15.02.00 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

15.03.00 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

15.04.00 Final colours and finishes shall be to the acceptance of the Owner.

16.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

16.01.00 Environment Protection

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

The Plant shall be designed meeting the latest environmental requirement issued by MoEF, GOI. In the event of Ministry of Environment & Forest stipulate any other conditions not specified hereunder, the Bidder shall comply with those requirements.

16.01.01 Liquid Effluent Discharge

a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (protection) Rules 1986, as amended till date.

b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

16.01.02 Air Quality Emissions

a) Suspended Particulate Matter at chimney outlet - Maximum 30 mg/Nm^3

b) Oxides of Nitrogen (NO_x) - 100 mg/Nm^3 .

c) Sulphur di-Oxide(SO_2) - 100 mg/Nm^3

d) Mercury (Hg) - 0.03 mg/Nm^3

e) The Efflux velocity from boiler stack(s) shall not be less than 25 m/sec.

g) Outlet dust emission level of bag filter installed in AHP and CHP shall be restricted to 30 mg/NM^3.

h) For The Coal Handling Plant, areas covered under Dry Fog Dust Suppression (DFDS) shall be designed to control the dust emission level in the working area measured at distance of 2m from the dust generation sources, over and above the atmosphere background dust level to shall be within 5 mg/NM3

The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

16.02.00 **Noise Level Requirement**

The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.

b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the Successful Bidder shall comply with the requirement.

17.00.00 **INSPECTION AND TESTING**

17.01.00 Inspection and Tests during Manufacture

17.01.01 The method and techniques to be used by the Successful Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

17.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

17.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

17.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Successful Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Successful Bidder shall forthwith forward to the Owner's Engineer duly certified copies of the Test Certificates in Three (3) copies for approval.

17.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

17.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Successful Bidder shall allow for trial assembly prior to dispatch from place of manufacture.

17.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material.

17.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

17.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

17.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by the Successful Bidder. Successful Bidder's scope and responsibility shall also include preparation of all necessary documents in the specific formats stipulated by the statutory bodies, coordination and follow up for above approvals.

17.02.00 **Performance Tests at Site**

17.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Successful Bidder on site under normal operating conditions. The Successful Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

17.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

17.02.03 The Successful Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

17.03.00 For details of specific tests required on individual equipment refers to respective section of this specification.

18.00.00 TRAINING OF OWNER'S PERSONNEL

The Successful Bidder shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

18.01.00 Training at Successful Bidder's Premises

The Successful Bidder shall conduct training of Sixty Five (65) engineers of the Purchaser on engineering, operation and maintenance of the Plant at the Successful Bidder's or Associates or Sub Vendor's premises where adequate training facilities are available during the design and manufacturing stage of the successful Bidder.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up:

Discipline	No. of Engineers	No. of Man-month
Operation	25 heads	25
Maintenance Boiler, Turbine,	25 heads	25
Electrical Maintenance	5 heads	5
Control & Instrumentation	10 heads	5
	65 heads	60

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Successful Bidder in any Plant where the equipment manufactured by the Successful Bidder or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Successful Bidder. All expenses inherently related to the training shall be borne by the Successful Bidder and shall include but not limited to travel expenses in case of off-shore training (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Successful Bidder shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Successful Bidder and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to :

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

2. Plant operation and systems training for operators including simulator training as applicable.

3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Successful Bidder shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

18.02.00 **Operation and Maintenance Training at Site**

The Successful Bidder shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Successful Bidder's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final hand over of the Unit..

The following instructors shall be at the Site continuously during the training :

a) One (1) for Steam Generator and Auxiliaries

b) One (1) for Turbine Generator and Auxiliaries

c) One (1) for Electrical Works

d) One (1) for Instrumentation and Control (Boiler and Auxiliaries)

e) One (1) for Instrumentation and Control (Turbine and Auxiliaries)

18.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Successful Bidder in the operation and maintenance of his supply and work under the direction of the Successful Bidder for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The successful Bidder shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers (ASME).

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission Publications.

t) Performance Test Code (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS).

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Ministry of Environment & Forests, Govt. of India.

hh) Central Board of Irrigation and Power (CBIP) Publications.

ii) National Building Code (NBC).

jj) Indian Road Congress (IRC).

kk) Latest guidelines of Railway Authority.

CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

The guidelines shall be applied in general, unless otherwise stated in other technical Volumes. In addition to these guidelines, Bidder shall refer the attached Plot Plan, drawing no. **12A05-DWG-M-003A,** for tentative arrangement of the various facilities under this package.

	ITEM	SPECIFICATION REQUIREMENT
A.	**Site conditions to be considered**	
1.	Prevalent wind direction during summer (for deciding Cooling Tower orientation)	Refer wind-rose in plot plan.
2.	Prevalent wind direction(s) during dry seasons (for deciding the location of coal stock pile and ash dump/ unloading areas, minimising the pollution effect due to dust)	Refer wind-rose in plot plan .
3.	**Location of:**	
a)	Water intake point.	Towards South.
b)	Water discharge point.	-.
c)	Plant drainage outfall point(s).	Towards East.
d)	Railway entries & exits.	Towards South.
e)	Road entries & exits.	Towards North & North-East.
f)	Electrical power transmission grid system.	Towards East.
g)	selected ash dump area.	Towards North.
h)	Nearest residential area.	Towards South.

ITEM		SPECIFICATION REQUIREMENT
B.	**Layout Requirements**	
1.	**Maximum permissible slope in**	
a)	Rail track	1 in 400
b)	Road	1 in 30
c)	Sides of unpaved embankment	1 in 2
2.	**Required road width**	
a)	Main roads	8.0 Metres with 2.5m wide shoulders on either side.
b)	Auxiliary interconnections	4.0 Metres with 1.0m wide shoulders on either side.
c)	Road to the power house unloading bay :	
	• Only for entry to the unloading bay • To pass through the unloading bay	Yes. No.
3.	**Required minimum horizontal distance between the nearest points of**	
a)	Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b)	Electrical transformer and any other building/facility	As per the Tariff Advisory Committee Rules.
c)	Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee Rules.
d)	Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code.
4.	**Required minimum vertical clearance**	
a)	Under pipes/cable racks at road crossings	8.0 Metres.
b)	Soil coverage over underground pipes	1.0 Metre (minimum).
c)	Pipe/Cable trench	No Trench. Pipe/Cable Racks shall be used exclusively.

	ITEM	SPECIFICATION REQUIREMENT
5.	Railway Wagon clearance	As per the rules of the Indian Railways.
6.	Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres.
7.	**Required level, above the local developed grade level, of**	
a)	top of all roads	150 mm.
b)	all outdoor paved areas	150 mm.
c)	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes.

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

	ITEM	SPECIFICATION REQUIREMENT
A.	**Minimum clear space required at all working and walking areas for operating & maintenance personnel**	
1.	**Horizontal, in all directions**	
a)	Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C.	1200 mm.
b)	Adjacent to any other plant facilities (including walls/structures)	1000 mm.
2.	**Vertical (head-room clearance)**	
a)	Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.2 Meters.
b)	Under any other plant facilities (including structures, pipes etc.)	2.2 Meters.
3.	**For all areas** where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment.
4.	**Minimum clear hand space required for**	
a)	The application of thermal insulation	100 mm
b)	Welding work	150 mm
c)	Bolt tightening	150 mm

B. **Floors, platforms, staircase, ladders, walls, doors & windows**

1.	**Statutory Requirement**	As per the regulations of OSHA, Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2.	**Operation & Maintenance Requirement**	
a)	Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b)	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3.	**Plinth level** of all buildings, above the Finished Ground Level (FGL)	300 mm. However, 500 mm for power house building.
4.	**Minimum access** opening required (with rolling shutter)	3.5 m wide x 4 m high or, more wherever entry of loaded truck is envisaged, depending upon the equipment size to be handled.

C. **Other Maintenance Requirement**

C. Other Maintenance Requirement

1.	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes

2.	Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, air compressors, blowers, heat exchangers, fuel oil pumps, filters etc.	Shall be possible without disconnecting or dismant-ling any piping/ducting.
3.	Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4.	Crane Approach	
	Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D.	Central Control Room	
	All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes
	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
	However, as a guide line, following features are given :	
a)	False ceiling and false flooring shall be provided.	
b)	Uniform height, colouring schemes for cabinets etc. shall be available.	
c)	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
d)	No opening shall be provided from Boiler side.	
e)	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	

f) Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.

g) The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.

h) Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.

i) Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.

D. **Toilet and drinking water facility**

Required in all buildings and on all floors wherever operating personnel are to be deployed.

SECTION-VI

PROJECT MANAGEMENT AND SITE SERVICES

CONTENT

SECTION-VI

PROJECT MANAGEMENT AND SITE SERVICES

1.00.00 PROJECT MANAGEMENT SERVICES

1.01.00 Responsibility

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

a) Planning and Monitoring

b) Owner's Engineering Management

c) Contracts Management

d) Quality Assurance, Inspection & Expediting

e) Construction Management

f) Spares Management

g) Commissioning Management

Detailed responsibilities in the above areas are discussed below :

1.02.00 Organisation

1.02.01 Headquarters

The project management team shall be stationed at the organizational headquarter and headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. . He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters related to this contract.

1.02.02 Central Co-ordination Cell

The central coordination/ cell shall be based in Kolkata and shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or references made by Owner and his Consultants without having the need to refer to his headquarters each time.

1.02.03 **Site Organisation**

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 **Organisation Chart**

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The following milestones shall be followed by the Contractor against each activity as detailed below:

1.	Letter of Award (LOA)	Zero Date
2.	Supply Completion	36 months from LOA
3.	Synchronization	38 months from LOA
4.	Completion of Trial Operation	42 months from LOA
5.	System & Completion of all facilities as per contract and handing over	45 months from LOA After rectifying all jobs as identified in the Punch List to the satisfaction of the Owner.
6.	P. G. Test	To be completed within three (3) months after Completion of all facilities and handling over.
7.	Guarantee/Warranty Period	For a period of 18 months from the date of completion of the facilities or twelve (12) months from the date of operation acceptance (or any part thereof), whichever occurs first and any suitable extension of time for completion of rectified job granted by Employer
8.	Final Acceptance	After the expiry of defect liability period

1.03.01 **Owner's Engineering Schedules**

These schedules shall cover various design submissions indicating different Owner's Engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment/ item covered in the scope of this specification.

1.03.02 **Manufacturing Schedule**

The Contractor shall submit to the Owner's Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Award (LOA). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Owner's Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 **Erection Schedules**

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules along with requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of Contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, Primavera.

1.04.00 **Detailed Responsibilities**

1.04.01 **Planning & Monitoring**

a) **Planning**

The Bidder shall prepare a Master Network Schedule in the form of PERT network consisting of at least 500 activities.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of Owner's Engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid, which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) **Monitoring & Progress Reporting**

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) Detailed package wise status of Owner's Engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 **Owner's Engineering Management**

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of Owner's Engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for Owner's Engineering activities.

Based on (L-2) network, the Bidder shall further develop the Level-3 (L-3) network for Owner's Engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Award and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software.

The Owner's Engineering management team should also co-ordinate all interface Owner's Engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related Owner's Engineering documentation before the same is submitted to the Owner.

1.04.03 **Contracts Management**

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacturing can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks

shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of bought out items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04 **Quality Assurance, Inspection and Expediting**

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacturing is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior to placement of Letter of Award. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner reserves the right to include vendors of his own choice. No further vendor approval will be given after six (6) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site up to erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05 **Construction Management**

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Award, the Contractor shall submit a programme of construction/erection/commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These

programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in-charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

1.04.06 **Spares Management**

Along with the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

a) Mandatory spares

b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised within twelve (12) months thereafter.

1.05.00 **Project Progress Review Meetings**

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution in respect of Sagardighi Thermal Power Plant unit #5 will be held initially at least once in two (2) months at Kolkata/site. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

1.06.00 **Owner's Consultant**

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner/Owner's Consultant and Contractor/Contractor's project management team shall be finalised during contract negotiations.

1.07.00 **Commissioning Management**

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

a) Commissioning Teams.

b) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the following manner and submitted for Owner's approval :

a) Paper of Principle

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

i) Establish design data against which Plant Performance will be compared.

ii) Set-out the testing objectives and proposals.

iii) Define the documentation required.

b) **Testing/Commissioning Schedule**

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

c) **Standard Check Lists**

Standard checklists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 **Test Reports**

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-à-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.

2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/F.O.B. port of shipment by Contractor till receipt of the same at site.

2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Owner's Engineer a report detailing all the receipts during the week.

2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.

2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.

2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

For Coal Handling Plant, satisfactory operation of the system, amongst others, shall consist of operation without spillage or choking anywhere even during monsoon.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

2.07.00 Supply and application of the final paints lubricating oils and all consumable till completion of facilities and hand over..

2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :

2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.

2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.

Supply of commissioning spares.

2.08.03 Supply of all chemicals and consumables, e.g. Regeneration chemicals, alum, lime, polyelectrolyte, resin, welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection commissioning work till completion of facilities and hand over, except those listed under exclusion elsewhere in this specification.

2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.

2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.

2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.

2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives etc. for respective portions of work under the jurisdiction of such statutes or laws.

2.08.08 The Contractor shall provide `Industrial Relations' unit and `Medical' unit to take care of his erection staff and the Owner shall have no obligation in this regard.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

2.10.00 **General Guidelines for Field Activities**

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's Owner's Engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's Owner's Engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication to owner.

2.10.03 The Owner's Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Owner's Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Owner's Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Owner's Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall

take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Owner's Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

2.10.05 The Owner's Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

2.10.06 The works under execution shall be open to inspection & supervision by the Owner's Owner's Engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.

2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's Owner's Engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.

2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. The contractor shall engage maximum number of local unskilled and semi skilled labours for construction works. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.

2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general Owner's Engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.

2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Owner's Engineer.

2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Owner's Engineer, will have to be done by the Contractor.

2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Owner's Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :

a) Product groups under which these items are re-leased are not covered in the scope of this tender.

b) Items are supplied by an agency other than the Contractor.

2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub oil system, carryout the hydraulic test of oil coolers, etc.

2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Owner's Engineer, with all the necessary tools & tackles, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Owner's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.

2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.

2.10.16 Equipment and material, which are wrongly installed, shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.

2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.

2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.

2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No

temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.

2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the safe operation of valves will be arranged by the Contractor.

2.10.21 For civil, structural and architectural works, volume IIG/1 & IIG/2 may be referred. For Instrumentation and Electrical works Vol. IIE and Vol. IIF1 & F2 may be referred.

2.11.00 Safety

2.11.01 Safety and overall cleanliness of work site shall be given top priority. The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.

2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.

2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.

2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.

2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Contractor. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.

2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.

2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.

2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.

2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.

2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.

2.11.11 Adequate number of temporary toilets/urinals (men & women separate) shall be provided at work places with soak pits. Adequate drinking water facilities and rest rooms shall be provided for workers to take food and rest.

2.11.12 All safety precautions shall be taken for welding and cutting operations as per IS-818.

2.11.13 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

2.12.00 Taking Delivery & Storage

2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.

2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.

2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.

2.13.00 Site Welding & Heat Treatment

2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.

2.13.02 All welders shall be tested and approved by Owner’s Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Owner’s Engineer shall be stamped by the welder on each joint done by them. The

Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.

2.13.03 The Owner's Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Owner's Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.

2.13.04 All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.

2.13.05 All welded joints shall be subject to acceptance by Owner's Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.

2.13.06 Preheating/post-heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Owner's Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Owner's Engineer prior to the commencement of each cycle and handed over to Owner's Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.

2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Owner's Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.

2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.

2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.

2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.

Fillet weld shall be made by shielded metal arc process as per applicable codes.

However, the Owner's Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.

In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.

2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.

2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.

2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

2.13.14 Each layer of welding shall have an even and smooth appearance.

2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.

2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surfaced to be welded are wet from any cause.

2.13.17 Following will be stages of inspection during welding:

a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Owner's Engineer.

b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.

2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.

2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume: II-E, II-F1 & F2 and II-G/1 G/2 & G/3 of this specification.

3.00.00 **PROTECTION AND CARE**

3.01.00 All construction and erection activities for this project are to be carried out in the plant premises.

3.02.00 Generator Stator Lifting may be considered by either of the two options as mentioned below:

a) With the help of two (2) nos. turbine room cranes.

b) With the help of separate lifting arrangement to be provided by the Bidder from outside the TG building A-row column before the construction of A-row building wall.

SECTION-VII

ENGINEERING SERVICES

CONTENTS

SECTION-VII

OWNER'S ENGINEERING SERVICES

1.00.00 GENERAL

1.01.00 As part of the overall project management activity, the Successful Bidder shall be responsible for proper Owner's Engineering and co-ordination of activities during various phases of execution of the contract. The Successful Bidder shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Owner's Engineer or the Review Consultant shall interact on matters related to Owner's Engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Successful Bidder and shall be responsible for all Owner's Engineering co-ordination. The Owner /Consultant /Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Successful Bidder or on matters involving the Successful Bidder, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the Successful Bidders. However such interaction will not, under any circumstance, dilute the responsibility of the Successful Bidder to provide a fully Owner's Engineered and coordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of Owner's Engineering information will be mutually agreed and finalized between the Owner and the Successful Bidder.

2.00.00 DESIGN COORDINATION MEETING

The Successful Bidder and his sub-vendors will be called upon to attend design co-ordination meetings with the Owner's Engineer, other Successful Bidders and the Consultants of the Owner during the period of execution of contract. The Successful Bidder including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata/ or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING OWNER'S ENGINEERS

The Successful Bidder shall agree to cooperate with the Owner's other Contractors and Consulting Owner's Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Owner's Engineer shall be provided with copies of all correspondences addressed by the Successful Bidder to other Sub- Vendors and Consulting Owner's Engineers in respect of such exchange of technical information.

4.00.00 GUIDELINES FOR OWNER'S ENGINEERING SERVICES

4.01.00 Prior to commencement of the Owner's Engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed Owner's Engineering work.

4.02.00 Owner's Engineering work shall be performed on modern and proven concepts and internationally accepted good Owner's Engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the Owner's Engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Successful Bidder.

4.03.00 At any stage during the performance of assignment, the Successful Bidder may be required to make certain changes/modification/improvements in design/ drawing/other documents, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution/operation of similar units. Such changes/ modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and Scope of the Successful Bidder.

4.04.00 During the course of review of detailed Owner's Engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.

4.05.00 During the course of review of detailed Owner's Engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants Owner's Engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.

4.06.00 It is not the intent to give details of every single task covered in the total Owner's Engineering work to be carried out by Successful Bidder, however, all Owner's Engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Successful Bidder. Broadly, the following are the minimum requirements in respect of scope of major items of work:

4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Successful Bidder from time to time, as detailed

designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-Vendors.

4.06.03 Review of sub-Vendor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.

4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments, etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.

4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.

4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.

4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support Owner’s Engineering.

4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.

4.06.09 Certification and submission of final as-built drawings for all areas.

4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.

4.06.11 All erection and assembly drawings which may be required at site.

5.00.00 **INSTRUCTION MANUALS**

5.01.00 The Bidder shall provide all necessary instruction manuals for the Owner’s review, comment, and final acceptance as required in the contract. The instruction manual shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.

5.02.00 **Erection Manuals**

5.05.01 The erection manuals shall be submitted at least three (3) months prior to commencement of erection activities of particular equipment/system. The manuals shall contain the following as a minimum:

a) Erection strategy.

b) Sequence of erection.

c) List of tools, tackles, heavy equipments like cranes, dozers etc required for erection.

d) Bill of Materials.

e) Safety precautions to be followed during erection.

f) Erection instructions.

g) Critical checks and permissible deviation/tolerances.

h) Check-list for pre-commissioning activities

i) Check-list for commissioning of the system.

j) Procedure for initial checking, testing and acceptance norms.

5.03.00 **Operation & Maintenance Manuals**

5.03.01 The operating and maintenance instructions together with drawings of the equipment, as completed, shall be in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble, and adjust all parts of the equipment. They shall outline a step-by-step procedure for all operations likely to be carries out during the life of the plant/ equipment. Each manual shall include a complete set of drawings together with performance/ rating curves of the equipment and test certificates wherever applicable.

5.03.02 If after commissioning and initial operation of the plant, the manuals require any modification/ additions in the view of the Owner or Bidder, the same shall be incorporated and the updated final manuals shall be submitted to the Owner.

5.03.03 The manuals shall include the following:

a) List of spare parts along with their drawing and catalogue and Pro-forma for ordering spares.

b) Location and identification guide for bearings of various equipments and lubrication schedule including charts showing lubrication checking, testing and replacement procedure.

c) Wherever applicable, fault location charts shall be included to facilitate fault detection.

d) Detailed specification for all consumables (including lubricating oils, greases, chemicals etc.) required for each equipment.

6.00.00 PLANT HANDBOOK

The Bidder shall provide the plant handbook to the Owner as per provision of the contract.

The Plant Handbook shall contain the following as a minimum:

a) Design and performance data

b) Process & instrumentation diagrams

c) Single line diagrams

d) Sequence & Protection interlock schemes

e) Alarm and trip values

f) Performance curves

g) General layout plan and layout of Balance of Plant building and auxiliary buildings

h) Important Do's and Don'ts.

7.00.00 TENDER STAGE DOCUMENT SUBMISSION

7.01.00 The Bidder shall submit along with his bid all documents/drawings as specified in RFP and respective sections of the Technical Specifications in Vol-II and Vol-III. The documents shall include but not be limited to the following:

a) All Bid proposal sheets duly filled up.

b) Detailed experience list and financial resources of the Prime Bidder his collaborators/associates in this bid as well as the sub-vendors proposed.

c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.

d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.

f) High level project schedule network indicating target dates for intermediate milestones and final commissioning of plant systems; This network shall be supplemented by a detailed write-up on proposed sequence and method of execution for project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.

8.00.00 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE

8.01.00 Owner's Engineering schedule shall be submitted by the Bidder as indicated in the RFP. Owner's Engineering schedule shall be developed in format as desired by the Owner/consultant.

The documents shall be divided into two categories: a) for approval and b) for information/further Owner's Engineering and co-ordination by the Consultant.

In preparing this schedule, the Bidder shall allow one (1) week from date of receipt for review and comments by the Consultant for each submission of a document.

This document submission schedule shall require acceptance by the Owner/Consultant.

Bidder shall also develop and submit a Master drawing list to the Owner/consultant.

8.02.00 All contract documents shall be marked with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

8.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Consultant.

8.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant:

a) System scheme and Process & instrumentation Diagrams (P & IDs).

b) Design basis documents / memoranda / calculations justifying sizing and selection of equipment, vessels, tanks, piping, valves & specialities as well as the process parameters.

c) Equipment data sheets and general arrangement drawings.

d) Materials of construction.

e) General Arrangement and Layout drawings.

f) Typical control schemes, circuit diagrams, drive/ feeder-wise control scheme showing all external interfaces.

g) Control System Configuration

g) Shop Inspection and Testing Procedures, Test Set-up & Instrumentation, Acceptance Criteria and Codes / Standards followed, correction curves / charts, etc.

h) Performance Test Procedures, Instrumentation, Acceptance Criteria and Codes / Standards followed, correction curves / charts, etc.

i) Schedules covering equipment delivery schedules, erection, testing and commissioning schedules at L1 and L2 levels.

8.05.00 Unless specified otherwise, the following categories of documents / drawings would be treated for information/further Owner's Engineering by the Owner/Consultant. The Bidder shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/ Consultant.

a) Equipment foundation drawings.

b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.

c) Predicted performance curves of equipment.

d) Various bills of quantity, schedules etc.

e) Piping fabrication drawings, isometrics etc.

f) Panel wiring diagrams.

g) Instruction/Operation manuals.

h) Service manuals and trouble shooting guide for C & I system including field instruments.

i) Operation logic diagrams.

j) Cable schedule and interconnection chart.

In essence, the Bidder is solely responsible for corrections and adequacy of design & Owner's Engineering for documents under this category.

8.06.00 Upon review, the Consultant shall put his remarks and one of the following action stamps on the drawing / document:

a) Approved.

b) Approved except as noted, forward final drawing

c) Approved except as noted, resubmission required.

d) Disapproved.

e) For information/reference only.

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Consultant. For action stamp in category (b), further review by Owner/Consultant would not be necessary provided the Bidder agrees & incorporates the minor comments made on the document.

Except for action stamp under category (c) & (d), the Bidder can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/ Consultant.

The Consultant may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Bidder shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds.

The Bidder's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Consultant.

8.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

8.08.00 For review by the Consultant, the Bidder shall furnish three (3) prints of each drawing (only for first submission). There upon all transaction of drawings including reviewed comments and stamping shall be done in soft. All transaction of drawings shall be accompanied by a reference letter mentioning the date, revision no. and document status. Only on receiving the Approval Stamping, bidder shall distribute 6 sets of drawings (2 at WBPDCL corporate office and 4 sets at WBPDCL site office).. The Bidder shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

8.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

SECTION-VIII

QUALITY ASSURANCE REQUIREMENTS

CONTENT

SECTION-VIII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 QUALITY ASSURANCE PROGRAMME

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Successful Bidder's works or at his Sub-Vendor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Successful Bidder shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Successful Bidder and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Successful Bidder shall generally cover the following :

a) His organisation structure for the management and implementation of the proposed quality assurance programme.

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

d) The procedure for purchase of materials, parts, components and selection of Sub-Vendor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

f) Control of non-conforming items and system for corrective actions.

g) Inspection and test procedure both for manufacture and all site related works.

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorising release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

n) 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 as per format enclosed at Annexure-A to this section.

2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured and tested at all the stages, as well as Services provided for erection, commissioning and testing shall be as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Bidder 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 Bidder's responsibility to draw up and implement such programme and reviewed by by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Owner's representative for review. Schedule of finalisation of such quality plans will be finalised before award.

2.02.00 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 Bidder'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.

2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Bidder's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.

2.04.00 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 Consultant's approval without which manufacture shall not proceed. In these approved quality plans, Owner/Authorised representative/Consultant shall identify Customer Hold Points (CHP), test/checks which shall be carried out in presence of the Owner/Consultant/Owners Owner's Engineer or his Authorised Representative and beyond which the work will not proceed without consent of Owner/Authorised representative/Consultant in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised Representative/Consultant for acceptance and dispositioning.

2.05.00 The Bidder shall provide adequate notice to the Owner for inspection before the material is dispatched as per the provisions of the Contract. No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of

all previous tests/inspections by Owner's Owner's Engineer/Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

2.08.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.09.00 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 Owner.

All brazers, welders etc. employed on any part of the contract at Bidder's/Sub-Vendor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

Under no circumstances any repair or welding of castings be carried out without the consent of the Owner. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Owner.

All pressure parts shall be subjected to hydraulic testing as per the requirements of IBR. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than thirty (30) minutes.

2.10.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for acceptance.

All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid

penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by Bidder. Bidder's scope and responsibility shall also include preparation and submission of all necessary documents in the specific formats and manner stipulated by the statutory bodies, coordination and follow up for above approvals.

2.11.00 All the Sub-Vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Bidder and finalised with the Owner shall be subject to Owner's review. Quality Plans of the successful Sub-Vendors shall be discussed, finalised and accepted by the Owner/Authorised representative and form part of the Purchase Order between the Bidder and the Sub-Vendor.

2.12.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Bidder and finalised with the Owner shall be furnished to the Owner for comments and subsequent acceptance before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their Sub-Vendor's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/acceptance of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Bidder in earning satisfactory performance of equipment as per specification.

2.13.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.14.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the acceptance of the Owner.

2.15.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 QUALITY ASSURANCE DOCUMENTS

3.01.00 The Bidder shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

a) Material mill test reports on components as specified by the specification.

b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

c) Non-destructive examination results /reports including radiography interpretation reports.

d) Factory tests results for testing required as per applicable codes and standards referred in the specification.

e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

i) When some important repair work is involved to make the job acceptable.

ii) The repair work remains part of the accepted product quality.

i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The Successful Bidder shall give the Owner’s Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Successful Bidder's account except for the expenses of the Inspector. The Owner’s Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Successful Bidder 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 six (6) copies.

4.02.00 The Owner’s Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Successful Bidder, 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 Successful Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Owner’s Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.03.00 When the factory tests have been completed at the Bidder's or sub-Vendor's works, the Owner/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Owner/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Owner/Inspector. Failure of the Owner/Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.

4.04.00 The Bidder 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 each calendar month.

FORMAT OF QUALITY ASSURANCE PROGRAMME

Name of Company / Successful Bidder	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____ Contractorr : _____			QP No. : _____ Date _____ Rev.No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remarks

SECTION-XI

PROTECTIVE COATING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a)	SSPC SP 10 / NACE 2 / Sa2½	:	Near White Blast Cleaning
b)	SSPC PA 2	:	Measurement of dry film coating thickness with magnetic gauges.
c)	ASTM D 45	:	Method for pull off strength using portable Adhesion Tester.
d)	NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings.
e)	NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
f)	NACE RP 0169 – 2002	:	Control of External Corrosion of Underground or Submerged Metallic Piping Systems.
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
h)	IS 3589:2001 Annexure-B	:	Steel Pipes for Water and Sewage Specification.
i)	AWWA C222-2000	:	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.

j)	IS 13213 : 2000	:	Polyurethane Full Gloss Enamel (Two pack)
k)	ISC HD 20 (11902)	:	Polyurethane coating for Interior and Exterior of steel pipe and fittings.
l)	ISC HD 20 (11055)	:	Solvent less Liquid epoxy system by application of Interior and Exterior surface of steel pipeline.

3.00.00 **GENERAL REQUIREMENTS**

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti-corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be

applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 **Surface Preparation**

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting up to SSPC SP10/NACE2/Sa2½ level to get "near white metal" surface before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.03.00 **Painting**

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to SSPC SP10/NACE 2/Sa2½ Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.02 Specification for application of paints for external surfaces protection of steel pipes and fittings which are buried underground / laid inside a Hume Pipe & or submerged Under Water and laid under Pipe Trenches (in road/rail/pipe or trench crossings) shall be as follows :

a) Surface preparation by means of sand blasting and shall conforms to SSPC SP10/NACE2/ Sa2½.

b) External surface of the pipe, fittings, specialties etc. handling raw water/ clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 1500 micron including primer coat.

4.03.03 Specification for application of paints for internal surface protection of large diameter pipes, if any, shall be as follows :

a) Surface preparation by means of sand blasting which shall conforms to SSPC SP10/NACE2/Sa2½ standard.

b) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

c) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

d) The minimum dry film thickness (DFT) of internal lining shall be 500 micron.

4.03.04 Specification for application of paints for protection of internal surfaces of DM Water Storage Tank(s) shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.05 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.06 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.07 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.08 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 /

NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 **Application of Epoxy Coating**

a) Coating shall be applied when

i) When the pipe surface temperature shall be at least 3°C above dew point temperature.

ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that
50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 **Application of PU Coating**

a) PU coating shall be applied when the pipe surface temperature at least 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 **TEST REQUIREMENTS**

6.01.00 **Measurement of dry film thickness**

Measurement of dry film thickness of coating: Coating thickness shall be in the range of ±20% and as per SSPC PA 2.

6.01.01 **Apparatus / Instrument**

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 **Procedures**

a) **Number of measurements**

For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.

Area measurement must be within specified range.

6.02.00 **Electrical Inspection (Holiday) Test**

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 √T ± 10 percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.03.00 **Adhesion Pull off Test**

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.03.02 **Prepare the test surface**

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.03.03 **Prepare Dolly (Test Pull Stub)**

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 **Select an adhesive**

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 **Attach the dolly to the surface**

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 **Adhesion Test Procedure**

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the hand wheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 **Coating Repair**

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 **Surface Preparation**

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 **Coating Application**

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection:

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 **Welded Field Joints**

6.05.01 **Preparation**

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 **Electrical Inspection**

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 **INFORMATION/DATA REQUIRED**

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

	Note: "Action 1*" will not be used for entire 1x660 MW Sagardighi Project. (Referred MOM dtd 28.01.2020)
5.3.10	After obtaining final approval either 'ACTION-1' or 'ACTION-5' in soft form, Vendor shall submit 6 (six) sets of hard Prints of such drawings and documents in the following manner: **WBPDCL corporate office: 2 Prints** **WBPDCL site office : 4 Prints** All such submissions shall be with a transmittal marked to the corresponding WBPDCL Unit coordinator. All the final and WBPDCL/DCPL approved Drawings/Documents shall also be submitted in soft form to WBPDCL Corporate Office by Vendor, post the engineering completion.
5.3.11	Revisions made shall be marked with an identifying Mark along with the Revision No. embossed on that Mark to clearly distinguish the changes made in the subsequent revisions and the reasons for those revisions shall be indicated in the drawing.
5.3.12	In case, BHEL does not agree with any specific comments, BHEL shall furnish the explanation for the same to DCPL /WBPDCL for consideration, acceptance and approval. However, acceptance of any deviation from the specification requirement shall be subjected to the approval of DCPL /WBPDCL as per the contractual provisions and may attract commercial implication as well.
5.3.13	**O&M MANUALS:** Vendor shall submit the O&M Manuals for equipment's to WBPDCL at least Three (03) months before the start of unit commissioning. The manuals shall be submitted as follows: (1 soft copy + 12 Set of Hard Copies) to be submitted to WBPDCL Sagardighi site (1 soft copy + 3 Set of Hard Copies) to be submitted at WBPDCL Corporate Office
5.3.14	**PG TEST PROCEDURE:** PG Test procedure shall be prepared and submitted at least three (03) months before the schedule of PG test to WBPDCL/DCPL for their approval. The approved procedure shall be submitted one copy in the form of CD and 6 (Six) Set in the form of hard copy. (1 soft copy + 4 Set of Hard Copies) to be submitted to WBPDCL Sagardighi site (1 soft copy + 2 Set of Hard Copies) to be submitted at WBPDCL Corporate Office
5.3.15	**SUBMISSION AND CO-ORDINATION OF ERECTION DRAWING / DOCUMENTS:** Vendor shall submit erection drawings/documents covering various equipment, plant and systems to WBPDCL at least three (03) months prior to start for erection activities of particular equipment/system. The drawings/documents shall be submitted as follows (1 soft copy + 4 Set of Hard Copies) to be submitted to WBPDCL Sagardighi site (1 soft copy + 2 Set of Hard Copies) to be submitted at WBPDCL Corporate Office If any discrepancy found on those documents by WBPDCL, further erection or commissioning shall be continued on mutual acceptance and documents shall be revised accordingly.

SECTION-I

SUB-SECTION-D

ANNEXURE-I
LIST OF MAKES OF SUB-VENDOR ITEMS
MISCELLANEOUS TANKS

SUB-VENDORS - MISCELLANEOUS TANKS				
S.NO	**ITEM**	**SUB-VENDORS**	**PLACE**	**TECHNICAL LIMIT**
1	**CS PIPES ERW**	TISCO	JAMSHEDPUR	UP TO 350 NB
		SAIL	ROURKELA	
		SURYA ROSHNI	BAHADURGARH	UP TO 400 NB
		JINDAL	GHAZIABAD	UP TO 350 NB
		RATNAMANI	KUTCH	UP TO 400 NB
		MAHARASHTRA SEAMLESS	RAIGARH	UP TO 500 NB
		WELSPUN	ANJAR	UP TO 400 NB (IS 3589)
2	**CS PIPES SEAMLESS**	MAHARASHTRA SEAMLESS	RAIGARH	UP TO 350 NB
		ISMT	AHMEDNAGAR	UP TO 150 NB
		JINDAL SAW	NASHIK	
		REMI METAL GUJRAT LTD	BHARUCH	UP TO 150 NB HOT FINISH & UPTO 100NB COLD FINISH
		ISMT	BARAMATI	UP TO 200 NB
3	**SS PIPES**	REMI	TARAPUR	
		RATNAMANI	KUTCH	
		APEX TUBES	BEHROR (ALWAR)	
		PRAKASH STEELAGE LTD	MUMBAI	SS SEAMLESS PIPE UPTO 50MM
		SUMITAMO	JAPAN	
4	**STRUCTURAL STEEL / MS-PLATE**	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		M/S UTTAM VALUE STEEL (LLOYDS)		
		ISPAT		
		JSW		
		INDIAN IRON & STEEL CO. LTD		
5	**GATE, GLOBE AND CHECK (STAINLESS STEEL VALVES)**	A.V. VALVES LTD	AGRA	
		MICON VALVES(INDIA) PVT LTD	MUMBAI	**GATE VALVES**: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 600 NB- Class up to 600 with MOC as CCS/CSS. **NR VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 700 NB- Class up to 600 with MOC as CCS/CSS. **GLOBE VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 80 NB- Class 150 with MOC as CCS.
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	

		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO		
		OSWAL INDUSTRIES		
6	**GATE, GLOBE AND CHECK (CS STEEL VALVES)**	A.V. VALVES LTD	AGRA	
		MICON VALVES(INDIA) PVT LTD	MUMBAI	**GATE VALVES**: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 600 NB- Class up to 600 with MOC as CCS/CSS. **NR VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 700 NB- Class up to 600 with MOC as CCS/CSS. **GLOBE VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 80 NB- Class 150 with MOC as CCS.
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2

		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO -L&T	CHENNAI / COIMBATORE	
		OSWAL INDUSTRIES		
		HITECH	AHMEDABAD	
		KSB WATER PUMPS / VALVES	COIMBATORE	
		KBL	KONDHAPURI	
		HAWA ENGINEERS	AHMEDABAD	
		BHEL	GOINDWAL	
		FOURESS ENGG	MUMBAI	UPTO 600 NB, CL-300 & 300NB CL-600
		FOURESS ENGG	AURANGABAD	
7	**LEVEL INDIATOR FLOAT AND BOARD TYPE**	SBEM	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
		CHEMTROL		
		DK INSTRUMENT	KOLKATA	
		V AUTOMAT	DELHI	
8	**PAINT**	ASIAN PAINT		
		BERGER		
		KANSAI NEROLAC		
		JOTUN		
		SHALIMAR		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		AKZONOBEL COATINGS		
9	**FITTINGS (MS/SS)**	PIPE FIT ENGINEERS	VADODARA	
		GUJRAT INFRA PIPES	VADODARA	
		MS FITTINGS	KOLKATA	
		TUBE PRODUCT	VADODARA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
		NL HAZRA	KOLKATA	
		EXCEL METAL		
		INTERTECH		

		FITTECH		
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
10	**SEAL POT / NAOH BREATHER**	SELF MANUFACTURED ITEM		
	INSPECTION CATEGORIZATION			
1	Cat-I: WBPDCL/ DCPL will directly participate in inspection and MDCC shall be issued to BHEL.			
2	Cat-II: Inspection will be carried out by BHEL third party inspection agency / BHEL and BHEL MDCC shall be issued to the vendor for physical dispatch.			
3	Cat-III: For COC items, BHEL will be fully responsible for meeting the contractual requirements including drawings / Documents. BHEL shall duly certify and approve the COC and BHEL MDCC shall be issued to the vendor for physical dispatch.			

The make of Sub-vendor items shall be generally as indicated above which is subject to customer / BHEL approval during detail engineering.

Make of any unlisted items shall be subject to customer / BHEL approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for Customer / BHEL's review and approval. Bidder shall furnish following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.

b) Documentation in the form of certificate that the equipment/system has been operating satisfactorily for two years as on the scheduled date of bid opening.

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily being submitted within one month of placement of LOI to ensure timely placement of order for BOIs

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

ANNEXURE-II

REFRENCE QUALITY PLANS

MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE: XX.XX.XX
	CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(PI)	DATE: 11.02.2020
	PROJECT:		PO NO.: LATER	DATE: XX.XX.XX
	ITEM: PIPE FITTINGS ,FLANGES & ACCESSORIES	SYSTEM: MISC.TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
					M C/ N			*D	M	C	N	
1	Pipes Fittings, Flanges & Accessories	Check for Type, Model No., Tag No.,	MI	Visual	100%	As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	
2		Dimensions	MI	Dimensional	100%	As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	
3		Physical and chemical Properties	MI	Review of TC	For Lot	As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Mfgr. TC	P	V	V	
4		Hydro test	MA	Hydro Test	100%	As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	

NOTES:

1. BHEL reserves the right for conducting repeat test, if required.
2. Photographs of packing of material before final dispatch is to submitted.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	11.2.2020	S. K. YADAV	Checked by:	11.02.2020	ASHISH PANIGRAHI
Reviewed by:	11.02.2020	SAYAN ROY	Reviewed by:	11/2/2020	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE:XX.XX.XX
	CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(LI)	DATE:11.02.2020
	PROJECT:		PO NO.:LATER	DATE: XX.XX.XX
	ITEM: LEVEL INDICATOR	SYSTEM: MISC. TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
					M C/ N			*D	M	C	N	
1	Level Indicator	Check for Type, Model No., Tag No.	MA	Visual	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
2		Float Leakage Test	CR	Mechanical	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
3		Review of TC for Material	CR	Visual	For Lot	MTC	MTC	Mfgr. TC	P	V	V	

NOTES:

1. BHEL reserves the right for conducting repeat test, if required.
2. Photographs of packing of material before final dispatch is to submitted.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	11.2.2020	S. K. YADAV	Checked by:	11.2.2020	ASHISH PANIGRAHI
Reviewed by:	11.02.2020	BAYAN ROY	Reviewed by:	11/02/2020	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE: XX.XX.XX
	CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(PL)	DATE: 11.02.2020
	PROJECT:		PO NO.: LATER	DATE: XX.XX.XX
	ITEM: MS PLATES	SYSTEM: MISC.TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*				
					M	C/ N				D	M	C	N	
1.0 RAW MATERIAL														
1	STEEL PLATES	Chemical composition and Mechanical test	MA	Review of corelated MTC	one/heat		IS:2062	IS:2062	Mfgr. TC	√	P	V	V	Refer Note below
2		Visual and dimensional check	MA	Visual and measurement	100%		Mfg.TC	Mfg.TC IS1852	Mfgr. TC	√	P	** W	** W	
3		Identification/ marking	MA	Corelation establish	100%		As per manufacturing practice	As per manufacturing practice IS 2062	Mfgr. TC	√	P	V	** W	

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

** **NOTE:** i) In case material is dispatched directly from Approved sub-vendor plant/stockyard or procured from dealer against co related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of approved sub vendor.

** ii) In case material is procured from dealer and co related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from them at NABL certified/approved laboratory for chemical & physical properties, however dimensional check shall be witnessed by BHEL.

iii) BHEL reserves the right for conducting repeat test, if required.

iv) Photographs of packing of material before final dispatch is to submitted.

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	11.2.2020	S. K. YADAV	Checked by:	11.2.2020	ASHISH PANIGRAHI			Reviewed by:			
Reviewed by:	11.02.2020	SAYAN ROY	Reviewed by:	11/2/2020	R K JAISWAL			Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN						SPEC. NO : PE-TS-435-100-M001					DATE: 17.01.2020
भी एच ई एल BHEL		CUSTOMER :						QP NO.: PE-QP-435-100-M004(C)					DATE: 17.01.2020
		PROJECT:						PO NO.: LATER					DATE: XXX
		ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL				SYSTEM: LP PIPING (WATER SYSTEM)		SECTION:					SHEET 1 OF 4

SL. NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
1.0 MATERIAL:														
1.1	BODY, BONNET, YOKE,WEDGE/ DISC, SEAT, SPINDLE BODY SEAT, BACK SEAT, THRUST PLATE	1. PHYSICAL & CHEMICAL PROPERTIES	MA	PHYS, CHEM. TESTS	ONE/ HEAT	-	APPD. DRG.	APPD. DRG.	MTC	√	P/ W	V	V	CORRELATION OF BODY & BONNET REQD. WITH MTC HEAT NO.
		2. HEAT TREATMENT	MA	REVIEW OF H.T. RECORDS	100%	-	-DO-	-DO-	H.T. INTERNAL INSPN RECORDS	√	P/ W	V	V	SOLUTION ANNEALING FOR SS VALVES
		3. SURFACE DEFECTS	MA	VISUAL	100%	-	MSS-SP-55	MSS-SP-55	INSPN REPORT	√	P/ W	V	V	
1.2	BODY, BONNET & DISC/ WEDGE	a) **CASTINGS** 1. SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34	ASME B16.34	INSPN REPORT	√	P/ W	V	V	RT ON CHANGE OF SECTION FOR ALL VALVES. (RT FILM REVIEW BY BHEL)
		2. SUB-SURFACE DEFECTS	CR	RT/UT	100%		ASME B16.34	ASME B16.34	INSPN REPORT					
		b) **FORGINGS** 1. SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34	ASME B16.34	INSPN REPORT	√	P	V	V	
		2. SUB-SURFACE DEFECTS	CR	UT	100%		-DO-	-DO-	-DO-					
2.0	SS/ STELLITE DEPOSIT ON DISC & BODY SEAT, BACK SEAT	1. SURFACE DEFECTS	CR	PT	100%	-	ASTM E165 & APP.DRG.	ASME B16.34	INSPN REPORT	√	P/ W	V	V	
		2. HARDNESS	MA	TESTING	100%		APP.DRG.	APP.DRG./ASME B16.34	MTC	√	P/ W	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	17.01.20	GK Morye	Checked by:	20.1.2020	KK Yadav
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN			SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
	CUSTOMER :			QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
	PROJECT:			PO NO.: LATER	DATE: XXX
	ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL		SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 2 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
3.0 GEAR BOX (AS APPLICABLE)														
3.1	GEAR, WORM GEAR & SHAFT	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	1/BATCH	-	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	MTC	√	P/ W	V	V	
		2. HARDNESS	MA	MEASUREMENT	100%		REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	MTC	√	P/ W	V	V	
3.2	GEAR BOX ASSEMBLY	1. APPEARANCE	MA	MEASUREMENT	100%		APPD. DRG/ IS 8935	APPD. DRG./ DATA SHEET/ IS 8935	ACTUATOR CERT.	√	P/ W	V	V	
		2. PERFORMANCE	MA	ELECTRICAL	SAMPLE		MFG. STD.	MFG. STD.	TEST REPORT	√	P/ W	V	V	
		3. DIMENSIONS	MA	PHYSICAL	100%		APPD. DRG/ IS 8935	APPD. DRG/ IS 8935	-DO-	√	P/ W	V	V	
		4. DESIGN VERIFICATION												
		a) TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/SIZE/RATED TORQUE	-	APPROVED PROCEDURE	APPROVED PROCEDURE	MTC	√	P/ W	V	V	REFER NOTE-3
		b) GEAR BOX P.O.D. (LIFE CYCLE TEST)	MA	CYCLE TESTING	ONE/ TYPE/SIZE/RATED TORQUE		APPROVED PROCEDURE	APPROVED PROCEDURE	MTC	√	P/ W	V	V	REFER NOTE-3
4.0 IN-PROCESS INSPECTION														
4.1	MACHINING OF ALL COMPONENTS INCLUDING BW	1. DIMENSIONS, WORKMANSHIP AND FINISH	MA	MEAS.,VISUAL	100%	-	MFG.DRG.	MFG.DRG.	LOG BOOK	-	P	V	V	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	17-01-20	GK Morye	Checked by:	20/1/2020	KK Yadav		
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN	SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
	CUSTOMER :	QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
	PROJECT:	PO NO.: LATER	DATE: XXX
	ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL — SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 3 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9		**			10
					M	C/N				D	M	C	N	
	ENDS	2.SURFACE & SUB-SURFACE DEFECTS	CR	1. PT 2. MPI (ACCESSIBLE AREA OF BODY & BONNET)	100%	-	ASME B16.34	ASME B16.34	LOG BOOK	-	P/W	V	V	
		3.SUB SURFACE DEFECTS (SPINDLE, BODY / DISCS SEAT RING)	CR	UT	100%	-	ASME B16.34	ASME B16.34	LOG BOOK	-	P/W	V	V	1. IF DIA/THK IS EQUAL OR GREATER THAN 40 mm. 2 IF BODY/ DISC SEATS THICKNESS EQUAL OR GREATER THAN 25 MM
4.2	WEDGE/DISC & SEAT RING, SPINDLE AND BACK SEAT	1. LAPPING	CR	BLUE MATCHING	100%	-	UNIFORM METAL TO METAL CONTACT	UNIFORM METAL TO METAL CONTACT	INSPN REPORT	√	P	V	V	
5.0	ASSEMBLY	1. DIMENSIONS	MA	MEAS.	100%	-	APPD.DRG.	APPD.DRG.	-DO-	√	P	V	V	
		2. WEAR TRAVEL	MA	MEAS.	100%	-	BSEN ISO 10434	-DO-	-DO-	√	P	V	V	FOR GATE VALVE ONLY
		3. VALVE LIFT	MA	MEAS.	100%	-	APPD.DRG.	-DO-	-DO-	√	P	V	V	
6.0 TESTING														
6.1	BODY, SEAT, BACK SEAT	1. LEAK TIGHTNESS OF BODY	CR	HYDRAULIC TEST	100%	REFER NOTE-2	APPD. DRG. /ASME B16.34	NO LEAKAGE	INSPN. REPORT	√	P	W	V	
		2. LEAK TIGHTNESS OF BACK SEAT AND SEAT	CR	HYDRAULIC TEST	100%		-DO-	LEAKAGE PERMISSIBLE AS PER API 598	-DO-	√	P	W	V	
		3. LEAK TIGHTNESS OF SEAT	CR	PNEUMATIC TEST	100%		-DO-	-DO-	-DO-	√	P	W	V	
6.2	OPERATIONAL TESTING FOR MANUALLY OPERATED VALVES	SMOOTH & FULL OPENING AND CLOSING	CR	MANUAL	100%	REFER NOTE-2	-DO-	SMOOTH OPERATION OF VALVES & CLEAR BORE	INSPN. REPORT	√	P	W	V	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	17-01-20	GK Morye	Checked by:		KK Yadav		
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:		RK Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN							SPEC. NO : PE-TS-435-100-M001					DATE: 17.01.2020
	CUSTOMER :							QP NO.: PE-QP-435-100-M004(C)					DATE: 17.01.2020
	PROJECT:							PO NO.: LATER					DATE: XXX
	ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL				SYSTEM: LP PIPING (WATER SYSTEM)			SECTION:					SHEET 4 OF 4

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
7.0	COMPLETE VALVES	OVERALL DIMENSION	MA	MEASUREMENT	SAMPLE	-	APPD.DRG	APP.DRG.	INSPN. REPORT	√	P	V	V	
8.0	END CONNECTION DETAILS	DIMENSIONS	MA	MEASUREMENT	100%	REFER NOTE-2	APPD. DRG.	APPD. DRG.	-DO-	√	P	W	V	
9.0	FINAL INSPECTION	CLEANLINESS & COMPLETENESS, NAME WITH VALVE TAG NOS.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P	V	V	
10.0	PACKING	APPD. DRG.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTO GRAPH	-	P	V	V	**REFER NOTE-4**

NOTES:

1. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
2. 10% or min. 2 nos. at random by BHEL/Customer & 100% by supplier for each type, size & rating.
3. Review/ Verification of Test Report/Certificate, in case these tests have been carried out earlier (Within the last 5 years from placement of PO) on the identical Model/Type/Rating of tested Gear Box at an independent laboratory or witnessed by reputed customer like NTPC etc. or third party inspection agency like Lloyds, TUV, DNV etc. if the above Test Reports/Certificates are not available or not found satisfactory by BHEL/Customer, then the required TYPE TEST to be carried out by the Vendor on Gear Box without any commercial implications at his own cost & witnessed by BHEL/Customer.
4. Supplier to provide the followings:
   a. Photographs of valves duly placed inside the wooden box just before the final packing.
   b. Photographs of the wooden box in which valves have been finally packed just before dispatch.
   c. Clearance for dispatch of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

LEGENDS:

***D**: Records, identified with "Tick"(√) shall be essentially included by supplier in QA Documentation.

** **M**: Supplier/ Manufacturer/ Sub-Supplier
P: Perform
MA: Major Characteristic
MTC: Mill Test Certificate
RT= Radiographic Test
C: Main Supplier/BHEL/ Third Party Inspection agency
W: Witness
MI: Minor Characteristic
PT: Penetrant Test
MPI=Magnetic Particle Inspection
N: Customer
V: Verification
CR: Critical Characteristic
UT: Ultrasonic Testing

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	17.01.20	GK Morye	Checked by:		KK Yadav		
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	21.1.2020	RK Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN			SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
BHEL		CUSTOMER :			QP NO.: PE-QP-435-100-M004(A)	DATE: 17.01.2020
		PROJECT:			PO NO.: LATER	DATE: XXX
		ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION	SYSTEM:		SECTION:	SHEET 1 OF 3

SL. NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
1.0 MATERIAL:														
1.1	BODY, BONNET, DISC, SPINDLE,	1. PHYS. & CHEM. PROPERTIES	MA	PHYSICAL & CHEMICAL TEST	ONE/ HEAT	-	APPROVED DRAWING	APPROVED DRAWING	MTC	√	P/ W	V	V	CORRELATION OF BODY& BONNET REQD. WITH MTC HEAT NO.
		2. HEAT TREATMENT	MA	REVIEW OF H.T.	100%	-	-DO-	-DO-	HT(MTC)	√	P/ W	V	V	SOLUTION ANNEALING FOR STAINLESS STEEL
1.2	BODY, BONNET	SURFACE & SUB SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34 AND TECH. SPEC.	ASME B16.34	MTC	√	P/ W	V	V	PT FOR SS VALVES
2.0	SS/ STELLITE DEPOSIT ON DISC & BODY SEAT	SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34 & APPD DRG.	ASME B16.34 & APPD DRG.	MTC	√	P/ W	V	V	
3.0 IN-PROCESS INSPECTION:														
3.1	MACHINING OF ALL COMPONENTS	1. DIMENSIONS, WORKMANSHIP AND FINISH	MA	MEAS.,VISUAL	100%	-	MFG.DRG.	MFG DRG.	LOG BOOK	-	P	V	V	
		2.SURFACE & SUB SURFACE DEFECTS	CR	PT (machined hard surfaces)	100%	-	ASME B16.34	ASME B16.34	-DO-	-	P	V	V	
3.2	DISC & SEAT RING	LAPPING	CR	BLUE MATCHING	100%	-	UNIFORM METAL TO METAL CONTACT		INSPN. REPORT	√	P	V	V	
4.0 TESTING:														
4.1	BODY, SEAT, BACK SEAT	1. LEAK TIGHTNESS OF BODY	CR	HYDRAULIC TEST	100%	REFER NOTE-2	APPD. DRG./ BSEN ISO 15761	NO LEAKAGE	INSPN REPORT	√	P	W	V	
		2. LEAK TIGHTNESS OF BACK SEAT AND SEAT	CR	HYDRAULIC TEST	100%		-DO-	LEAKAGE PERMISSIBLE AS PER API 598	-DO--	√	P	W	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	01.22	GK Morye	Checked by:		KK yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal			Approved by:			

MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN			SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
	CUSTOMER :			QP NO.: PE-QP-435-100-M004(A)	DATE: 17.01.2020
	PROJECT:			PO NO.: LATER	DATE: XXX
	ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION		SYSTEM:	SECTION:	SHEET 2 OF 3

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			10
		3. LEAK TIGHTNESS OF SEAT	CR	PNEUMATIC TEST	100%	REFER NOTE-2	APPD. DRG./ BSEN ISO 15761	LEAKAGE PERMISSIBLE AS PER API 598	INSPN REPORT	√	P	W	V	
4.2	OPERATIONAL TESTING FOR MANUALLY OPERATED VALVES	SMOOTH & FULL OPENING AND CLOSING	CR	MANUAL	100%	REFER NOTE-2	SMOOTH OPERATION OF VALVES & CLEAR BORE		INSPN. REPORT	√	P	W	V	
5.0	COMPLETE VALVES	OVERALL DIMENSION	MA	MEAS	SAMP-LE	-	APPD.DRG	APP.DRG.	-DO-	√	P	V	V	
6.0	END CONNECTION DETAILS	DIMENSIONS	MA	MEAS.	100%	REFER NOTE-2	APPD. DRG.	APPD. DRG.	-DO-	√	P	W	V	
7.0	FINAL INSPECTION	CLEANLINESS & COMPLETENESS, NAME WITH VALVE TAG NOS.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P	V	V	
8.0	PAINTING	1. SURFACE PREPARATION 2.UNIFORMITY & THICKNESS	MI MI	VISUAL MEASUREMENT	100% 100%		APPD. DRG. -DO-	APPD. DRG. -DO-	-DO- -DO-	√	P	V	V	APPLICABLE FOR FCS HOSE VALVE
9.0	PACKING	APPD. DRG.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTOGRAPH	√	P	V	V	REFER NOTE '3'

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	17.01.20	GK Morye	Checked by:		KK yadav		
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:		RK Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO : PE-TS-435-100-M001				DATE: 17.01.2020
भा एच ई एल BHEL			CUSTOMER :					QP NO.: PE-QP-435-100-M004(A)				DATE: 17.01.2020
			PROJECT:					PO NO.: LATER				DATE: XXX
			ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION			SYSTEM:		SECTION:				SHEET 3 OF 3
SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N			*		**			
										D	M	C	N	
1	2	3	4	5	6		7	8	9					10

NOTES:

1. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
2. 10% or min. 2 nos. at random by BHEL/Customer & 100% by supplier for each type, size & rating.
3. Supplier to provide the followings:
   a. Photographs of valves duly placed inside the wooden box just before the final packing.
   b. Photographs of the wooden box in which valves have been finally packed just before dispatch.
   c. Clearance for dispatch of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

LEGENDS:

***D**: Records, identified with "Tick"(√) shall be essentially included by supplier in QA Documentation.

** **M**: Supplier/ Manufacturer/ Sub-Supplier
P: Perform
MA: Major Characteristic
MTC: Mill Test Certificate

C: Main Supplier/BHEL/ Third Party Inspection agency
W: Witness
MI: Minor Characteristic

N: Customer
V: Verification
CR: Critical Characteristic

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	13/01/20	GK Morye	Checked by:	16/1/2020	KK yadav		
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

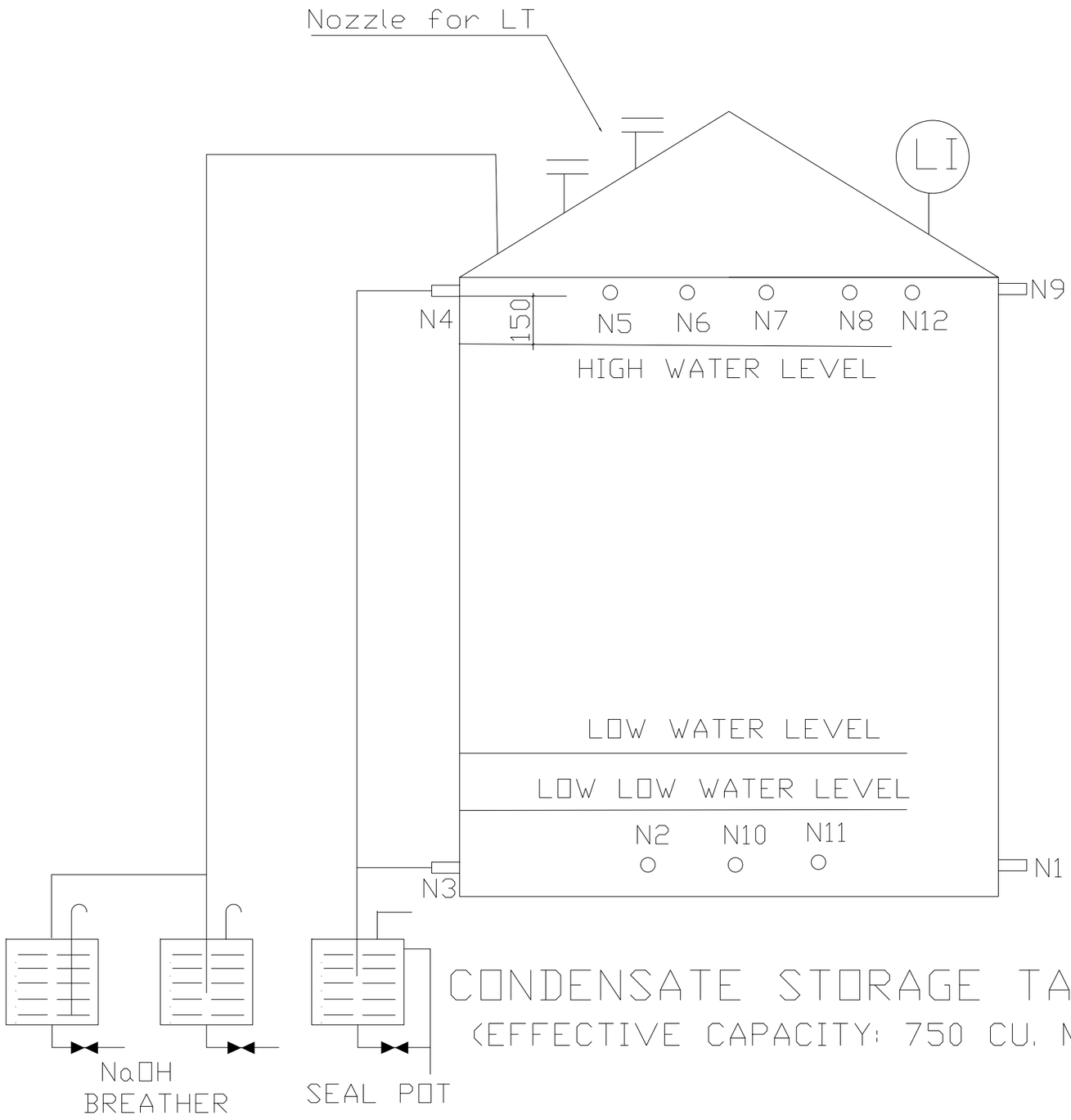
ANNEXURE-III

DATASHEET AND SKETCH OF CONDENSATE STOAREG TANK

BHEL PEM	DATA SHEET-A FOR CONDENSATE STORAGE TANK PROJECT TITLE: 1X660MW SAGARDIGHI STPP	DOC NO: PE-DC-445-167-A001
Sl.No.		
1	SERVICE IDENTIFICATION	CONDENSATE STORAGE TANK
2	SYSTEM	DM SYSTEM
3	APPLICABLE CODES/ STATUTORY REGULATIONS	IS-803/API650
4	EFFECTIVE CAPACITY (m3)	750
5	NUMBER REQUIRED	ONE (01) NO.
6	STORAGE MEDIUM	DM WATER
6A	OPERATING PRESSURE	ATMOSPHERIC PRESSURE
6B	DESIGN PRESSURE	FILLED WATER HEAD + ATMOSPHERIC
6C	HYDROTEST PRESSURE	FILLED WATER HEAD
6D	DESIGN TEMPERATURE	60 DEG.C
7	TYPE	VERTICAL, CYLINDRICAL
8	SIZE	10.8 M DIA x 9.8 M HEIGHT (REFER NOTE-3)
9	CORROSION ALLOWANCE	2 MM
10	PRESSURE CLASS	DESIGN FOR FILLED WATER HEAD / ATOMSPHERIC
11	MINIMUM PLATE THICKNESS INCLUDING CORROSION ALLOWANCE	Bottom – 8 MM, Shell - 8 MM , Roof- 8 MM
12	JOINT EFFICIENCY	0.85
13	MATERIAL OF CONSTRUCTION	MILD STEEL TO IS:2062 Gr. B
14	COURSE WIDTH OF PLATES	1.5M/1.8M/2.0M AS PER IS:803.
15	LOCATION OF INSTALLATION	OUTDOOR
16	DRAIN VALVE FOR TANK	100 NB
17	DRAIN VALVE FOR NaOH/CO2 BREATHER	25 NB
18	DRAIN VALVE FOR SEAL POT	50 NB
19	HAND RAILING	i)Size of pipe: 32 NB ii)Material: ERW pipe as per IS:1239 (Medium Gr.),Part-I, Galvanized
20	NOZZLE CONNECTIONS REQD /	AS PER ENCLOSED SKETCH / SOCKET WELDED FOR
	END CONNECTION	SIZE <= NB50 & BUTT WELDED FOR SIZE > NB50
21	PIPING/NOZZLE MATERIAL	STAINLESS STEEL TO SA312 TP 304, SCH 10S FOR > NB50 & 40S FOR <= NB50
22	VALVES MATERIAL	STAINLESS STEEL (refer datasheet)

BHEL PEM	DATA SHEET-A FOR CONDENSATE STORAGE TANK	DOC NO: PE-DC-445-167-A001
	PROJECT TITLE: 1X660MW SAGARDIGHI STPP	
Sl.No.		
23	VALVES END CONNECTION	SOCKET WELDED FOR SIZE <= NB50
		FLANGED FOR SIZE > NB50
24	INSTRUMENTS / ACCESSORIES PROVIDED	(a) CONSERVATION VENT VALVE /NAOH BREATHER(TO BE PLACED ON GROUND). (b) OVERFLOW OF 200 NB & DRAIN PIPING OF 100 NB WITH DRAIN VALVE. (c) SEAL POT WITH DRAIN VALVE ETC FOR OVERFLOW. (d) LEVEL GAUGE FLOAT & BOARD TYPE (REFER ANNEXURE-V) TO COVER ENTIRE RANG. (e) 2 NOS INSTRUMENT CONNECTIONS ON TANK ROOF FOR LEVEL TRANSMITTERS (RADAR TYPE). (f) SAMPLING CONNECTION WITH 25 NB VALVE ON TANK. (g) 3 NOS. INSTRUMENT CONNECTIONS ON TANK ROOF FOR FLOAT AND BOARD TYPE LEVEL GUAGE. (h) STEEL STAIRS AND PLATFORMS FOR EXTERNAL APPROACH & INTERNAL VERTICAL LADDER. (i) FOLLOWING SPARE CONNECTION SHALL BE PROVIDED WITH SPARE VALVE: 1)SPARE VALVE SIZE 200 NB, QUANTITY : 4 NOS. 2)SPARE VALVE SIZE 150 NB, QUANTITY : 2 NOS. (j)DIP HATCH (k) Spiral staircase along the shell of tanks and internal rung ladder to access through roof manhole.
25	INSIDE PROTECTION & EXTERNAL PAINTING	REFER ANNEXURE-VI REGARDING PAINTING
26	MANHOLE & TYPE	TWO(2) NOS. ONE ON SHELL (SIZE 600 MM) & OTHER ON ROOF. MANHOLE.
27	FUNCTIONAL DEMONSTRATION	FOR FUNCTION DEMONSTRATION OF CS TANKS THE FOLLOWING SHALL BE DONE: 1) SPOT RADIOGRAPHY 2) BOTTOM PLATE TESTING BY AIR OR VACUUM BOX. 3) SHELL TESTING BY FILLING WITH WATER (HYDROTEST). 4) FIXED ROOF TESTING BY AIR
28	LIST OF DRAWINGS ATTACHED	SKETCH FOR CONDENSATE WATER STORAGE TANK: PE-DC-445-167-S001
NOTE		
1)ALL OTHER STANDARD TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS APPLICABLE SHALL BE CONSIDERED		
2)ALL THE REQUIREMENTS SHOWN UNDER DATASHEET AND SKETCH OF CONDENSATE STORAGE TANKS ARE BARE MINIMUM , ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL		
3)ADDITIONAL HEIGHT REQUIRED TO MEET THE EFFECTIVE CAPACITY TO BE PROVIDED BY THE BIDDER WITHOUT ANY COMMERCIAL IMPLICATION.		

1X660 MW SAGARDIGHI (UNIT 5)



NOZZLE NO.	DESCRIPTION	SIZE(NB)
N1	COND OUTLET	200
N2	OUTLET SPARE WITH BLIND FLANGE	200
N3	DRAIN	100
N4	OVERFLOW	200
N5	DM INLET	200
N6	RE-CIRCULATION	50
N7	INLET SPARE WITH BLIND FLANGE	200
N8	EXCESS DUMP	200
N9	INLET SPARE WITH BLIND FLANGE	200
N10	OUTLET SPARE WITH BLIND FLANGE	200
N11	CPU PUMP SUCTION	150
N12	CPU PUMP RETURN LINE	65
N13	SPARE WITH BLIND FLANGE	150
N14	SPARE WITH BLIND FLANGE	150

ALL SPARE CONNECTIONS ARE BLANK FLANGED AND WILL BE PROVIDED WITH ISOLATION VALVES AS PER SPECIFICATION REQUIREMENT.

NOTES:-

1.0 HIGH WATER LEVEL SHALL BE MIN 150 mm BELOW BOTTOM OF OVERFLOW NOZZLE.

2.0 NOZZLE ORIENTATION SHALL BE AS PER FINAL LAYOUT.

3.0 NaOH BREATHER SHALL BE PLACED ON THE GF LEVEL AS SHOWN THE SKETCH.

PE-DC-445-167-S001

ANNEXURE-IV

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the following drawings / documents during detail engineering for approval / information / reference (as he case may be): -

Sl. No.	BHEL Drawing / Document No.	Title	Schedule Submission Date from LOI	Resubmission after incorporating comments
1	PE-V0-445-167-A001	DESIGN CALCULATION OF CONDENSATE STORAGE TANKS	4 weeks	Within 1 week
2	PE-V0-445-167-A002	GA DRAWING OF CONDENSATE STORAGE TANKS	4 weeks	Within 1 week
3	PE-V0-445-167-A003	FABRICATION DRAWINGS OF CONDENSATE STORAGE TANKS	5 weeks	Within 1 week
4	PE-V0-445-167-A004	DATASHEET & GENERAL ARRANGEMENT DRAWING OF COMPONENTS OF CST	6 weeks	Within 1 week
5	PE-V0-445-167-A005	STAAD CALCULATION OF ROOF STRUCTRE AND SHELL BUCKLING CHECK OF CONDENSATE STORAGE TANKS	3 weeks	Within 1 week
6	PE-V0-434-167-A006	GA DRWG OF ROOF STRUCURE FOR CONDENSATE STORAGE TANKS	5 weeks	Within 1 week
7	PE-V0-434-167-A007	SUB-VENDOR LIST WITH INSPECTION CATEGORISATION PLAN FOR CONDENSATE STORAGE TANKS	3 weeks	Within 1 week
8	PE-V0-434-167-A008	QAP FOR VALVES(SS) OF CONDENSATE STORAGE TANKS	6 weeks	Within 1 week
9	PE-V0-445-167-A009	QAP OF OTHER COMPONENTS FOR CONDENSATE STORAGE TANKS	6 weeks	Within 1 week
11	PE-V0-445-167-A011	O&M MANUAL FOR CONDENSATE STORAGE TANKS	8 weeks	Within 1 week

NOTE:

1. Any other drwgs/docs indicated else where in the specification shall be submitted by vendor for approval of BHEL/customer.
2. Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
3. Internet explorer version – Minimum Internet Explorer 7.
4. Internet speed – 2 mbps (Minimum preferred).
5. Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
6. Vendor's internal proxy setting should not block DMS application's link (http://dmsserver.bhelpem.com/Wrench%20Web%20Access/Login.aspx.).

COMPANY SEAL

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

ANNEXURE-V

DATASHEETS FOR BOUGHT OUT ITEMS

DATASHEET OF LEVEL INDICATOR

S.NO.	COMPONENT	DESCRIPTION
1	Type	Float and Board
2	Float Material & Tape MOC	SS 316
3	Pulley and Pulley housing material	SS-304
4	Guide wire	SS-316
5	Accuracy	± 10 mm /Manufacturer std.
6	Spring tension Assembly	SS-304
7	Anchor plate	SS-304
9	Calibrated scale board	Aluminum with black graduation
10	Quantity	One (1) No. per tank

DATASHEET OF PIPES, FITTINGS, FLANGES & ACCESSORIES

S.No.	Description	Material Standard	Dimensional Standard
1.0	**SS Pipes**		
1.1	50 NB and below	Stainless steel pipe as per ASTM A-312, TP 304, Seamless, Sch. 40S	As per ANSI B-36.19, socket welded
1.2	65 NB and above	Stainless steel pipe as per ASTM A-312, TP 304, ERW, Sch.10S	As per ANSI B-36.19, BW ends
2.0	**SS Fittings(Elbow, Tees & Reducers)**		
2.1	50 NB and below	Forged Stainless steel as per ASTM A-182, F-304	ANSI B 16.11, S/W ends
2.2	65 NB and above	Stainless Steel as per ASTM A-351- CF8 or ASTM A 403 WP304, ERW	ANSI B 16.9, B/W ends
3.0	**SS Flanges**		
3.1	For SS Pipes up to 50 NB	ASTM A182 F304	ANSI B16.5, RF
3.2	For SS Pipes above 50 NB	ASTM A403 Gr. 304	ANSI B16.5, FF
4.0	**Gaskets**		
4.1	All Gaskets	Neoprene to suit ANSI B16.5 RF flange	ANSI B16.21 3 mm Thk
5.0	**Bolts & Nuts**		
5.1	Wherever applicable in all the tanks.	ASTM A-193, Gr. B7 for Bolts ASTM A-194, Gr. 2H for Nuts	ANSI B 18.2.1 & ANSI 18.2.2

DATASHEET OF VALVES:

S.NO.	COMPONENT	DESCRIPTION
1.	Body & Bonnet	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
2.	Wedge & Seat ring	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
3.	Trim	ASTM A182 Gr F304
4.	Rating	Class 800 (50NB & below) Class 150 (50NB above)
5.	Ends	SW to B16.11 (50NB &below) Flanged to B16.5 (50NB above)
6.	Design Standards	B16.34 / API600 for Gate valve B16.34 / BS1873 for Globe valve
7.	Testing standards	API 598 for all valve (All sizes)
8.	Bolts & Nuts	A193 Grb7 & A194 Gr.2H

ANNEXURE-VI

PAINTING SPECIFICATION

PAINTING SPECIFICATION

PAINTING SPECIFICATION FOR MISCELLANEOUS TANKS, NaOH BREATHER AND SEAL POT			
Coat Description	**Tank Internal**	**Tank External, Structural steel works, piping, stairways & other accessories**	**Tank Underneath**
Surface Preparation (As per SSPC, Vis 1 or DIN 55928, Section-4 or SIS 055900)	SA 2.5	SA 2.5	Wire Brushing/ hand tool cleaning to ST-2.
Primer	One (1) coat of epoxy primer containing high level of Zinc Phosphate Anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.	One (1) coat (minimum DFT of 100 microns) of Epoxy resin based zinc phosphate primer.	One (1) coat of high build coal tar epoxy suitably pigmented (2 pack), DFT: 80 – 100 microns each coat.
Intermediate coat	N. A.	One (1) coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.	N. A.
Finish	Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.	One (1) coat (minimum DFT of 75 microns) of epoxy paint of approved shade and color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.	N. A.
Total DFT	500 microns	300 microns	80-100 microns
Note: Final colour of paint shall be “Sea Green”, Shade no. 217.			

SECTION-II

SUB-SECTION-A

STANDARD TECHNICAL SPECIFICATIONS- MECHANICAL

1.0 SCOPE

This specification covers design, engineering, supply of material, fabrication, assembly, inspection and testing at shop as well as at site, erection and commissioning, painting and functional demonstration testing at site.

2.0 CODES & STANDARDS

The design, fabrication & assembly, erection & performance of steel tanks shall comply with all latest statutory regulations and safety codes applicable in the locality where the tanks are to be installed. Tanks shall conform to the latest applicable Indian / British / USA standards. The vendor shall not be construed to be relieved of his responsibility by virtue of this specification. The tank in general shall conform to the latest editions, as applicable, out of the following standards.

I. IS-800: Code of practice for use of steel in general building construction

II. IS-803: Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.

III. IS-804: Specification for rectangular pressed steel tanks

IV. IS-805: Code of practice for use of steel in gravity water tank.

V. IS-816: Code of practice for metal arc welding for general construction in MS.

VI. IS-817: Code of practice for training and testing for metal arc welder

VII. IS-2825: Code of practice for unfired pressure vessel

VIII. BS-2594: Specification for carbon steel welded horizontal cylindrical storage tank

IX. BS-2654: Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry

X. Indian Factories Act

XI. American code for oil tanks API 650

XII. Material Specification as per relevant IS / or approved equal

XIII. American water works association standards (AWWA D100)

3.0 DESIGN REQUIREMENT

3.1 General Requirement

3.1.1 All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid which these tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain.

The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.

3.1.2 Tank thickness shall be calculated as per IS803/API650 latest edition. Intermediary wind girder design, Wind Design, Seismic design, anchor bolt design / selection etc. shall be done as per API 650 latest edition, latest addendum available at the time of detail engineering.

3.1.3 All tanks will be designed for the capacities, dimensions and working conditions as specified in this specification. The tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. A **2.0 mm** corrosion allowance for shells, bottom and roofs above and beyond the required thickness / calculated thickness / nominal thickness as specified in the design code shall be provided.

3.1.4 Vessel seams shall be so positioned that they do not pass through nozzle connections on vessel. For vessels consisting of more than two sections, longitudinal seams shall be offset.

3.1.5 The inside seam should be ground smooth, suitable for application of corrosion resistant primer. If the stiffening of shell, bottom and / or roof is necessary, tanks will be stiffened from outside.

3.1.6 Flange faces of all nozzles shall be machined and squared with the vessel center line.

3.1.7 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m^2 of projected area.

3.1.8 The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.

3.1.9 When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface. The plate shall not be gouged or torn in process of removing lugs.

3.1.10 In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.

3.1.11 Material of construction of all tanks shall be mild steel conforms to IS – 2062 grade – B unless otherwise specified in the specification.

3.2 Alignment

3.2.1 Plates to be joined by butt-welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whichever is larger.

3.2.2 In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate

thickness exceeding 8 mm except that for plate thickness 8 mm and under, the maximum shall be 1.5 mm.

3.2.3 Each tank shall be properly constructed ensuring perfect vertical alignment with 5 mm or as specified in the relevant code / standard and tank circularity within 5 mm on diameter or as specified in the relevant code / standard. Local bulging and / or depressions at any location of tank particularly shell shall not be permitted.

3.3 WELDING

3.3.1 Tanks and other attachments shall be welded as per IS-816.

3.3.2 Welding sequence shall be so adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be submitted for approval of BHEL giving details of material, welding position, sequence, type of electrode used, pre-heat & post weld requirement etc as per the code of construction. Brand name of electrodes to be used with proper classification (e.g. E 6013) shall be as per BHEL's approval.

3.3.3 Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.

3.3.4 Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets, bolts, nuts etc. shall be conforming to relevant standards of repute and approved by the purchaser prior to use.

3.3.5 Each tank shall be complete with access staircase, ladder and safety cage and fittings like drain connection, overflow connection(pipe) till bottom of tank, tank inlet and outlet covers, level gauge glass, fittings with isolation cocks and protection covers, tank vent connection etc. all complete with needed accessories for the completeness of the tanks.

3.3.6 All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.

3.4 STAIRCASE / ACCESS LADDER AND HAND RAILING

3.4.1 All cylindrical vertical tanks shall be provided with spiral staircase and shall conform to the requirements specified in design codes / standards unless specified otherwise. All stair treads shall be 32 mm steel fabricated gratings. Each tread, if needed, shall be housed in individual steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall have minimum 1200 mm clear width.

3.4.2 Access ladder, one (1) for each horizontal cylindrical / rectangular tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm diameter rods spaced at not more than 30 mm center to center. All ladders shall have steel fabricated safety cage to the approved construction. Safety cage shall be provided about 2.5 m clear height of the ladder. Access ladder's stringers shall be widely spaced at top for free access to the tank roof.

3.4.3 All staircase and roofs of vertical cylindrical tanks shall be provided with pipe hand railings of effective height as indicated in the relevant code / standard throughout. Handrails shall be constructed out of 32 mm medium class galvanized steel pipe conforming to IS- 1239: 1968. Handrail posts shall be arranged at spacing not greater than 1850 mm. Two (2) sets of pipes horizontal runners all along the length shall be provided. All welds joints in the handrails shall be ground flush to protect any person getting injured. Steel toe plates of 100 mm flats shall be used. Hand railing shall be fabricated and installed in an approved manner as directed by purchaser in accordance with approved drawings.

3.4.4 Unless otherwise specified, for all flanged connections, vendor shall furnish suitable counter flanges and necessary nuts, bolts and gaskets materials.

3.4.5 Unless otherwise specified, bolts and nuts shall be hexagonal head conforming to bolts and nuts shall be SA 193 & 194 respectively.

3.4.6 Gaskets shall be 3 mm thick full-face. On completion of hydraulic test / water fill test, contractor shall replace the gaskets used during testing at his own cost.

3.4.7 Void.

3.4.8 During erection of tank, shell plates shall be suitably supported both for outside and inside to avoid buckling / collapsing of tank due to high-speed wind, gust or severe storm, if any, occurring during erection.

3.5 VERTICAL CYLINDRICAL STORAGE TANKS

3.5.1 The vertical cylindrical storage (non- pressure) tanks shall be of mild steel welded construction and shall be designed in accordance with codes and standards as specified. The vertical cylindrical storage tanks shall have slightly sloping bottom towards an adequately sized sump inside the tank to enable complete draining of the tank. The tank shall be designed for a wind pressure and seismic coefficient as specified.

3.5.2 Conical roof shall be either self-supported or supporting. The roof shall have a slope as specified in the relevant design code to ensure drainage of rainwater. Needed roof rafters and purlins adequately designed shall be provided.

3.5.3 All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.

3.5.4 All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.

3.5.5 All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non-injurious methods.

3.5.6 Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all

vertical joints be staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 6 mm.

3.5.7 The tank height shall be completed by the provision of top curb/ angle which shall be butt-welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.

3.5.8 Tank roof shall be either self-supported or supported from rafters / steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding bolted connections at one end and preferably on the tank periphery side. The roof-supporting frame shall have needed tie rods or bracing sets.

3.5.9 Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.

3.5.10 Openings needed for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall the bolted and hinged covers unless otherwise specified.

3.5.11 All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

3.6 RECTANGULAR TANKS

3.6.1 Rectangular tanks shall be fabricated in steel material and shall be designed to withstand internal hydrostatic pressure. In addition, these shall be checked for a wind pressure and seismic coefficient as specified wherever applicable. While worst of these two shall be considered, the permissible stress shall be increased as per good engineering practice when their effect considered with tank load.

3.6.2 Tank bottom and / or side plates shall be of minimum 8 mm thick plate. Corrosion margin of at least 2.0 mm shall be provided over the design thickness of bottom and / or side plates.

3.6.3 To support tank plates and to maintain required unsupported plate length, adequately sized and spaced steel structural closed frame shall be provided inside the tank. Longitudinal and / or vertical structural members to connect and adequately support these frames shall be provided at corners. Horizontal diagonal members / sway bracings at corner shall also be provided.

3.6.4 Tank plates cut to size shall be welded on these frames. Plate butt weld joints at other locations shall be eliminated to avoid warping of the plates at free joints. Adequate openings in the structural frames, particularly at the bottom shall be provided to ensure complete unrestricted drainage of tank at one point. Suitable sized drain valve of size minimum 25 NB unless otherwise specified, shall be provided below the tank bottom for proper draining of the tank.

3.6.5 Complete assembled tank shall have at its bottom longitudinal steel fabricated bearer beams welded to it. The tank with bearer will rest over number of concrete blocks to be provided by purchaser. The

tank shall be adequately bolted / welded to the concrete blocks. Needed inserts / anchor bolts shall be furnished by the bidders. Grouting of tank over concrete blocks in approved manner shall be included in bidder's scope of work, if erection is also awarded to the bidder.

3.6.6 Where rectangular tanks are flushed in dual compartments the inside partition plate shall be well reinforced to withstand hydrostatic test pressure completely on one side throughout the full height.

3.6.7 The rectangular tank shall be designed as per good engineering practice and reference shall be taken from the book named "Theory of plates and shells" by Timoshenko. Design calculation shall be done in accordance with the above mentioned book.

3.6.8 Suitable steel structural e.g. channels shall be provided below the bottom plate so that tank can rest on the foundation / slabs through the structural supports.

3.9 HORIZONTAL CYLINDRICAL TANK

3.9.1 The horizontal cylindrical tank with dished ends shall be of mild steel welded construction and shall be designed in accordance with BS – 2594 / IS – 2825 / ASME as specified. The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be considered, the permissible stress shall be increased as per relevant code / standard.

3.9.2 The shell and dished end plate thickness shall be chosen as per design requirement but in no case the dished end and shell plate thickness shall be less than 8 mm.

3.9.3 All seams, longitudinal as well as circumferential, shall be butt-welded. Longitudinal seams should not be situated in the lower one-third of a tank or on the top center line.

3.9.4 All tank shall be supplied with integral saddle support and shall be designed in accordance with BS-2594 / IS – 2825 / ASME as specified.

4.0 TESTING AND INSPECTION AT MANUFACTURERER'S WORKS

4.1 General

4.1.1 The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.

4.1.2 All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out the necessary tests required by codes at his own cost.

4.1.3 Alloy cast iron and cast steel components shall be tested for both physical and chemical properties in absence of purchaser's representatives. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.

4.1.4 All materials including valves, instruments, pipings, flanges, counter flanges etc. shall be procured from BHEL approved manufacturer's only. Dealers are not acceptable.

4.2 TESTING AND INSPECTION FOR TANKS

4.2.1 The scope of testing and inspection for pressure vessel covered in this specification shall generally comprise of the following:

I. Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.

II. Examination of materials of construction and identification with material test certificates.

III. All the plates of thickness 50 mm or more shall be ultrasonically tested to ensure freedom from laminations.

IV. Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.

V. Inspection of dished end flanges and alloy steel bolting where required.

VI. Inspection during fabrication at appropriate stages including fit ups.

VII. For all butt welds, the root run and final run shall be subjected to dye-penetrate or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye-penetrate / magnetic particle examination.

VIII. Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatment procedure as required by codes and specifications.

IX. Examination of internal cleanliness before final closure.

X. Dimensional examination of completed vessel including axis marking, proof marking, match marking etc.

XI. Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification. In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.

XII. Witnessing cleanliness, preservation, packing and marking.

XIII. Stamping of vessel and issue of certificates.

XIV. All tanks under this specification shall be tested as per the relevant design and testing code / standard. Supplier shall submit the detailed testing procedure for the tanks during detail engineering stage for BHEL / customer / consultant's approval and approved document shall be adhered by them and testing shall be done accordingly without any commercial implication.

4.2.2 **NON - PRESSURE TANKS**

The scope of testing and inspection for non-pressure tanks covered in this specification will comprise of the following:

i. Identification of materials to manufacturer's test certificates.

ii. Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling.

iii. Checking of dimension and match marking.

iv. Bottom testing

a. After the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

b. Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of purchaser.

c. Alternatively, the bottom seams may be tested by vacuum box method subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS- 803, 1976 (figure-24)

v. Shell testing

The shell of fixed roof non - pressure tanks shall be tested after completion of roof. Testing shall be done by filling the tank with water to the level of the top leg of the top curb angle and noting any leaks.

vi. Roof testing

The roof of the tank shall be tested by pumping air under the roof plates while the tank is still full of water. In the non - pressure tank, the roof shall be tested to a pressure of 75 mm of water gauge and in case of pressure roof tanks, to a pressure of one and a quarter times the pressure at which the pressure sides of the pressure / vacuum relief valve is designed to open. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

vii. All field-testing shall be performed prior to any painting or coating application.

4.3 REPAIR OF LEAKS

4.3.1 All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

4.3.2 In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity, the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

4.3.3 In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only by welding and if necessary, after first cutting out the defective part.

4.3.4 When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

4.3.5 No welding shall be done on any tank unless all lines connecting thereto have been completely blanked off. No repairs shall be attempted on tanks while filled with oil, nor any tanks which have contained oil until the tanks have been emptied, cleaned and freed from gas in a safe manner. No repair shall be attempted on a tank which has contained oil except in a manner approved in writing by the purchaser, and in absence of the purchaser's inspector.

SUB-SECTION-B

FORMAT FOR OPERATION AND MANITENANCE

Format for Operation & Maintenance Manual

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

SUB-SECTION-C

SITE STORAGE AND PRESERVATION GUIDELINES

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. ‘No smoking’ signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	**Description of the equipment**	**Type of Storage**	**Check for**	**Remarks**
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

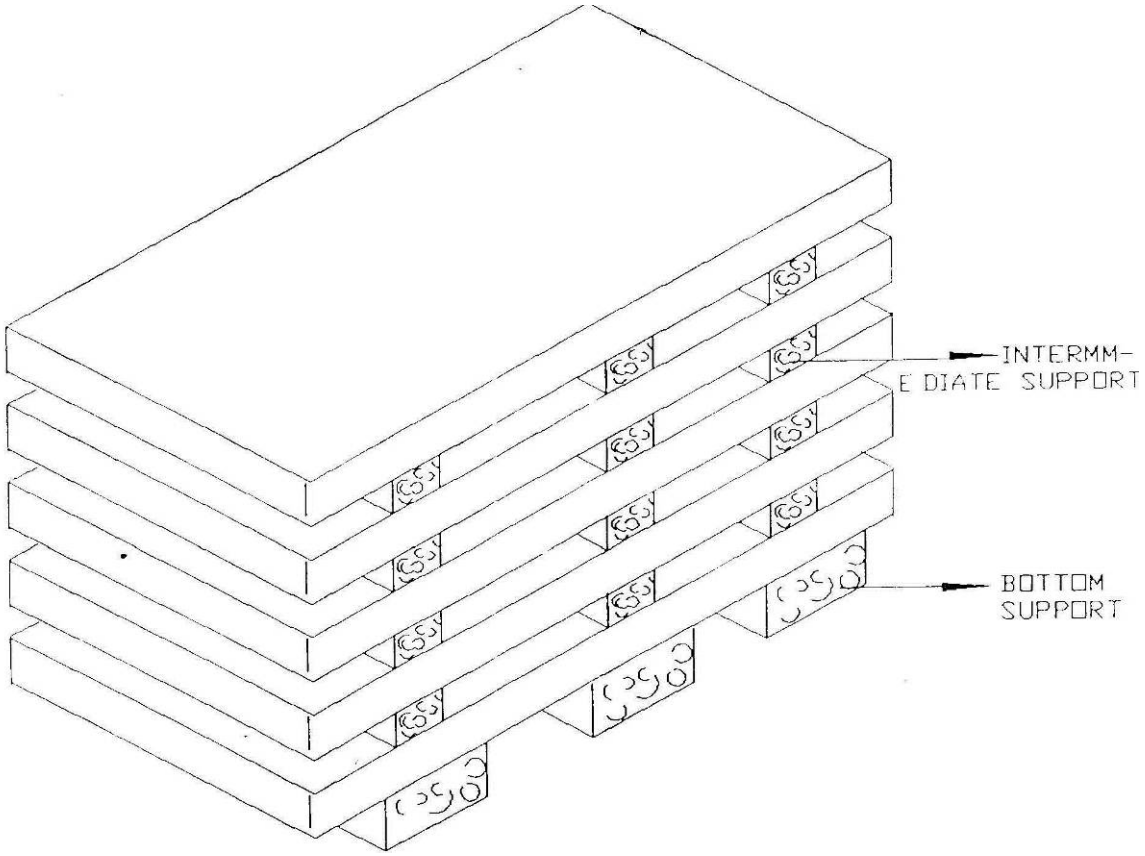


Figure – 1 – PLATE STACKING ARRANGEMENT

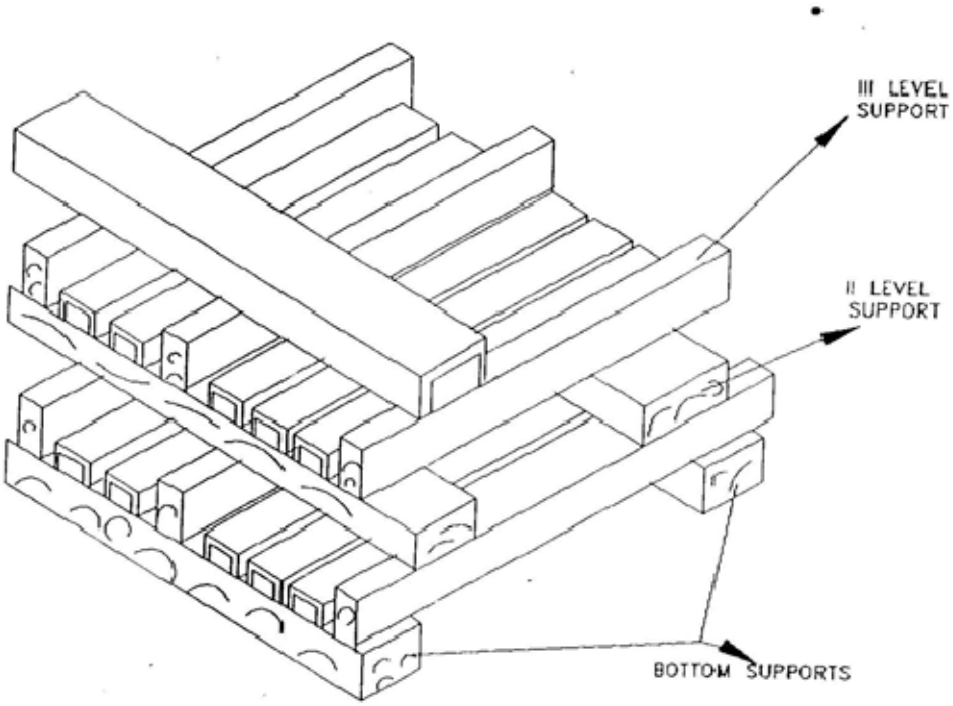


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION-III

ANNEXURE-1
LIST OF DOCUMENTS TO BE SUBMITTED WITH THE BID

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

1. Compliance cum confirmation certificate.
2. Pre-bid clarification schedule in case of any clarifications.
3. Deviation schedule in case of any deviations by bidder.
4. Un priced copy of priced format for package (mentioning quoted against each item)

Note: Offer will be considered as incomplete in absence of any of above documents. Document/s other than above, if any, submitted with the offer will not form part of contract and accordingly will not be considered for bid evaluation.

ANNEXURE-2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to

approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

ANNEXURE - 3

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

ANNEXURE-4 (DEVIATION SHEET WITH COST OF WITHDRAWL)

TITLE: TECHNICAL SPECIFICATION FOR MISC. TANKS - SITE FABRICATED
PROJECT:-1X660MW SAGARDIGHI STPP

TECH SPC NO: PE-TS-445-167-A001

TENDER ENQUIRY REFERENCE:-

NAME OF BIDDER:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. Cost of withdrawal of deviation will be applicable on the basic price (i.e, excluding taxes, duties & freight) only.
2. All the bidders has to list out all their Technical and Commercial Deviations (if any) in detail in the above format.
3. Any deviation not mentioned above and shown separately of found hidden in offer, will not be taken cognizance of.
4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. in the absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT
5. Bidder shall furnish price copy of above format along with price bid.
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per **Annexure-VII of GCC, Rev-07** will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in un-priced copy of this format.
11. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.