

**TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.
(TANGEDCO)**

2X800 MW UPPUR STPP

**TECHNICAL SPECIFICATION
FOR
MILL REJECT SYSTEM (PNEUMATIC TYPE)**

SPECIFICATION NO.: PE-TS-425-160-A001



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



2X800 MW UPPUR STPP

SPECIFICATION No: PE-TS-425-160-A001

MILL REJECT SYSTEM (PNEUMATIC TYPE)

DATE: Nov 2017

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2X800 MW UPPUR STPP
MILL REJECT SYSTEM (PNEUMATIC TYPE)

SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-4253-160-A001

SECTION - I

REV 00

Sub Section

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SECTION – I**SPECIFIC TECHNICAL REQUIREMENTS****SUB-SECTION IA – Specific Technical Requirement (Mechanical)****SUB-SECTION IB – Specific Technical Requirement (Electrical)****SUB-SECTION IC – Specific Technical Requirement (C&I)**

**TITLE**

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SUB-SECTION – IA**SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)**



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SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to, design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site, erection and commissioning, trial run at site, performance guarantee test and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for **Mill Reject System** including mandatory spares, erection and commissioning spares and tools and tackles.
- 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 the responsibility of providing such facilities to complete the supply, erection and commissioning.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment 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.
- 1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 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 Vol-III of the specification. 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.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the deviation schedule along with cost of withdrawal; 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 The standard quality plan is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan as minimum requirement during manufacturing and testing.



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1.0 SCOPE OF WORK

Design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing, shipment and delivery at site, unloading, handling & transportation at site, Erection & Commissioning, structural work, minor civil works as required, trial run, Performance Guarantee test and handing over of Mill Reject Handling System including supply of mandatory spares, erection and commissioning spares and tools & tackles as per details in different sections of this specification.

Detailed system write-up & control philosophy shall be furnished by the successful bidder during detail engineering & the same shall be subject to customer approval during detail engineering.

1.1 SCOPE OF SUPPLY

Scope of supply shall comprise of but not necessarily limited to the following:

- a) Stack up assembly of pyrite hopper and conveying vessel below each mill shall comprise of following items.
 - 1 no. pneumatic cylinder operated knife gate valve with solenoid valve, open and close limit switches at mill outlet/pyrite hopper inlet.
 - 1 no. of pyrite hoppers complete with sizing grid, flexible/expansion joint at its inlet, rupture disc, by pass chute, oversize material chute, inspection window, Maintenance hole (generally closed) water spray nozzles & supporting structures.
 - 2 nos. of RF type level switch with probes per pyrite hopper i.e. high and high- high.
 - One no. Temp. Switch in redundant mode per pyrite hopper.
 - 1 no. of pneumatically operated knife gate valve at pyrite hopper outlet for pyrite hopper isolation with solenoid valve, open and close limit switches for interlock.
 - 1 no. of pneumatically operated knife gate valve at oversize discharge chute of pyrite hopper provided with solenoid valve, open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
 - 1 no. of pneumatically operated knife gate valve at by pass chute of pyrite hopper provided with solenoid valve, open & close limit switches for interlock with pyrite hopper inlet knife gate valve.
 - 1 no. of transporter vessel complete with pneumatically operated inlet valve, Alloy CI outlet bend, local control panel etc.
 - 1 set of MS ERW pipe for mill reject conveying from transporter vessel to Mill Reject Storage bunker.
 - 1 lot of Alloy CI bends
- b) Terminal boxes (qty. as per layout) with up stand on bunker top for terminating the reject conveying pipes.
- c) 4 nos. mill reject bunkers, i.e., one no. mill reject bunker per mill bay along with structure, liner (conical & straight portion) and lever operated bunker discharge gate with



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canvas chute at bunker outlet, staircase up to mill reject bunker roof top, operating & maintenance platform, hand railing, bag filter, RF type level probe, pressure relieve valve, Chain pulley block and monorail arrangement etc.

- d) 3 nos. (2W+1S) oil free screw type air compressors with drive motor, local control panel, instruments and all other accessories.
- e) 4 no. air receiver per mill bay complete with drain traps, safety relief valve, instruments and all accessories.
- f) 4 Nos. of Trolley for manual reject disposal.
- g) 4 no. trolley mounted portable type sump pump along with local control panel complete with suction (min. 10 m long) & discharge hose (min. 10 m long) with 50 M power cable for pumping out water drains from local pit to nearest plant drain, control panel, instruments and all other accessories.
- h) 1 lot of piping, fittings, valves & instruments for conveying air, instrument air, cooling water for transporter vessel inlet valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc.
- i) 1 lot of Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack along with required Stainless steel impulse/pneumatic tubing.
- j) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C
- k) All structures including pipe cum cable rack required for supporting of various pipes in bidder's scope. Bidder may take support from existing mill bunker bay structures wherever possible.
- l) All insert/embedment plates along with dash/anchor fastener, anti-vibration pads below conveying vessel if applicable foundation bolts/ anchor bolts etc. required for bidder's equipment.
- m) Charge of all lubricants and fluids as per GTR
- n) Electrical and C&I scope as per enclosure elsewhere in the specification.
- o) One (1) set of Mandatory Spares as per the list attached in specification.
- p) One (1) set of erection & commissioning spares as required for the complete system.
- q) One (1) set of Maintenance tools and tackles as per the list attached in specification.
- r) All counter- flanges with nuts, bolts and gaskets at all the terminal points.
- s) Relevant scope of supply as per GTR, GCC & SCC.
- t) Any other instrument, item required for making the installation complete in all respect within battery limits and for satisfactory operation of the system, unless specifically EXCLUDED from scope under Clause No. 2.0 below.

1.2 SCOPE OF SERVICES

Scope of services shall include but not necessarily limited to following:

- a) Unloading, Storage, handling and transportation at site

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- b) Minor civil work like penning, chipping of foundation, grouting etc.
- c) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary instrumentation for pre-commissioning, trial run, and performance guarantee test shall be arranged by the successful bidder at their own cost.
- d) Erection & Commissioning of Mill Reject Handling System.
- e) Inspection & testing, trial run, performance guarantee & handing over to end client
- f) Painting of all equipment within the battery limit
- g) Electrical scope of services as per enclosure elsewhere in the specification
- h) Preparation of Civil input drawings & documents for foundation details (including load data, GA, foundation pocket details etc.) of storage bunkers, compressors, air receivers, pipe rack and pit / trench details for transporter vessel and reject conveying pipes.
- i) Review of Civil drawings prepared by BHEL based on civil input drawing furnished by the successful bidder.
- j) Relevant scope of services as per GTR, GCC, ECC & SCC.
- k) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system, unless specifically EXCLUDED from scope under Clause .No. 2.0 below.

2.0 EXCLUSION

- a) Civil work for Mill Reject Handling system including
 - i) Road approach for various facilities related to Mill Reject Handling System.
 - ii) Transporter vessel foundation
 - iii) Pit & Trench as required in mill bay
 - iv) Mill reject compressor and Air receiver foundation
 - v) Mill Reject bunker foundation
 - vi) Various cable trenches, pipe pedestals & pipe rack foundation.

However, location, sizing and loads and any other input related to above as applicable for above shall be given by the successful bidder within 8 weeks of placement of LOI.

- b) Fire Protection system for compressor house
- c) Lighting of Mill bay, compressor house & bunker area
- d) Electrical exclusion as per Electrical scope sheet enclosed in the specification
- e) Relevant exclusion as per GTR, GCC, SCC & ECC.

3.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

As per Utility Requirement – Section III D.



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4.0 TERMINAL POINT

Mill Reject inlet towards pyrite hopper side	Mill reject spout (tramp iron) as per details indicated in enclosed GA of Mills.
Mill Reject outlet towards road tanker	Mill reject bunker outlet with canvas chute.
Equipment cooling Water, Instrument Air and Service Water tapings	As mentioned in Utility Requirement – Section III D.

5.0 PERFORMANCE / DEMONSTRATION GUARANTEES (Refer Annexure G)

6.0 ERECTION, PRE-OPERATIONAL TESTING/STARTUP & COMMISSIONING PROCEDURE

This shall be as furnished by the successful bidder during detail engineering for customer's review and acceptance.

7.0 PAINTING/CORROSION PROTECTION REQUIREMENT (Refer Annexure K of Painting Specification)

Successful bidder shall furnish detailed Painting Schedule for Mill Reject System (based on painting specification attached with specification) for customer / client approval during detail engineering.

8.0 LAYOUT REQUIREMENTS

Piping and equipment installation shall be according to the regulations and recommendations of recognized Indian / International Standards, Codes and Statutes, as and where applicable, practice in vogue (to be supported with back up document to the satisfaction of customer).

9.0 EQUIPMENT DESIGN CRITERIA

9.0.1 The minimum design criteria to be followed for various equipment shall be as per requirements indicated under specific and standard technical specifications for Mill Reject Handling System.

In case of *any contradictory requirement* in specification of particular equipment, the requirement given in section I shall prevail over those indicated in Section-II. Further, in case of any contradictory requirement within the same section and clarifications not having been sought by the bidders w.r.t. the same within the stipulated period, the most stringent requirement as per interpretation of the customer will prevail. Successful bidder will furnish



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detailed data sheets/ specifications/design calculations for various equipment for customer/consultant's approval during detail engineering. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

9.0.2 All pipe sizing and equipment sizing, capacity of pyrite hopper and pyrite vessel shall be subject to customer's approval during detail engineering without any cost implication to the customer.

10.0 QUALITY PLANS, INSPECTION & TESTING PROCEDURE (Reference Annexure B)
All QPs / CLs shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

11.0 DRAWINGS/DOCUMENTS REQUIRED WITH THE BID (Refer Section-III)
The drawings and documents to be submitted with the bid shall strictly be the list. Any document other than those indicated therein will not be reviewed and will not form part of contract.

12.0 DRAWINGS/DOCUMENTS REQUIRED DURING DETAIL ENGINEERING (Refer Annexure L)
The tentative list of drawings and documents required during detail engineering shall be as per the list. The list, however, will be finalized with the successful bidder prior to start of detail engineering.

13.0 DRAWING/DOCUMENT DISTRIBUTION SCHEDULE (Refer Annexure-I)
Drawing/document distribution schedule shall be as per Annexure-I enclosed elsewhere in the specification.

14.0 DOCUMENT MANAGEMENT SYSTEM (DMS)
Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System (DMS). Bidder would be provided access to DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:



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- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor’s Internal proxy setting should not block DMS application’s link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)”
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM’s DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor section. For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

15.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION (Refer Annexure M)

Bidder to note that the flow diagram of Mill Reject System shows the minimum requirement including instruments for the system. Any additional equipment/instruments required for safe, efficient & reliable operation of the system within the battery limit shall also be considered as included in bidder’s scope without any commercial/ cost implication to BHEL.

16.0 OTHER REQUIREMENTS

i) Site Visit before submission of offer

Bidders shall make Site visit in order to familiarize themselves with the existing facility and condition of site before submitting the bid in order to make their offer complete. BHEL shall not entertain any cost implication for making the system complete for any lack of input data during detail engineering.

ii) Technical Requirements

- Operation philosophy and control philosophy shall be submitted by the vendor during detail engineering stage for BHEL / CUSTOMER /CONSULTANT approval and approved document shall be adhered and the system shall be provided accordingly for which no commercial implication shall be entertained by BHEL.
- All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.
- Mill Reject System design shall also consider the presence of occasional burning coal particles along with the rejects, which would increase the reject temperature.
- Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

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- Civil works will be provided by BHEL / customer. Hence, bidder has to furnish the civil inputs in time. **Bidder has to carry out the rectification in the civil works in the event of any changes in the civil input data furnished by them or delay in submission of input data by them.** Bidder to furnish the civil foundation drawing along with the loading data for approval during detailed engineering stage showing / indicating the followings :-
 - a) Scope of work by BHEL / customer and bidder shall be indicated with different legend or in the form of note.
 - b) Civil loads shall be furnished showing detailed calculation.
 - c) Details of pockets as required for anchor bolts.
- Bidder to depute competent designer (s) at BHEL’s/ CUSTOMER /CONSULTANT office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.
- All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
- All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-
 - a) All drawings and documents shall bear BHEL’s title block and drawing / document number.
 - b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
- Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, performance guarantee test procedure, list of sub – vendors (mechanical, C & I and erection and commissioning), technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

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Annexures

Annexure	Title
A	Equipment Design / Selection Criteria and Customer Specification
B	Quality Assurance
C	Site Information
D	Sub-vendor List
E	Mandatory Spares
F	Maintenance Tools and Tackles
G	Performance guarantees requirement, trail run, commissioning requirement, operation & erection manual, third party inspection, FQP requirement
H	General Technical Requirements
J	Low Pressure Piping
K	Painting Specification
L	Drawings/documents to be submitted after award of contract
M	Input Drawings



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ANNEXURE A
EQUIPMENT DESIGN/SELECTION CRITERIA

Mill Data		
	No. of mills (working & standby) at 100% BMCR with worst coal firing per unit	9 mills (7 working + 2 standby)
	Type of Mills	HP1103 With Dynamic Classifier
	Elevation of Mill Reject Spout (Tramp iron spout)	2.400m from EL. 0.0m
	Mill Arrangement	Side mill layout
Reject Data		
	Reject Temperature (Normal/Design) (deg. C)	Around 180 deg. C / 200 deg. C
	Max/Normal Size of mill rejects to be handled	(-)50 mm
	Bulk Density for	
	a) Volumetric calculation	1600 Kg/m ³
	b) Load calculation	2400 Kg/m ³
System Data		
	Type of mill reject system	Pneumatic conveying system
	System capacity / reject generation	0.78 TPH per mill
Equipment Data		
1.	Pyrite Hopper	
	No of Pyrite Hopper	One (1) no. per mill
	Number of outlet	Three (3) nos.
	Capacity	2 times Transporter Vessel capacity
	Pyrite Hopper Accessories	
	Temperature Switch	One(1) no. each hopper alarm purpose
	RF type level probe	Two (2) nos. (1 no. for High level & 1 no. High - High level) for interlock, permissive and alarm
	Level Probe	Selected level probe shall be suitable for 350 degree temp.
	Water Spray quenching system along with valve station solenoid operated spray nozzle	One (1) no. per hopper
	Rupture disc	One (1) no. per hopper /MOC: Aluminum
	Flexible joint	One (1) no. per hopper
	Oversize reject chute	One (1) no. per hopper
	Bypass Chute	One (1) no. per hopper
	Material of construction	
	Pyrite hopper body	MS as per IS 2062 Gr A, 10 mm THK
	Grid	SS 304/MS IS 2062 with epoxy coat with opening suitable to allow 50mm (max) particle



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	Supports, Platform	MS as per IS 2062 Gr A
	Provision of inspection/poking doors in pyrite hopper	Yes
	Pressure Gauge at each service water and instrument air-line to pyrite hopper	One (1) no.
2.	Knife Gate Valve (Metal to metal seated)	
	Type & Quantity	
	Knife gate valve at Mill outlet - (KGV-1)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Over size discharge chute of Pyrite Hopper (KGV-2)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at By Pass Chute of Pyrite Hopper (KGV-3)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Knife gate valve at Pyrite Hopper outlet (KGV-4)	One (1) no. 200 NB Pneumatic cylinder operated per hopper
	Material of construction	
	Body	Cast Iron 225 BHN (IS 210 Gr. FG 260)
	Knife Gate	10 mm thick SS (ASTM A 240 type 304) (Edge hardened to 350-400 BHN)
	Seat	Replaceable type alloy CI or SS smooth finished with 250 BHN hardness
	Deflection cone	Provided before the pyrite hopper inlet knife gate valve
	Method of operation	Solenoid operated pneumatically actuated with provision for manual override facility
	Each knife gate valve (KGV-1 to KGV-4) shall be provided with open and close limit switch for interlock and control purpose with indication in OWS of DDCMIS based control system and local control panel/pneumatic panel.	
3.	Transporter Vessel	
	No. of transporter vessel envisaged	One (1) no. per hopper
	Capacity of transporter vessel	To suit the conveying rate with 85% filling
	Material of construction	
	Transporter vessel	Cast iron or Mild Steel IS - 2062, Gr. A as per ASME code for unfired vessels or as per IS 2825
	Inlet Valve	MOC of inlet valve shall be as per proven design of MRS system supplier suitable for intended application as per IS/BS/International Codes
	Type of valve	Dome/plate/butterfly/swing type as per supplier's proven practice



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	Dedicated pneumatic panel with minimum features as mentioned. (One (1) no. per stack up assembly)	- One "Power On" indication - Push button for Probe override operation - Push button for Purge operation (Purge or equivalent system as per vendor's proven practice shall be decided during detail engineering) - Local indication of limit switches of pneumatically operated KGV's and vessel inlet valve.
	Outlet bend (ACI 400BHN)	One (1) no. per transporter vessel
	Conveying velocity	Less than 6m/sec
	Number of cycle per hour	Not more than 6 per hour
4.	Reject conveying pipe	
	Reject conveying pipe size	As per system requirement (to be decided by system supplier)
	Quantity	As per layout requirement
	Material of pipe line	MS ERW IS 1239(Heavy grade) (<=150Nb) / 3589 (>150 Nb)
	Type of joint in pipe line	Flanged
	Distance over which material is to be conveyed and the lift	As per layout requirement
	Conveying pipe bends	
	Material of conveying pipe bends	Alloy CI (400BHN) Radius of bends-5D.
	Quantity	One (1) lot
5.	Bunker & Its Accessories	
	Number required	One (1) no. per bay
	Effective Capacity	65 T per bunker
	Number of outlet	One (1) no. per bunker
	Material of Construction and Thickness	
	Bunker Plates	10mm thick, MS plates as per IS 2062 Gr A/B
	Liners	3 mm THK. SS 304 in Straight & conical portion.
	Discharge gate (Manual)	Twin Sector gates MS to IS 2062 with TISCRA/SAI HARD Liner
	Pressure Relief Valve	One (1) no. per bunker
	Level Transmitter & Level Probe	One (1) no. 3D type acoustic type level Transmitter & One (1) no. RF type level probe per bunker
	Terminal Boxes with Up stand on bunker top for terminating the reject conveying pipes	One (1) set per bunker as per IS 2062 Gr. A/B (requirement as per layout).



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		Impacting surface shall be provided with SAIL HARD/TISCRAI liner.
	Clear access/headroom underneath MRS bunker for a road tanker/truck	4.5 m
6.	Bag Filter on Bunker top with associated instruments	
	Type & Number	Reverse pulse jet type / One per bunker
	Material of filter cloth	Polyester needle felt of antistatic type
	Air to cloth ratio (at maximum air flow)	1.0 m/min, 10% additional bags to be provided
	Bag cage	MS, IS 2062, Gr. A, 3mm thick, galvanized
	Outlet air quality (SMP level) at bag filter discharge;	Less than 30 mg/NM3
	Differential Pressure Gauge and Differential Pressure Switch	One (1) no. each per bag filter
	Electric hoist over bag filter	- No. of Electric Hoist – 1 no. - Service condition – Class II outdoor - Capacity of Electric hoist shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment/component to be handled
7.	Compressors with drive motor and all other accessories	
	No. and type of compressors	3 Nos. (2 working + 1 Standby) Oil free screw type air compressors
	Location	Housed in MRS Compressor House
	Pressure	As per supplier's proven practice
	Service	Conveying air
	Type of Drive	Electric Motor
	Compressor selection criteria	75% RH with 45 deg. C. - Each compressor shall be sized to cater air requirement of unit - At least 50% margin shall be provided on compressor capacity over and above the maximum flow requirement. - Noise level- Shall be limited to 85dBA at a distance of 1.0 m in horizontal direction from the nearest surface of the machine and at a height of 1.5 m from the floor



TITLE
2X800 MW UPPUR TPS
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

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 Sub Section -IA
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		level in elevation. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC 651 or BS: 5969 or IS 9779.
	Materials of construction	As per attached specification
	Instrumentation	As per manufacturer's standard practice with redundancy requirement as per attached C & I specification.
8.	Air receiver with isolation valves, instruments & accessories	
	Quantity	Four (4), One (1) no. per bay
	Design Code	IS: 2825 Class III vessel A corrosion allowance of 3mm (minimum) shall be provided. It shall be designed for 1.5 times the compressor discharge pressure.
	Capacity	Each air receiver capacity shall be selected to convey one complete cycle with a minimum margin of 25% provided over and above the calculated air capacity. Minimum 5 cub. m.
	Shell/ Body	MS IS 2062 Gr A/B; thickness as per design calculation
	Safety relief valve, fusible plugs, pressure gauges, pressure switch, temperature gauge, flanged pipe connections, inspection manholes with automatic drain traps	One (1) no. per air receiver Pressure gauges shall be provided at each air inlet line to air receiver in addition to pressure gauge on air receiver
	Auto drain & Y type Strainer	One (1) no. per air receiver
	Structural platform for maintenance of safety relief valves and instruments	To be provided by supplier.
9.	Pipe work for Conveying Air, Instrument Air, Cooling Water for Inlet Valve top plate of Transporter Vessel (if applicable), Cooling water for Quenching in Pyrite Hopper, Cooling water for air compressor	
	Quantity	One (1) lot
	Material of construction	Service water, DMCW water and



TITLE
2X800 MW UPPUR TPS
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		Instrument air pipeline: as per low pressure piping specification. Conveying air pipelines : MS ERW pipes as per IS-1239($\leq 150\text{NB}$) (heavy grade)/3589($>150\text{NB}$)
10.	Type and no. of sump pumps with local control panel	4 nos. trolley mounted portable sump pumps
	Material of construction	
	Casing, suction bell and impeller	2.5 % Ni-CI to IS 210, FG260
	Shaft/Sleeves	EN-8
	Capacity	10 m ³ /hr with suction and discharge hose of 10m (min)
	Head discharge	10 MWC Head
11.	Impulse tubing	Shall be of SS 304 type
12.	Control System	DDCMIS based control system (BHEL scope)
13.	Lines for various services Valves for Air & Water Lines Fittings, Flanges, Fasteners & Gaskets Velocities	As per Low Pressure Piping Specification

12.0 **MILL REJECT HANDLING SYSTEM**

12.1 **System Description**

12.1.1 The scope of Mill Reject System shall include collection of mill rejects from mills and transportation of the same to storage bunker through dense phase pneumatic conveying system. From storage silo the mill rejects shall be disposed off in trucks.

12.1.2 The scope of supply includes the following:

- One (1) no. pyrite hopper with discharge chute, emergency chute work etc for each mill as required.
- Two (2) nos. pneumatically operated isolation gates for inlet & outlet of pyrite hoppers complete with compressed air pipework, solenoid valves & supporting arrangement for each pyrite hopper.
- Conveying pipework from individual mill reject handling equipment to the reject storage silos with all accessories like bends, fixtures, flange joints, structural steel supports, anchors/ inserts/ trestles, walkways etc. as required.
- Two nos. of mill reject silos, one for each mill bay shall be provided for each unit. The silo shall be in steel construction. Mill reject handling system shall be designed considering reject generation of 1% of the mill capacity at worst coal firing. Mill reject silo shall be effectively sized for 16 hours storage of reject generated at the above rate considering four mills in the Necessary supporting steel structures, platforms, staircase, manual operated unloading gate, 3mm thk SS Plate liners covering straight length portion and conical portion of mill reject storage hoppers (bunkers), level switches, air relief devices etc shall be provided. The storage silos shall be designed to provide a clear access of 4.5 m for a road tanker/ trucks to come under the silo and receive the rejects using suitable chute work.
- Suitable spray quenching, to cool the mill reject in pyrite hoppers. Quenching water shall be provided from 2 x 100% pumps installed for RO Stage II Reject sump for this purpose.
- Four (4) nos air receivers (2 per unit), each of capacity min 5 cum, with all accessories, interconnecting pipework etc shall be provided.
- Three (3) nos. (2W + 1S) oil free screw compressors, with drives & accessories, to cater to the compressed air requirements of mill reject handling system for two (2) units working simultaneously. Compressors shall be located in the main compressor House.
- Necessary lifting devices of adequate capacity to handle the mill reject handling equipment.
- Complete instrumentation as indicated in Volume V.
- Necessary electrical equipment as required.
- Civil structural works associated with mill reject handling system including foundation bolts, pockets, grouting, underpinning etc.

12.1.2 Each mill shall be provided with collection and transportation equipment comprising of one (1) pyrite hopper with water spray arrangement, valves at inlet and outlet and one (1) mill reject vessel. Each mill reject vessel shall be connected to storage silo through conveying pipeline of MS ERW heavy grade. Storage silo shall be of MS construction with SS liners and shall be provided with discharge gate at its outlet to discharge rejects into a truck. The SS liner shall be 3 mm thick SS 304 material.

Three (3) (2W+1S), oil free, rotary, screw air compressors shall be provided for conveying mill rejects from pyrite hoppers to storage bunker. The instrument air required for operation of various pneumatic valves shall be drawn from plant instrument air header. The water required for cooling of valves and for sparging pyrite hoppers shall be drawn from RO stage II reject water. Radio Frequency type level probes shall be provided in pyrite hopper to start/stop evacuation cycle or for indication.

The conveying velocity of reject shall not be more than 6.0 meters/sec and number of cycles shall not be more than 6 per hour.

12.2 Equipment Description

12.2.1 Pyrite Hopper

One (1) pyrite hopper shall be provided below each bowl mill. The pyrite hopper shall be made of minimum 10 mm thick steel plates conforming to IS 2062. The pyrite hopper shall be provided with one pneumatic cylinder operated plate valve on upstream which will be normally kept in open position. Grid shall be provided in the hopper to prevent passage of over size material to mill reject vessel. One (1) chain/manual operated plate valve shall be provided to remove rejects collected on the grid manually. Pyrite hopper shall be provided with by pass chute with cylinder operated plate type valve to unload the pyrite hoppers on the ground in case of emergency. Pyrite hopper shall be provided with pneumatically operated plate valve on downstream side which is normally kept in open position. Pyrite hopper shall be provided with level probes and temperature switches. Arrangement of nozzles to spray water shall be provided when temperature goes beyond the preset value. The pyrite hopper shall be provided with 3 pneumatic valves (inlet, oversize & bypass) and one manual maintenance valve (outlet). However material handling valve shall be pneumatic as per system requirement. Shall be reviewed DDE. Outket valve of pyrite hopper shall be manual and normally kept open .No valve is provided at outlet of transporting vessel in line with proven design of reputed suppliers. DDE.

12.2.2 Mill Reject Vessel

One (1) mill reject vessel shall be provided for each pyrite hopper to transport mill rejects to storage bunker by means of dense phase conveying system. Transport vessel shall be provided with one cylinder operated inlet valve, outlet vale and air inlet valve. Inlet valve of transport vessel is normally in open position. After lapse of predetermined time or commencement signal by level probe of pyrite hopper, the inlet valve of transport vessel closes and air is injected through air inlet valve and vessel is pressurised. At predetermined pressure rejects are transported to storage bunker through pipeline. At predetermined pressure, the inlet vale opens and air inlet valve closes. This cycle goes on repeat.

12.2.3 Storage Bunker

Two nos. of mill reject silos, one for each mill bay shall be provided for each unit. Mill reject handling system shall be designed considering reject generation of 1% of the mill capacity at worst coal firing. Mill reject silo shall be effectively sized for 16 hours storage of reject generated at the above rate considering four mills in the bay.. The storage bunker shall be provided with stainless steel liners on inner walls. Adequately sized bag filter to vent the transport air to atmosphere, terminal boxes, level probe and pressure relief valve shall be provided over top of storage bunker. Manual operated discharge gate shall be provided at out of storage bunker to unload the rejects into trucks. Easy unloading of rejects into trucks shall be confirmed by the bidder and will be reviewed during detailed engineering.

12.2.4 Air Compressors

Two (2) - oil free, multistage, rotary screw type air compressors, one working and one standby shall be provided to supply air required for conveying mill rejects from transport vessel to storage bunker. The compressors shall be of continuous indoor duty complete with air coolers necessary valves with vent pipe work ducted to a safe discharge outlet. The air pipe work shall be of ERW pipes to IS: 3589/1239 heavy quality construction. At least 10% margin shall be provided on compressor capacity over and above the maximum flow requirement.

12.2.5 Air Receiver

Four (4) nos Air receiver (minimum 5 M³ capacity each) shall be provided for mill rejects handling system. Air receivers shall be designed in accordance with ASME Section-VIII or IS: 2825. Corrosion allowance of 3 mm shall be considered for the design. The air receiver shall be of vertical cylindrical design with dished ends.

The air receiver shall be designed for 1.5 times the compressor discharge pressure.

The air receiver shall have inlet/outlet connections, safety relief valves, fusible plugs, pressure gauges, pressure switch, temperature gauge, flanged pipe connections, inspection manholes with automatic drain traps. Pressure gauges shall be provided at each air inlet line and on air receiver. The air receiver shall have structural platforms for maintenance of safety relief valves and instruments.

12.2.6 Mill Rejects Conveying Pipeline

Rejects conveying pipeline shall be MS ERW heavy grade to IS: 1239/3589. Pipes shall be jointed by welding and all fittings, bends etc shall be alloy cast iron and the radius of bends shall be not less than 3D.

DATA SHEET FOR MILL REJECT HANDLING SYSTEM

S. No.	Item	Units	Description
1.0	MILL REJECT SYSTEM		
a	Max Lump size of mill rejects	Mm	20
b	Max Rate of Rejects Genrated per mil	TPH	By Bidder (Tentative 1.6TPH)
c	Total No. of Coal Mills per unit	Nos.	By Bidder
d	Temperature of Mill Rejects	Deg C	200 (Max)
e	Sorage Required for mill rejects	Nos.	One no. per unit
f	Bulk Density of mill rejects		
	i) for volume considerations	T/m3	1.6
	ii) for structural considerations	T/m3	2.4
g	Design Extraction rate of mill rejects from pyrite hopper		Mill reject handling system shall be designed considering reject regeneration of 1% of mill capacity at worst coal firing.
h	Mill reject conveying capacity	TPH	Minimum 15
2.0	MILL REJECT HANDLING VALVES		SS 410
a	Type		Dome/ Type/ Swing Type/ Dome
b	Material of construction		
	i) Body		Cast Iron 225 BHN
	ii) Plate/ Disc		10 mm Thk 300 - 350 BHN SS
	iii) Seat		Replaceable type alloy CI or SS smooth finished with 250 BHN hardness
	iv) Method of operation		Solenoid operated pneumatically actuated with provision for manual override facility
3.0	TRANSMITTER VESSEL		
a	Location/ Quantity		Below Pyrite hopper
b	Type		Suitable for dense phase conveying
c	Material of Construction		Cast Iron/ fabricated out of MS plate construction will be as per ASME code for unfired pressure vessels or IS 2825
d	Conveying Pipes		IS 1239 Heavy Grade
e	Bends/ Fittings/ Laterals		Alloy cast iron 400 BHN
4.0	MILL REJECT STORAGE SILOS		
a	Quantity		Two nos. of mill reject silos, one for each mill bay shall be provided for each unit
b	Construction		Steel Construction (MS IS 2062)with 3mm Thk SS 304 lining in conical as well as vertical portion
c	Type of level measurementand indicator		Continuous/ RF Type
5.0	AIR COMPRESSOR		
a	Type		Oil Free Screw type
b	Service		Mill Reject Conveying Air
c	Cooling		Water Cooled (DMCW)

S. No.	Item	Units	Description
d	Quantity		2 nos (1W+1S)
6.0	BAG FILTER		
a	Location/ Quantity		1 no. per silo
b	Type		Reverse pulse jet type
c	Material of Bags		Polyester needle felt of antistatic type
d	Air to cloth ratio	m/min	1
e	Conveying air piping		MS ERW as per IS 1239 Heavy Grade upto 150 NB and IS 3589 above 150 NB.

TECHNICAL SPECIFICATION FOR Conveying Air Compressor
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Material of Construction

a.	Compressor chamber	:	Cast iron coated with corrosion resistant material
b.	Rotor	:	Forged carbon steel coated with corrosion resistant material; 2 nd stage stainless steel
c.	Timing gears	:	Low alloy steel
d.	Inlet throttle valve & housing	:	Aluminium/stainless steel
e.	Shaft seals	:	High alloy steel
f.	Unloading cylinder header	:	Aluminium
g.	Water separator	:	Cast iron
h.	Non return valves	:	Stainless steel spring loaded type
i.	Blow off valve	:	Stainless steel
j.	Safety valve	:	Brass
k.	Tube of blow off cooler	:	Stainless steel type 304
l.	Cooler casing	:	Carbon steel/SG iron
m.	Gear box casing	:	Cast iron/SG iron
n.	Gears	:	Alloy steel
p.	Bearings	:	Oil lubricated antifriction type suitable for at least 40,000 running hours
q.	Shaft seals	:	Floating restrictive ring type design

	TITLE 2X800 MW UPPUR STPP MILL REJECT SYSTEM (PNEUMATIC TYPE) SPECIFIC TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-425-160-A001	
		SECTION - I	
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		Sub Section -IA	Date: Nov 2017

Annexure-B

QUALITY ASSURANCE

QUALITY PLANS, INSPECTION & TESTING PROCEDURE

The following Quality plans/ Check lists of mechanical items are attached for ready reference of supplier.

- a) Local Panel
- b) Transport Vessel
- c) Pyrite Hopper
- d) Terminal Box
- e) Bunker Discharge Gate
- f) Pressure Relief Valve
- g) Air Receiver
- h) Rupture Disc
- i) Chain Pulley Block
- j) Bag Filter
- k) Pipes
- l) ACI Bends
- m) Knife Gate Valves
- n) Sump Pumps
- o) Expansion bellow
- p) Plates & Structures

The inspection requirements indicated in the above QP's / CL's shall be adhered to as a minimum. Inspection requirement of some of the items are also elaborated in the technical specification under Sec-IIA. The QP's for above items as well as other items not listed above but required, as part of the system shall be prepared by the successful bidder in project specific format to be finalised with the successful bidder after award of contract.

Standard Quality Plans of few instruments & motors are enclosed elsewhere in the specification, for compliance by the bidder.

All QP's/CL's shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer / consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

		S/Contactor : Mfr:- Works:-			Manufacturing Quality Plan Item :-Local Panels QAP No. LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Materials CRCA Sheet	Visual	Major	Visual	100%	Appr. Drg / IS: 513	Appr. Drg / IS: 513	IR	-	P	-	-	
		Chem. & Physical.	Major	Chem.& Physical.	100%	Do	Do	TC	¥	V	V	V	
		Thickness	Major	Measurement	100%	App. Drawing	App. Drawing	IR/TC	¥	V	V	V	
2	Bought outs Verification of type, size & Make of FLV unit, PG, PS, SV	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Approved Drawing / Data Sheet	IR/TC	¥	V	V	V	
3	Painting Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	¥	V	V	V	
4	Final Inspection	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	¥	P	W	V	
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	¥	P	W	V	
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	¥	P	W	V	
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	¥	P	W	V	
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	¥	P	W	V	
5	QA Documents	Review	Major	verification	100%	-	-	-					
Manufacturer / Sub Vendor SIGNATURES		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N ->CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document. No.:				
			Name & Signature of Approving Authority with Seal										

		S/Contactor :		Manufacturing Quality Plan				Project:-					
		Mfgr:- Works:-		Item :- Transport vessel QAP No. LOI Nos:- Contractor :- M/s BHEL				Package :- Mill Rejects System Client : Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Dome & dome Valve Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Hardness Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Plates for Vessel	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.3	Insert Seal	Surface Defects Hardness	Major	Visual Measurement	100% 1/Lot	Mfr's Drg. / Std	Mfr's Drg. / Std	- IR	- √	P P/V	- V	- V	
1.4	Shaft	Physical Check Chemical Check	Major	TS & Elongation Chemical Comp.	1/Heat 1/Heat	App. Drg. / IS Std.	App. Drg. / IS Std.	TC	√	P/V	V	V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V V	V V V	Welders to be approved by BHEL / CLIENT
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-	
2.4	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	At Painted Condition
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	√	P/V	W	W	
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

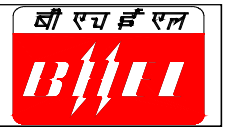
		SI/Contactor :			Manufacturing Quality Plan			Project:-						
		Mfr:- Works:-			Item :- Pyrite Hopper QAP No. LOI Nos Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9	10					11
								TYPE	D	M	C	N		
1	Raw Materials													
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V		
1.2	Spray Nozzle	Surface Defects Chemical Check Dimensions	Major	Visual Chemical Comp. Measurement	100% 1/Lot 100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	- MTC IR	- √ √	P P/V P	- V V	- V V		
2	In - Process Insp.													
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V W	Welders to be approved by BHEL	
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-		
3	Final Inspection													
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W*	W*	* -> Witness 10%	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting shall be Heat Resistance	
4	QA Documentation													
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V		
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-					
							Name & Signature of Approving Authority with Seal							
SIGNATURES														

		S/Contactor :-		Manufacturing Quality Plan				Project:-					
		Mfgr:-		Item :- Terminal Box QAP No. :- LOI Nos:- Contractor :- M/s BHEL				Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
2	In - Process Insp.												
2.1	Welders Qualification & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification	100%	ASME sec - IX	ASME sec - IX	WPS / PQR	√	P/V	V	V	Welders to be approved by BHEL / CLIENT
			Major	DPT on Root run	100%	ASTM E-165	ASTM E-165	IR	√	P/V	V	V	
			Major	DPT on Final run	10%	ASTM E-165	ASTM E-165	IR	√	P/V	W	V	
2.2	Flange Machining and Drilling	Dimensions	Major	Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	If Applicable
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	P/V	V	V		
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			SIGNATURES						Name & Signature of Approving Authority with Seal				

		S/Contactor :-		Manufacturing Quality Plan Item :- Bunker Discharge Gate QAP No. :- LOI Nos:- Contractor :- M/s BHEL				Project:- Package :- Mill Rejects System Client :- Consultant :-					
		Mfgr:- Works:-											
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC	- - √	P P P/V	- - V	- - V	
1.2	Shaft	Physical Check Chemical Check UT If Dia > 50 mm	Major	TS & Elongation Chemical Comp. Internal defect	1/Heat 1/Heat 100%	do	do	TC TC IR	√ √ √	P/V P/V P/V	V V V	V V V	
1.3	Cylinder / Actuator	Visual / Specification	Major	Visual	100%	do	do	Mir's TC	√	V	V	V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	V V V	Welders to be approved by BHEL / CLIENT
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation.TC -Test Certificate,IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-			
				Name & Signature of Approving Authority with Seal									
SIGNATURES													

		S/Contactor :- Mfgr:- Works:-			Manufacturing Quality Plan Item :- Pressure Relief Valve QAP No. : LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- . Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10	11			
								TYPE	D	M	C	K	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - V V	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √ √	P/V P/V P/V P/V	V V W W	V V V V	Welders to be approved by BHEL / CLIENT
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	- - P -	- - P -	P -	- -	- -	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							NAME & SIGNATURE OF APPROVING AUTHORITY WITH SEAL						
SIGNATURES													

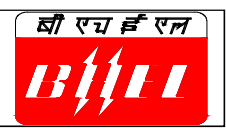
		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Mfrgr:- Works:-			Item :- Air Receiver QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9	10				11
								TYPE	D	M	C	K	
1	<u>Raw Materials</u>												
1.1	Plates for Shell, Dished End & Flange	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - V V	
1.2	Formed Dished End	Dimensions Thickness/Thinning DPT of Knuckle	Major	Measurement Measurement DP Test	100% 100% 100%	App. Drg. / Data Sheet ASTM E-165	App. Drg. / Data Sheet ASTM E-165	IR IR TC	√ √ √	P P P/V	- - V	- - V	
2	<u>In - Process Insp.</u>												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects do do	Major Major Critical	Procedure / Qualification DPT on Root run DPT on Final run Radiography Test on all C/S & L/S including T & X	100% 100% 10% 100%	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class-II / ASME Sec VIII	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class II / ASME Sec VIII	WPS / PQR IR IR RT Film / Report	√ √ √ √	P/V P/V P/V P/V	V V W V	V V W V	Welders to be approved by BHEL / CLIENT
2.2	Fabrication	Marking, Cutting, Rolling, Edge Preparation, Joint & Nozzle set up	Major	Visual, Measurement (Ovality, off set orientation)	100%	Mfr's Standard / Approved Drg.	Mfr's Standard / Approved Drg.	IR	-	P	-	-	
3	<u>Final Inspection</u>												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.2	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	W	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR		P/V	W	-	Painting before disp.
4	<u>QA Documentation</u>												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC -> Test Certificate , IR - Inspection Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						
SIGNATURES													

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Rupture Disc QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Materials -> Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Appved Data Sheet / Drg.	ASTM A240 Type - 304 / Appved Data Sheet	MTC	√	V	V	V	
2	Final Inspection -> Dimension -> Burst Test of Rupture Disc	Measurement Functional	Major Major	Mesurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	√ √	P P	W W	W W	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K ->Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			SIGNATURES						Name & Signature of Approving Authority with Seal				

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item:- CHAIN PULLY BLOCK QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking				Remarks
1	2	3	4	5	6	7	8	9	10				11
								TYPE	D	M	C	K	
1	Materials												
->	Load Chain	Mech. Properties Breaking Load Test, Proof Load test	Major	Review of Mfr's Test Certificate	1 per Lot	IS:6216 /Appr. Drg / Appr. Data sheet	IS:6216 /Appr. Drg / Appr. Data sheet	MTC	√	P/V	V	V	
->	Load Sheave	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:1865 /Appr. Drg / Data sheet	IS:1865 /Appr. Drg / Data sheet	MTC	√	P/V	V	V	
->	Gear & Pinion	Chemical Composition	Major	Lab Analysis	1 per Heat	IS:4432/Appr. Drg / Data sheet	IS:4432/Appr. Drg / Data sheet	MTC	√	P/V	V	V	
->	Hook	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:8610 / IS:1875 /Appr. Drg / Data sheet	IS:8610 / IS:1875 /Appr. Drg / Data sheet	MTC	√	P/V	V	V	
2	In Process												
->	Hook	Proof Load Test	Major	Load Test	100%	IS:8610 /Appr. Drg / Appr. Data sheet	IS:8610 /Appr. Drg / Appr. Data sheet	MTC / IR	√	P	V	V	
		DPT after Load Test	Major	DPT	100%	ASTM E-165	ASTM E-165 / No Defects	IR	√	P	V	V	
3	Final Inspection												
->	Assembly	Operation Check	Major	Visual	100%	Smooth Operation /	Smooth Operation / IS	IR	√	P	W	V	
		Functional Test	Major	Visual	100%	IS 3832 Appr. Drg /	3832 Appr. Drg / Appr.	IR	√	P	W	V	
		Load Test & Over Load Test	Major	Load Test	100%	App. Data Sheet	Data Sheet	IR	√	P	W	V	
		Overall Dimensions	Major	Measurement	100%			IR	√	P	W	V	
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	W	V	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			SIGNATURES							Name & Signature of Approving Authority with Seal			

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Materials												
1.1	Manifold Body / Casings (MS Plate / Sheet / Pipe)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS: 1239 Class Med.	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS : 1239 Class Med.	MTC	√	V	V	V	
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	√	V	V	V	
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	V	
2	In Process												
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	√	P	V	V	** -> DPT & Hydro -Test of Manifold to be witnessed by vendor
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	√	P	V**	V	
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	√	P	V**	V	

Document No.:-

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking					Remarks	
1	2	3	4	5	6	7	8	9		10					11
								TYPE	D	M	C	K			
3	Final Inspection														
3.1	Assembly \$-> Pneumatic Test at 1.1 times W/Pressure	Dimensional Pne. test \$of Manifold in Assly. Functional Test of Pulsing System	Major Major Major	Measurement Leakage by soap solution Pulse Sequence	100% 100% 100%	Appr. Drawing Appr. Data Sheet Appr. Data sheet / Testing Procedure	Appr. Drawing No Leakage Appr. Data sheet / Testing Procedure	IR IR IR	√ √ √	P P P	W W W	V V V	Pressure Drop across Filter Bags & Emission Level at Filter outlet shall be checked at Site		
4	Painting	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	√	P	-	-			
TESTING PROCEDURE TO BAG FILTER															
1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on No - Load Condition to be conducted. 2-> The Soenoid valve shall be connected to the sequential timer and suitable electric supply shall be provided. Air header to be connected to supply of compressed air. The Timer is set and Sequential operation of Solenoid operated valve is observed.															
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-						
							Name & Signature of Approving Authority with Seal								
SIGNATURES															

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

• Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter & casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld.

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- MS GI ERW Pipes (IS:1239/IS3589) QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Final Inspection of Finished Pipes	Physical Dimensional Mechanical Properties Chemical Hydro Test	Major Major Major Major	Visual Measurement Tensile, elongation, Bend or Flattening Chemical Analysis Pressure Testing	100% IS: 4711 1 per heat 100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR IR / TC TC IR / TC	- √ √ √	P P / V P / V P	W* V V W *	V V V W*	* -> Random 5% of offered lot irrespective of size
2	Galvanising (For GI Pipes)	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736	As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	√	P	W #	V	# one sample for each size
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	√	P	W	V	
4	Review of QA Documents	-----	-----	-----	-----	As per QAP	As per QAP	-----	√	V	V	V	
NOTES :- For SAIL Pipes verification of reports for the tests mentioned in Sl. No. 1 & 2 by BHEL & Client For GI Pipes, Galvanising Check as per relevant standard shall be done. All material shall be as per approved data sheet in case of ambiguity in QAP, material as data sheet shall be final.													
Manufacturer / Sub Vendor SIGNATURES		Contractor SIGNATURES	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
							Name & Signature of Approving Authority with Seal						

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- ACI Bends QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :- .					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking				Remarks
1	2	3	4	5	6	7	8	9	10				11
								TYPE	D	M	C	K	
1	Raw Material												
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-	
2	Final Inspection												
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	√	P	V**	V	** Chemical. Analysis to be Witnessed by Vendor
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	W*	W*	* 10% by Vendor / BHEL / CLIENT
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W*	W*	
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	√	P	W*	W*	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			SIGNATURES						Name & Signature of Approving Authority with Seal				

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client :- Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material / Bought Out's												
1.1	Body	Chemical & Mechanical	Major	Foundry TC	1 per Heat	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	√	P/V	V	V	
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	√	P/V	V	V	
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	√	P/V	V	V	
2	In - Process Inspection												
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	V	# -> Test Pressure as per Data Sheet
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	V	
3	Final Inspection												
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	BHEL / Vendor/CLIENT to Witness 10 % of Quantity.
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	√	P	W	W	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	W	
Manufacturer / Sub Vendor SIGNATURES		Contractor SIGNATURES	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
			Name & Signature of Approving Authority with Seal										

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

बी एच ई एल BHEL		S/Contactor :- Manufacturer :-			Manufacturing Quality Plan Item :- Sump Pump QAP No. :- LOI Nos:- Contractor :- M/s BHEL			Project:- Package :- Mill Rejects System Client - Consultant :- .					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	<u>Raw Material / Bought Out's</u>												
1.1	Casing	Chemical, Mechanical, Hardness, Surface Defect	Major	Chem. Comp. Mechanical Hardness Visual	1 per Heat 1 per Heat 1 Per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	V	
1.2	Impeller	do	Major	do	do	do	do	do	√	P/V	V	V	
1.3	Shaft	Chemical, Mechanical, Surface Defect	Major	Chem. Comp. Mechanical Visual & UT if Dia >50 mm	1 per Heat 1 per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388 for UT	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388	do	√	P/V	V	V	
1.4	Shaft Sleeve	Chemical Hardness	Major	Chem. Comp. Hardness	do	do	do	do	√	P/V	V	V	
2	<u>In - Process Inspection</u>												
2.1	Casing	Soundness of Casting / Leakage	Major	Hydro Static Test	100%	Appr drg. / Data Sheet / IS 5120	No Leakage	IR	√	P	V	V	Hyd. Test at 200% of pump rated head or 150% of Shut off head which ever is higher for 30 min.
2.2	Impeller	Residual unbalance	Major	Dyanamic / Static Balancing	100%	Approved Drg / Data Sheet / ISO 1940 Gr. 6.3	ISO 1940 Gr. 6.3	IR	√	P	V	V	

Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	

3	Final Inspection												
3.3	Performance Test with Calibrated Test Lab Motor	Q Vs Head, Power & Efficiency, Noise & Vibration	Major	Measurement & Curves	100%	Approved Drg / Data Sheet / HIS	Approved Drg / Data Sheet / HIS	IR	√	P	W	W	Noise - 85 db max. & Vibration - 50 microns max.
3.2	Pump strip test in case of doubt due to abnormal sound	Undue Wear	Major	Visual / Strip Test	100%	Mfr's Standard	No Undue Wear	IR	√	P	W	W	
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting Schedule	IR	–	P	-	-	
			LEGENDS:-										
			Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report				For Client Use:-		Document No.:-				
Manufacturer / Sub Vendor		Contractor	M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT										
SIGNATURES			P->Perform, V-> Verification, W-> Witness						Name & Signature of Approving Authority with Seal				

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :-EXPANSION BELLOW QAP No. :- LOI Nos:- -			Package :- Mill Rejects System Client :-					
			Contractor :- M/s BHEL			Consultant :-)							
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	K	
1	Raw Material												
1.1	Bellows	physical & Chemical	Major	Lab Analysis	1 per Heat	AS204 TP304/ Approved Drg.	AS204 TP304/ Approved Drg.	MTC	√	V	V	V	
1.2	Fianges/ End Pipe	physical & Chemical	Major	Lab Analysis	1 per lot	IS 2062 / Approved Drg.	IS 2062 / Approved Drg.	MTC	√	V	V	V	
2	In - Process Inspection												
2.1	Bellows & Pipe	Dimension	Major	Measurement	100%	Approved Drg.	Approved Drg.	IR	√	P	V	V	
	** For Bellows	Soundness Of Weld of L-Seam	major	DPT **(Before & After Forming)	100%	ASTM E- 165	No Cracks/ Linear Indication	IR		P	V	V	
3	Final Inspection												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Fiange	Major	visual	100%	ASTM E-165	No Crack / Linear Inication	IR	√	P	W	V	
3.2	Testing	Dimensions pressure	Major Critical	Measurement Hydraulic	100% 100%	Approved Drg EJMA D.3.2.1/ Data sheet	Approved Drg EJMA D.3.2.1/ Approved Drg.	IR IR	√ √	P P	W W	W W	
		Spring Rate Test (Axial)	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	√	P	W	W	
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	√	p	W	W	
3.30	Painting	Visual/ Measurement	Major	DFT	100%	Approved Painting Schedule	Approved Painting Schedule	IR	√	p	-	-	
		LEGENDS:-					For Client Use:-		Document No.:-				
		Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report											
Manufacturer / Sub Vendor		Contractor											
		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT											
SIGNATURES		P->Perform, V-> Verification, W-> Witness					Name & Signature of Approving Authority with Seal						

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

Manufacturer's Name & Address :		MANUFACTURING QUALITY PLAN					Project : BHEL Ref. : Contract No.: Contractor : BHEL SUB-CONTRACTOR-						
		Item : MS Plates & Structures			QP No. : Rev. No. : 0 Date : Page No.: 11 of 1								
Sub-System :													
Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance	Format of Record		Agency			Remarks
1	2	3	4	5	6	7	8	9	D	P	W	V	11
	RAW MATERIAL												
1	Steel Plates	Chemical composition and Mechanical test	Major	Review of corelated MTC	One/heat	IS:2062	IS:2062	Mfgr. TC	✓	3		2,1	Refer Note Below
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC IS 1852	Mfgr. TC	✓	3	2,1		
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	✓	3	2	1	
			LEGEND : 1 - BHEL / CUSTOMER 2 - VENDOR 3 - Manufacturer CR - Critical Characteristics MA - Major Characteristics MI - Minor Characteristics							BHEL Doc. No.			Rev. 0
MANUFACTURER/ SUBCONTRACTOR		CONTRACTOR											
SIGNATURE								REVIEWED BY		NAME & SIGNATURE OF APPROVING AUTHORITY			

Notes:

- 1 In case material is despatched directly from SAIL/TISCO 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 SAIL/TISCO.
- 2 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 each plate at NABL certified/ approved laboratory or any govt approved laboratory for chemical & physical properties, However dimensional check shall be witnessed by BHEL.
- 3 There will not be any inspection by CUSTOMER.

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1600 MW (2 units of 800 MW each) Coal Based Thermal Power Station. The Project Site is located in Uppur, Valamavoor and Thiruppalaikudi villages of Thiruvadanai Taluk, Ramanathapuram District.

1.2 Location

The proposed site for main power plant is located at Uppur in Ramnathpuram District of Tamil Nadu.

The nearest Railway station is Thiruppalaikudi Railway Station, 3Kms from site

ECR Connecting Ramanathapuram and Pattukottai is the nearest road access.

The nearest airport is at Madurai at a distance of 140 km.

The nearest port is Tuticorin located at a distance of 130 km.

1.3 Type of Plant

The proposed 2 x 800 MW Super-Critical Power Project consists of coal fired steam generator connected to a reheat type steam turbine generator along with all the required auxiliaries. Circulating cooling water system is envisaged for condenser cooling.

The description and salient technical data of the Steam Generator, Steam Turbine Generator, Auxiliary systems, Electrical, Control & Instrumentation, Civil etc. are explained elsewhere in the specification:

1.4 PROJECT INFORMATION



2 x 800 MW Supercritical Coal Based Uppur
Thermal Power Project
Spec. No. SE/E/T&H(P)/OT No.01 /2015-16



1.1	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)	
1.2	Project Title	:	2 x 800 MW Uppur Thermal Power Project	
1.3	Owner's Engineer	:	Desein Private Limited; New Delhi	
1.4	Project Site Location	:	Place	Uppur
			State	Tamil Nadu
			Country	India
1.5	Nearest Railway Station	:	Ramanathapuram at 28 KM away	
1.6	Nearest City	:	Ramanathapuram	
1.7	Nearest Highway	:	ECR Connecting Ramanathapuram and Pattukottai	
1.8	Nearest Airport	:	Domestic air port at Madurai (140 KM)	
1.9	Nearest Sea Port	:	Tuticorin Port (130 KM)	
1.10	Site Elevation	:	+ 4.5 m	
1.11	CLIMATOLOGICAL DATA	:		
i.)	HIGHEST TEMPERATURE RECORDED	:	37.8°C	
ii.)	MINIMUM TEMPERATURE RECORDED	:	22.3°C	
iii.)	DRY BULB TEMPERATURE (DBT) FOR DESIGN PURPOSE	:	30 ± 10°C 50°C (for electrical equipment)	
iv.)	RELATIVE HUMIDITY FOR DESIGN PURPOSE	:	75 ± 15%	
v.)	ANNUAL RAINFALL	:	827 mm (avg.)	
1.12	Source of Water (Distance from site)	:	Sea	
1.13	Primary Fuel & Source	:	Imported Coal (Indonesia and S. Africa)	
1.14	Startup Fuel & Source	:	HFO/ L.D.O. (Domestic)	
1.15	Earthquake Data	:	Zone III as defined in IS: 1893-2002	

1.5 Access to Site

Site is well connected and located along ECR Connecting Ramanathapuram and Pattukottai. Site is well connected by rail also.

1.6 Plant Rating, Capacity, Availability, PLF



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Each of the two units shall have a Turbine maximum continuous rating (TMCR) of 800 MW at generator terminals based on the following site conditions.

- Ambient air temperature
- Condenser cooling water inlet temperature of 33°C and 9°C temperature rise across the condenser.
- Generator power factor of 0.85.
- Fuel specification as given elsewhere.
- Design temperature for electrical equipment is 50°C.

The VVO capacity of the steam turbine shall not be less than 105% of TMCR flow at rated parameters. Boiler maximum Continuous Rating (BMCR) will be established to match the steam flow at VVO conditions, but BMCR flow shall not less than 108% of TMCR flow.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc.

The plant load factor (PLF) being considered is 85%.

1.7 Power Evacuation

Power will be evacuated from the proposed thermal power station at 765 KV voltage level through 765 KV transmission lines. The power evacuation lines would be double circuit 765 KV lines which will act as Line in & Line out circuit.

1.8 Site Selection

The following factors which influence the project site selection have been found very favourable to establish and operate the project.

- a. Availability of fuel.
- b. Existing power plant
- c. Availability of adequate cooling water.
- d. Availability of adequate land for locating the power plant with approach roads.
- e. Suitability of land from topographical and geological aspects
- f. Proximity of National Highways, Ports & Transport of fuel & heavy equipment.
- g. Facility for interconnection with transmission and distribution system for evacuation of power.
- h. Environmental aspects.

Total land required for the project is approx. 900 acres which is under the possession of TANGEDCO.

1.9 Fuel

1.9.1 Source of Fuel



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Coal shall sourced from Indonesia or any other source Domestic coal requirement for the power plant will be sourced from coal mines in Orissa.

The steam generator shall be designed for the following conditions :

- **Best Coal** – 100% Imported Coal
- **Design Coal** – 70% Imported & 30% Domestic Coal
- **Worst Coal** – 50% Imported & 50% Domestic Coal

The analysis of fuel is given below :

1.9.2

Coal Analysis:

Coal Quality Parameters

SL.NO	DESCRIPTION	DOMESTIC COAL	IMPORTED COAL
1.	HIGHER HEATING VALUE -As Fired basis given Kcal/kg	2800 (GCV as received basis)	6250 (GCV Air dried basis) 5642 (as received basis)
2.	TOTAL MOISTURE %	During rainy season 20% (inherent + surface)	16.5%
3.	HGI* Abrasiveness expected YGP Shale and sand stone content Feed coal size	45 to 55 Average 52 50 to 70 mg/kg 20% max. upto 50 mm.	51

* for SG design the belnded coal is the weighted average of the parent coal. For mill design HGI 45 shall be considered,

DOMESTIC COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis		
1.	Moisture	%	16.00
2.	Volatile Matter	%	19.00
3.	Ash	%	45.00
4.	Fixed carbon	%	20.00
	Total	%	100
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	27.70
2.	Hydrogen	%	2.60
3.	Nitrogen	%	0.52
4.	Oxygen	%	7.26
5.	Sulphur	%	0.50
6.	Ash	%	45.00
7.	Moisture	%	16.00



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Sr. No.	Particulars	Units	Parameters
8.	Carbonates	%	0.38
9.	Phosphorous	%	0.04
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1100
2.	Spherical, ST	deg C	1200
3.	Hemispherical, HT	deg C	1300
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	Sio2	%	59.54
2.	Al 2 O3	%	29.00
3.	Fe2O3	%	6.42
4.	CaO	%	1.50
5.	Na2O	%	0.08
6.	K2O	%	-
7.	TiO2	%	1.60
8.	SO3	%	0.25
9.	P2O5	%	0.51
10.	MgO	%	0.50
11.	Others	%	0.60
12.	Total		100.00
E	Resistivity of fly ash	Ohm - cm	1.73x 10 ¹²

IMPORTED COAL

Sr. No.	Particulars	Units	Parameters
A.	Proximate Analysis (As received)		
1.	Moisture	%	16.50
2.	Volatile Matter	%	36.45
3.	Ash	%	6.62
4.	Fixed carbon	%	40.43
5.	Total	%	100.00
B.	ULTIMATE ANALYSIS, % (As received)		
1.	Carbon	%	60.12
2.	Hydrogen	%	4.38
3.	Nitrogen	%	1.48
4.	Oxygen	%	10.37
5.	Sulphur	%	0.53
6.	Ash	%	6.62
7.	Moisture	%	16.5
8.	Carbonates	%	-
9.	Phosphorous	%	-
10.	Others	%	-
	Total	%	100.00
C.	Ash fusion temperature	deg C	
1.	Initial deformation, IT	deg C	1230
2.	Spherical, ST	deg C	1270



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Sr. No.	Particulars	Units	Parameters
3.	Hemispherical, HT	deg C	1320
4.	Fluid, FT	deg C	-
D.	Ash Analysis, %		
1.	SiO ₂	%	36.00
2.	Al ₂ O ₃	%	13.90
3.	Fe ₂ O ₃	%	14.80
4.	CaO	%	12.70
5.	Na ₂ O	%	0.70
6.	K ₂ O	%	1.70
7.	TiO ₂	%	0.80
8.	SO ₃	%	10.60
9.	P ₂ O ₅	%	0.20
10.	MgO	%	8.60
11.	Others	%	-
12.	Total	%	100.00

The plant should be suitable to accept imported coal sourced from any country. The limiting parameters of imported coal are furnished below :

S. No.	Particulars	Unit	Parameter
1	Total Moisture (ARB)	%	Up to 23 (Max)
2	Ash (ADB)	%	Up to 20 (Max)
3	Gross Calorific Value (ADB)	Kcal / Kg	5800 - 6500
4	Sulphur (ADB)	%	Up to 1 (Max)
5	Fixed Carbon (ADB)	%	30-50
6	Volatile Matter (ADB)	%	25-45
7	HGI		45-60
8	IDT (Under Reducing Atmosphere)	Deg C	1100-1250
9	Size	Mm	< 50

Note: ADB stands for “As dried Basis” and ARB for “As Received Basis”

1.9.3

Specification of LDO

Specific gravity @ 15° C	0.8348
Gross calorific value, Kcal/kg	10400
Pour point “°C” max.	12
Flash point “°C” min.	66
Sulphur % “T” max.	0.5
K. Viscosity in Centistokes @ 50° C max.	7.5
Ash by wt. %	0.01
Water & sediment Vol. Max. %	0.25



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1.9.4 Specification of HFO

Flash point “°C” min.	66
K. Viscosity in Centistokes @ 50° C max.	370
Ash by wt. %	0.1
Water content by volume % max	1
Sediment by weight % max	0.25
Total Sulphur by weight % max	4.5
Gross calorific value, Kcal/kg	10800

1.9.5 Fuel Linkage

Coal is proposed to be imported from Indonesia or any other country and blended with domestic coal.

1.9.6 Fuel Transportation

The coal shall be received at Tuticorin port and transported by rail from there.

1.10 Source Of Water**1.10.1 Source**

The raw water intake shall be from Bay of Bengal.

1.10.2 Chemical analysis of Sea Water:

S.No.	Parameters	Value (ppm)
1.	Total Solids	35,000
2.	Dissolved solids	21,620
3.	Suspended Solids	580
4.	Ignited residue	17,500
5.	Volatiles Solids	4,700
6.	Acid Insolubles	112
7.	Chlorides (as Cl)	20,232
8.	Sulphates (as SO ₄)	1,457
9.	Iron (as Fe)	70
10.	Total alkalinity (as CaCO ₃)	525
11.	Alkalinity due to Normal Carbonates (as CaCO ₃)	Nil
12.	Alkalinity due to bi-Carbonates (as CaCO ₃)	525



13.	Total hardness (as CaCO ₃)	8,155
14.	Permanent hardness (as CaCO ₃)	6,200
15.	Temporary hardness (as CaCO ₃)	1,955
16.	Calcium hardness (as CaCO ₃)	1,255
17.	Magnesium hardness (as CaCO ₃)	6,900
18.	P _H	8.2

1.10.3 Requirement

The requirement of water for the plant will be for meeting the requirement of make up for the re-circulating cooling water system, dust suppression system in coal handling plants, ash disposal system and the RO/ D.M. water plant which will be supplying the power cycle make up requirements, etc. In addition the water requirements will be for drinking and service purposes. Water requirement is estimated as approx. 18000 m³/hr.

1.11 Source of Equipment

The proposed plant will be supplied, erected and commissioned on EPC basis with BTG & BOP as separate packages..

1.12 Power Evacuation Plan

Power will be evacuated from the proposed thermal power station at 765 KV voltage level and fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO). The Karaikudi substation is about 40 KM north west of the plant.

1.13 Average Yearly Generation

The average yearly generation is calculated considering the following.

- The expected plant load factor is 85 %. With this PLF the average yearly generation will be around 11914 Million units.

1.14 INFORMATION FOR ENVIRONMENTAL APPRAISAL

1.0 GENERAL INFORMATION ABOUT THE PROJECT

- 1.1 Name / Title of the Project : 2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project
- 1.2 Name of Owner : Tamilnadu Generation and Distribution Corporation (TANGEDCO)



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- 1.3 Location of the Project : Uppur, Valamavoor and Thiruppalaikudi Villages, Ramanathapuram District, Tamil Nadu
- 1.4 Capacity of the project under consideration : 2x 800MW
- 1.4.1 Govt. land / Private land / others : Land being acquired
- 1.45.2 Topographical feature, demographic profile & physiography : Refer Volume VI
- 1.5.3 Nature of soil : Clayey soil
- 1.5.4 Distance from the nearest town / city / major human settlements : Madurai – 140 KM
- 1.5.5 Population to be displaced : Nil
- 1.5.6 Distance from water source : Approx. 1 km
- 1.5.7 Area of forest land, if involved : Nil
- 1.5.8 Distance of forest from the site : N.A
- 1.6 Is this an extension? : No
If so indicate capacity of existing plant
- 1.7 What is the ultimate capacity envisaged : 2 x 800 MW
- 2.0 GENERAL ENVIRONMENTAL INFORMATION**
- 2.1 Area of the land proposed to be acquired : Refer Plot Plan Land already acquired
- i. Area required for plant : 900 Acres
- ii. Ash disposal : 100 % dry fly ash disposal and 100% wet bottom ash disposal is envisaged to existing ash pond.



- iii. Plant facilities : The area is adequate for locating all the required systems for 2x800 MW.
- 2.2 Area proposed to be built-up or developed : Power station will be built-up in the proposed site as indicated in the plot plan.
- 2.3 Specify site characteristics River basin/ estuarine / coastal / others : Site is adjacent to Bay of Bengal
- 2.4 Is the site situated in the forest area? Give following details : No
- 2.4.1 Area : N.A
- 2.4.2 Type of forests : N.A
- 2.5 Is site situated near to the forests? Give the distance from the site. : N.A.
- 2.6 Give a description of the flora within 25 km of your plant site under the following heads :
- a. Crops :
b. Forest :
c. Grass land :
d. Endangered species :
e. Others (Specify) :
- 2.6.2 Give details of the following features, if they exist, within a radius of 25 km of the proposed site? :
- i. Fisheries :
ii. Sanctuary / natural park biosphere reserve :
iii. Lakes / ponds / reservoir :
iv. Stream / river :
v. Estuary / sea : Bay of Bengal is 1 km from site
vi. Hills / mountains :
vii. Historic / cultural / tourist / archaeological scenic :

Refer details in the specification elsewhere.



sites / defence
installations

2.7 Human settlement :

2.7.1 Total number of persons :
proposed to be employed

i. During construction : 2500

1200(0.75person/MW) TANGEDCO

ii. During operation : direct employees



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SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
I	SELF MFG ITEMS			
1.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	IN CASE BID HAS BEEN SUBMITTED ON COLLABORATION ROUTE, ITEMS IDENTIFIED UNDER SELF-MANUFACTURED ITEMS SHALL BE SOURCED FROM COLLABORATOR/ PRINCIPAL/ APPROVED AND PROVEN SOURCES OF PRINCIPAL
2.	DENSEVEYOR	SUPPLIERS/SUB-VENDORS		
3.	BUNKER DISCHARGE GATE (SECTOR GATE)	SUPPLIERS/SUB-VENDORS		
4.	TERMINAL BOX	SUPPLIERS/SUB-VENDORS		
5.	PRESSURE RELIEF VALVE	SUPPLIERS/SUB-VENDORS		
6.	PNEUMATIC PANEL	SUPPLIERS/SUB-VENDORS		
7.	PYRITE HOPPER	SUPPLIERS/SUB-VENDORS		
II	BOUGHT OUT ITEMS			
A	MECHANICAL			
1.	BAG FILTER	ORIENT FAN (FORMER ACCO)	KOLKATA	
		THERMAX	PUNE	
		BATLIBOI	SURAT	
		FLAKT	MUMBAI	
2.	DRAIN TRAPS	SPIRAX MARSHAL	MUMBAI	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		GREAVES COTTON	MUMBAI	
3.	GATE. GLOBE. CHECK VALVES- C.I	LEADER	JULLANDHAR	
		KBL	KONDAPURI	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	MUMBAI	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		A.V. VALVES LTD	AGRA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		LEADER	JULLANDHAR	
		KBL	KONDAPURI	
		BANKIM	HOWRAH	
		H.SARKAR	HOWRAH	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
4.	GATE. GLOBE. CHECK VALVES- G.M	LEADER	JULLANDHAR	MAIN CONTRACTOR COC ALONG WITH MANUFACTURER STD. TC TO BE SUBMITTED.
		SANT VALVES	JULLANDHAR	
		A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	MUMBAI	
		VALTECH INDUSTRIES		
5.	GATE. GLOBE. CHECK VALVES- C.S / F.S	KSB	COIMBOITORE	
		WEIR BDK	HUBLI	
		FOURESS	MUMBAI	
		LEADER	JULLANDHAR	
		AUDCO (L&T)	CHENNAI	
6.	BALL VALVES	MICRO FINISH	HUBLI	MAIN CONTRACTOR COC ALONGWITH
		WEIR BDK	HUBLI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		PRECISION ENGG.	MUMBAI	MANUFACTURER STD. TC TO BE SUBMITTED.
		WEIR BDK ENGG INDUSTRIES	NEW DELHI	
		FLOW CHEM. INDUSTRIES	AHEMDABAD	UPTO 50 NB 800 CLASS: 350NB 150 CLASS
		AUDCO	CHENNAI	
		AKAY INDIA	HUBLI	UPTO 50NB 800 CLASS
		A V VALVES	AGRA	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS LTD.	CHENNAI	
		ATAM VALVES	JALANDHAR	(1) BALL VALVES: FCS/FSS - 1/2" TO 2" #800 & CCS/CSS - 2.1/2" TO 4" # 150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0
		GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	SIZE UP TO 2" & #800 WITH MOC AS FCS & FSS AND FOR SIZE FROM 65 NB TO 150 NB & #150 WITH MOC AS CCS AND CSS.
		INTERVALVE (INDIA) LTD.	PUNE	STEEL BALL VALVES UPTO 50NB, #800 AND 65NB TO 150NB. #150
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		LEADER VALVES LTD.	JALANDHAR	CAST STEEL UPTO 200 MM, CLASS 150/300.
		DEMBLA VALVES LTD.	THANE	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	FORGED CARBON & ALLOY STEEL BALL VALVES, SCREWED TYPE BALL VALVES RATING 800, SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150, SIZES 65 TO 200 FLANGED TYPE.
		VAAS AUTOMATION	NEW DELHI	
		BELGAUM AQUA VALVE	BELGAUM	
7.	SAFETY RELIEF VALVES	LEADER	JULLUNDHAR	
		BHEL	TRICHY	
		KEYSTONE (TYCO FLOW CONTROL)	HALOL	
8.	MS G.I / ERW PIPES	JINDAL	GHAZIABAD/HISSAR	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		SURYA ROSHNI	BAHADURGARH	UPTO 400 NB
		SAIL	ROURKELA	
		TATA TUBE	JAMSHEDPUR	UPTO 150 NB ERW PIPES AS PER IS 1239
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	SPIRAL WELD SAW AS PER IS 3589
		LALIT PROFILE	THANE	SPIRAL WELD SAW AS PER IS 3589

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SAMSHI PIPES INDUSTRIES	VADODARA	SPIRAL WELD SAW AS PER IS 3589
		MUKUT PIPES	RAJPURA	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		INDUS TUBES	G B NAGAR	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		MANN IND	INDORE	SPIRAL WELD SAW AS PER IS 3589
		SURENDRA ENGG	RAJPURA	SPIRAL WELD SAW AS PER IS 3589
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	SPIRAL WELD SAW AS PER IS 3589
		JCO GAS PIPE	CHINDWARA	SPIRAL WELD SAW AS PER IS 3589
		NUKAT TANKS AND VESSELS	TARAPUR	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		DADU PIPES	SIKRANDRABAD	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	UPTO 400 NB ERW PIPES AS PER IS 3589 AND SAW AS PER IS 3589
		MAHARASHTRA SEAMLESS	RAIGAD	200-500 NB ERW PIPES AS PER IS 3589
		WELSPUN	ANJAR/BHARUCH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		JINDAL	GHAZIABAD/HISSAR	UPTO 150 NB
		SURYA ROSHNI	BAHADURGARH	UPTO 350 NB ERW PIPES AS PER IS 1239/3589
		SAIL	ROURKELA	UPTO 400 NB
9.	ACI BENDS	CRAWLEY & RAY	HOWRAH	
		MENON METALLICS	PUNE	
		PARAMOUNT	NAGPUR	
		NORTHERN ALLOY	BHAV NAGAR	
10.	PLATE VALVE/KNIFE GATE VALVE (H/W OPTD & CYLINDER OPTD)	VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
		FOURESS	BANGALORE	
		DEZURIKK	CHENNAI	
		JAASH	INDORE	
		VAAS INDUSTRIES	CHENNAI	
		ORBINOX	COIMBATORE	
11.	METTALIC EXPANSION BELLOWS	MB METTALIC BELLOWS	CHENNAI	
		SUR INDUSTRIES	KOLKATA	
		LONE STAR	CHENNAI	
12.	RUPTURE DISC	BS & B SAFETY SYSTEM	CHENNAI	
13.	CHAIN PULLEY BLOCK	HERCULES (INDEF)	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
		LEAP	NEW DELHI	
		TRACTEL	FARIDABAD	
		LIFTING EQUIPMENTS & ACESSORIES	DELHI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
14.	CONVEYING COMPRESSOR (RECIPROCATING)	KIRLOSKAR PNEUMATICS	PUNE	
		INGERSOLL RAND	AHEMDABAD	
	CONVEYING COMPRESSOR (SCREW TYPE)	ELGI	COIMBOITORE	
		ATLAS COPCO	BELGIUM. ASSEMBLY AND TESTING AT PUNE	
		KIRLOSKER PNEUMATIC PUNE	PUNE	
15.	SUMP PUMP (WATER SERVICE)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
		BEST & CROMPTON	CHENNAI	
		SAM	COIMBOITORE	
16.	PNEUMATIC ACTUATOR/ CYLINDER (UP TO 12")	SCHARDER	PUNE	
		NUCON	HYDERABAD	
		VASS	CHENNAI	
		ROTEX	MUMBAI	
17.	MS PLATES / STRUCTURES & SS LINERS (REFER NOTE - 3)	SAIL		
		ISPAT INDUSTRIES		
		ESSAR STEEL		
		IISCO		
		JSW		
		RINL		
		LLOYD STEEL INDUSTRIES LTD.		
		TISCO		
		JSPL		
18.	GRATING	INDIANA	PUNE	
19.	TOOLS AND TACKLES	BRANDED		
20.	AIR RECEIVER	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	SELF-MANUFACTURING
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
		UNITED ENGG WORKS	NASIK	
		INTIGRATED ENGINEERS	PUNE	
		DIAMOND FABRICATOR	PUNE	
		SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
		PARKAIRE	NEW DELHI	
		TEMASME VESELLEX	NOIDA	
21.	STRAINERS (Y-TYPE & BASKET TYPE)	MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING CO.	DELHI	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		FILTRATION ENGINEERS (I) PVT. LTD.	MUMBAI	
		OTOKLIN GLOBAL BUSINESS	MUMBAI	

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LIMITED		
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NOIDA	
		SAROJINI ENTERPRISES	KOLKATA	
		OTOKLIN FILTERS	MUMBAI	
		BHATIA ENGINEERING CO.	DELHI	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
22.	DRAIN PUMP (SUBMERSIBLE)	SU MOTORS	MUMBAI	MAIN CONTRACTOR COC ALONGWITH MANUFACTURER STD. TC TO BE SUBMITTED.
23.	HORIZONTAL/VERTICAL CENTRIFUGAL PUMP	KBL	KIROLSKARWADI	
		M&P	PUNE	
		FLOWMORE	GHAZIABAD	
		SULZER PUMPS INDIA LTD.	NAVI MUMBAI	
		WORTHINGTON	GHAZIABAD	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
	VERTICAL CENTRIFUGAL PUMP	KISHORE PUMP	PUNE	
		SAM TURBO	COIMBATORE	
		KSB	PUNE	
		BEST AND CROMPTON	CHENNAI	
		VOLTAS	MUMBAI	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING, CHINA	
24.	FITTINGS	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
25.	S.S. PIPES (FOR SMALL QUANTITY 500 M)	REMI	MUMBAI	
		RATMANI	AHMEDABAD	
		APEX TUBES	BEHROR	
		CHOKSI	AHMEDABAD	
26.	STEEL PLATE, STRUCTURAL STEEL AND SECTION FOR FIRE WATER STORAGE TANK	SAIL	ANY PLANT	FOR SMALL QUANTITY: AUTHORISED STOCKIST/ DEALER OF APPROVED LISTED MAKES FOR WHICH TCS/IRS WILL BE FURNISHED
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
27.	GEARED MOTOR	PBL	ANAND - V.V NAGAR	
		PREMIUM	PUNE	
		BONFIGLIOLI	CHENNAI	
		SEW	GERMANY	
		IC	AURANGABAD	
28.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDRABAD	
		HERCULES HOISTS LTD.	KHALAPUR	UPTO 25.0 T CAPACITY.
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	DELHI	
		MEEKA MACHINERY PVT. LTD.	AHEMDABAD	UPTO 15 TONNES.
		REVA INDUSTRIES LTD.	FARIDABAD	
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHEMDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	
		TECHNO INDUSTRIES	AHEMDABAD	
29.	MRHS - SILO	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS/ SITE	
30.	FQP RECEIPT, STORAGE & ERECTION	SUPPLIERS/SUB-VENDORS	VENDORS MFR. WORKS	
B	ELECTRICAL & INSTRUMENTATION			
1.	MOTORS	SIEMENS	MUMBAI	FOR HT AND LT MOTOR
		NGEF	BANGALORE	UP TO 15KW
		KEC	BANGALORE/HUBLI	HUBLI UP TO 90KW
		CGL	AHEMAD NAGAR	
		ABB	FARIDABAD/ BANGALORE	FARIDABAD UP TO 55KW, BANGALORE ABOVE 55KW & UP TO 200KW.
		MARATHON	KOLKATA	FOR HT AND LT MOTOR
		CROMPTON GREEVES	AHMEDABAD	FOR HT AND LT MOTOR
		JYOTI	VADODARA	FOR LT MOTOR ONLY
		LHP	SOLAPUR	UP TO 120 KW
		BHEL	BHOPAL	FOR HT MOTOR ONLY
		BHARAT ELECTRIC (BHEL)		FOR LT MOTOR ONLY

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		BBL	MUMBAI	UP TO 160KW (LT MOTOR ONLY)
2.	ANNUNCIATORS	IIC	MUMBAI	
		PECON	AHEMDABAD	
		PROCON	CHENNAI	
3.	PULSE VALVE	ASCO	CHENNAI	
		MANIK	PUNE	
4.	CABLE GLANDS	SUNIL & CO.	KOLKATTA	
		ARUP ENGG.	KOLKATTA	
		QUALITY PRECISION	KOLKATTA	
		COMET	MUMBAI	
5.	CABLE LUGS	DOWELLS	MUMBAI	
		BILLET (3D)	VALSAD	
		WAGO	INDIA	
		COMET	MUMBAI	
		CHETNA	NASHIK	
6.	MICRO-PROCESSOR / MICRO-CONTROLLER	ALLEN BRADLY	BANGALORE	
		SIEMENS	BANGALORE	
		GE	BANGALORE	
		SCHENIDER	BANGALORE	
7.	CABLE TERM.& JOINT KITS	3M ELECTRO AND COMMUNICATION INDIA P.LTD	RAJENDRA PLACE, DELHI	CABLE TERM.& JOINT KITS
		HARI CONSOLIDATED PVT.LTD.,NEW DELHI	JHANDEWALAN, NEW DELHI-DELHI	
		RAYCHEM RPG PRIVATE LIMITED	JANAKPURI NEW DELHI	
		YAMUNA CABLE ACCESSORIES PVT. LTD.	AMBALA ROAD, JAGADHRI YAMUNANAGAR-HARYANA	
8.	PAINT	ASIAN PAINTS (I) LTD.	ANY PLANT	
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

SUB-VENDOR LIST MILL REJECT HANDLING SYSTEM (PNEUMATIC TYPE)

2. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.



TITLE TECHNICAL SPECIFICATION OF MILL REJECT HANDLING SYSTEM 2X800MW UPPUR TPP	DOCUMENT NO. PE-TS-425-160-A001	
	REV	0
	SHEET	

2X800MW UPPUR TPP		
Mandatory spares list for Mill Reject Handling System		
Sl. No.	Equipment Name	Quantity for Two units
I	MECHANICAL	
1	DOME TYPE INLET VALVE	
	DOME SHAPED HEAD FOR INLET VALVE	1 NO
	INFLATABLE SEAL FOR INLET VALVE	4 NOS
	INSERT RING	1 NO
	SPIGOT PIECE	1 NO
	TOP PLATE	1 NO
	EXTERNAL LIP SEAL	4 NOS
	SHAFT SEAL	4 NOS
	O' RING	4 NOS
	SPRING PIN (INNER)	2 NOS
	SPRING PIN (OUTER)	2 NOS
	SET OF GASKET	2 NOS
	PNEUMATIC CYLINDER SEAL KIT	1 NO
	AIR LIMIT SWITCH SEAL KIT	1 NO
	QUICK EXHAUST VALVE DIAPHRAGM FOR SEAL	1 NO
	QUICK EXHAUST VALVE DIAPHRAGM FOR PNEUMATIC CYLINDER	1 NO
	SILENCER FOR VALVE ASSEMBLY	1 NO
2	CONVEYING LINE UPTO SILO TOP	
	PIPE LINE FITTINGS, BENDS, SPOOL PIECES	8 NOS. FOR EACH SIZE AND TYPE.
3	KNIFE TYPE ISOLATION VALVE	
	ASSEMBLY OF GATE	2 NOS
	SLIDE GATE	2 NOS
	VALVE STEM	2 NOS
4	ACTUATORS COMPLETE WITH MOTOR FOR ALL MOTORIZED VALVES OF EACH TYPE AND RATING.	5 % IN EACH SIZE, TYPE RATING & MAKE.
5	REVERSE PULSE JET BAG FILTER	
	FILTER BAGS	8 NOS
	PULSE VALVE COIL	2 NOS
	PULSE VALVE DIAPHRAGM	2 NOS
	SPRAY NOZZLE FOR SURGE HOPPER	4 NOS
6	AIR COMPRESSOR	
6.1	DRY AIR INTAKE FILTER	2 NOS
6.2	COMPLETE SET OF LOADING – UNLOADING VALVE ASSEMBLY	2 SETS
6.3	LOW PRESSURE COMPRESSOR ELEMENT	1 SET
6.4	HIGH PRESSURE COMPRESSOR ELEMENT	1 SET
6.5	INTER COOLER TUBE BUNCH	1 SET
6.6	AFTER COOLER TUBE BUNCH	1 SET
6.7	AUTOMATIC PURGE DRAIN VALVE FOR INTER COOLER AND AFTER COOLER(AUTO DRAIN TRAP)	1 SET
6.8	AIR OUTLET CHECK VALVE	2 SETS
6.9	RUBBER AIR OUTLET COMPENSATOR	1 SET
6.10	LUBE OIL FILTER	2 SETS
6.11	LUBE OIL PRESSURE REGULATING VALVE	1 SET



TITLE

**TECHNICAL SPECIFICATION
OF
MILL REJECT HANDLING SYSTEM
2X800MW UPPUR TPP**

DOCUMENT NO. PE-TS-425-160-A001

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SHEET

6.12	DIFFERENTIAL OIL SEALS FOR LUBE OIL SYSTEM	2 SETS
6.13	COOLING WATER INLET AND OUTLET CONNECTION RUBBER BELLOWS	2 SETS
6.14	GEAR BOX COMPONENT	
6.14.1	DIFFERENT OIL SEALS	2 SETS
6.14.2	SET OF BEARINGS	1 SET
6.14.3	BREATHING SYSTEM	2 SETS
6.15	COMPONENTS OF L.P ELEMENTS	
6.15.1	GEAR PINION	1 SET
6.16	COMPONENT OF HP ELEMENT	
6.16.1	GEAR SETS	1 SET
6.16.2	DIFFERENT SAFETY VALVES	1 SET
6.16.3	FLEXIBLE RUBBER STUD COUPLINGS FOR COUPLING COMPRESSOR TO THE MOTOR	1 SET.

MANDATORY SPARES

1.0. SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

1.1. MANDATORY SPARES

- a) The bidder shall indicate the prices for each and every item (except for items not applicable to the bidder's design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules.

Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

- b) The Employer reserves the right to buy any or all the mandatory spares parts.
- c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.
- d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.2. RECOMMENDED SPARES

- a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.



- b) Price of recommended spares will not be used for evaluation of the bids. The price of these spars will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

1.3. START-UP & COMMISSIONING SPARES

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

- 1.4. The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.
- 1.5 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
- 1.6 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- 1.7 All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- 1.8 The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalize order for recommended spares.
- 1.9 Each spares part shall be clearly marked or labeled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
- 1.10 All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.



- 1.11 The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipment covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
- 1.12 The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
- 1.13 In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
- 1.14 The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.

GENERAL NOTE:

1. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.
3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as per the list from Volume - II.
4. Identification:

Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.





TITLE
2X800 MW UPPUR STPP
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-425-160-A001
SECTION - I
REV 00
Sub Section -IA
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ANNEXURE-F **MAINTENANCE TOOLS & TACKLES**

Sl.No.	Description	Qty.	Unit
1	Spur geared chain pulley block of 2.0 tonnes capacity , 3 mtr.	1	Nos.
2	2 lbs ball pen hammers	2	Nos.
3	Cold Chisel 8"	2	Nos.
4	6" outside and inside caliperse	2	Nos.
5	Double end spanners and ring spanners upto one inch size	2	Sets
6	6 feet long measuring tape	1	Nos.
7	a Hacksaw frames 1/2" x 12	4	Nos.
	b HSS blade 12 x 1/2"	6	Nos.
	c Hacksaw blades	6	Nos.
8	Allen keys set	2	Sets
9	Pipe wrenches 18"	2	Nos.
10	10" right angle	1	Nos.
11	12" aluminium spirit levels	2	Nos.
12	Filler Gauges - 8" & 12"	2	Sets
13	10" slide wrenches	2	Nos.
14	6",8",10",12" screw drivers	1	Set
15	Insulated Pliers 8"	1	No.
16	Tommy Bars 6"	2	Nos.
17	a) Cotton Hand Gloves	2	Pairs
	b) Lather Hand Gloves	2	Pairs
18	Lifting wire ropeslings 8 ft with eye at each end 1/2 " size and 5/8" size	2	Pair each
19	Wrachet and sockets set for hexagonal head screws & bolts size M-6 to M-24	1	Set
20	Flaring tools with disc	1	Set
21	Grease Gun	1	No
22	Oil Gun	1	No
23	Screw Pitch Gauge	1	No
24	a) JK Flat file 12" smooth	2	Nos.
	b) JK Half round file 12" rough	2	Nos.
	c) JK Half round file 12 " fine	2	Nos.
	d) Square file 12"	2	Nos.
	e) Round File 12"	2	Nos.
25	Line Tester no: 814	2	Nos.
26	a) Cutting Pliers 8"	2	Nos.
	b) Nose Pliers 6"	2	Nos.
27	Soldering iron with flux	1	No.
28	Vice 4" & 12"	1	No. each
29	Taps and Dies	1	No.
30	Steel Scale 12" & 24"	2	each
31	Hand Lamps	2	Nos.
32	Torch with Battery (2 sizes)	2	Nos.

	TITLE 2X800 MW UPPUR STPP MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-425-160-A001	
		SECTION: II	
		REV 00	
		Sub-Section	Date SEP 2017

ANNEXURE –G

PERFORMANCE GAUARNTTEE & LIQUIDATED DAMAGES

Performance Guarantee test shall comprise of

Guarantee Under Category – I

Liquidated damages are applicable for following guarantees:

- i) Guaranteed auxiliary power consumption for conveying air compressor (refer price schedule)
If the contractor is not able to demonstrate the guarantees, CLIENT/ BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after levying liquidated damages.

Guarantee Under Category – III

The parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

- i) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
- ii) Following shall be demonstrated at shop for compressor
 - **Power consumption**, Capacity and discharge pressure of each air compressor
- iii) Following shall be demonstrated at shop for compressor
 - Parallel Operation of air compressor, if applicable
 - Vibration and noise level of air compressors
- iv) Guarantees of all equipment as per approved data sheet & quality plan.
- v) Particulate emission rate from bag filters less than 30 mg/nm³ of air shall be demonstrated at site.
- vi) Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.
- vii) Parallel operation of air compressors, if applicable, shall be demonstrated at site.
- viii) Noise: All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished & installed under these specification, expressed in decibels to a reference of .0002 microbar shall not exceed 85 dba except for –

	TITLE 2X800 MW UPPUR STPP MILL REJECT SYSTEM (PNEUMATIC TYPE) STANDARD TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-TS-425-160-A001	
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- Safety valves & associated vent pipes for which it shall not exceed 105 dba.
- Regulating drain valves in which it shall be limited to 90 dba.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A – weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar, shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

Guarantee under compulsory correction

The contractor shall make every effort to practicable to correct the deficiencies. In case the Contractor fails to meet the guarantees, the equipment / system shall be replaced with the one that shall meet the guaranteed values without any time and cost implication to the Owner. The following items are under compulsory correction.

1. Conveying capacity (tph)
2. Compressor capacity/numbers (NM3/min)

b) Balance 10% of the price of shall be paid within Ninety (90) days from the date of receipt of spares in good conditions at site against a bank guarantee of equivalent amount and valid till 90 days beyond the completion of guarantee period. This payment shall be effected on certifying by Site Engineer, Uppur.

- 9.6 In case of delay in supply/ erection / commissioning, final 10% payment for supply, erection, commissioning of equipments as well as supply of mandatory spares will be released only after recovery of all dues including LD.

9.7 PAYMENT FOR OCTROI DUTY (IF ANY):

- 9.7.1 Octroi duty if any shall be included in the quoted price & hence liability, if any on this account shall be to the contractor's account.

10.0 MANDATORY SPARES:

- 10.1 A list of mandatory spare parts to be supplied by the Contractor is given in Volume-II.

These spares should be dispatched that they are available at site before commencement of trial operation. The value of the mandatory spares shall not exceed 5% of the CIF value of the equipment price to be supplied under this EPC contract. The contractor shall be responsible for safe storage of mandatory spares till completion of PG test and handing over of the plant to TANGEDCO.

10.2 THREE YEARS O&M SPARES:

The contractor in his bid shall furnish the list of spares over and above the mandatory spare required for three years operation and maintenance of the plant and equipments supplied by the contractor, with price inclusive of all taxes and duties including inland transportation and insurance charges as per requirement of clause no. 55.2 of Section-1 and clause no.53.9 of Section 2 of volume 1 of the specifications.

11.0 QUALITY PLAN FOR MANUFACTURE OF EQUIPMENT:

- 11.1 The Quality plan for manufacture is a document, which presents in a tabular form. The Quality Control checks to be exercised by the Contractor during the various stages of manufacture and despatch in order to meet the requirements of this Contract. This plan shall detail the components manufactured, characteristics being controlled and acceptance norms for this characteristic and the agency responsible for performance and witnessing the checks.

- 11.2 After issuance of Letter of Intent (LOI), the contractor shall submit to the Owner, the detailed quality plans to be followed during manufacture of all major equipments. These quality plans shall be discussed mutually and updated by the Contractor taking into consideration the requirement of the Owner. The quality plan when approved shall form a part of the contract. This



document shall be followed for inspection of the concerned equipment.

- 11.3 The details of the quality assurance / quality checks envisaged by the Contractor during manufacturing of the equipment supplied by him or procured through his sub-vendors / sub-contractors shall be detailed out in the quality plans to be submitted by the Contractor. The contractor may also furnish any additional information regarding quality assurance / quality checks in the additional sheets, if required. Quality plans for major equipments manufactured by the Contractor or procured through his sub-vendors / sub-contractors shall be submitted during engineering. After approval of the Owner is accorded various quality plans shall be bound as a booklet and shall be submitted to the Owner as soon as possible. The contractor shall ensure that the approved quality plans are followed scrupulously by him and by his sub-vendors / sub-contractors and manufacturing of the items covered under the quality plans shall be taken up only after Owner has approved the quality plan.

12.0 OWNER'S REPRESENTATIVE AT SITE:

- 12.1 SE/Civil/Uppur Projects, "2 x 800 MW Supercritical Coal Based Uppur Thermal Power Project in Ramanathapuram District, Tamil Nadu" shall be the Owner's representative at site and shall act as an In-charge for all the site works. The contractor's Resident Engineer shall report to him for all the day to day works.

13.0 CONSIGNEE

All materials shall be
consigned to:
SE/Civil/Uppur Projects
Tamil Nadu Generation and Distribution Corporation Limited
Uppur
SPP

14.0 PAINTS, CONSUMABLES

- 14.1 Pursuant to the Clause No. 25.0 of Section 3, Volume I, it shall be the responsibility of the contractor to supply all the paints as required.
- 14.2 It shall be the responsibility of The Contractor to supply all consumables like, grease, lubricating oils, all chemicals, ink & graphs for recorders etc., up to satisfactory completion of trial operation and three months thereafter. The Contractor shall also arrange any additional quantities required specifically for the Performance Guarantee Test. Contractor shall furnish specifications of all such consumables to enable the Owner to purchase his future requirements well in advance.

15.0 THIRD PARTY INSPECTION:

- a) Indigenous supplies: - The equipment to be supplied under this Contract shall be inspected during manufacturing as per the quality plan to be



finalized. Material verification and stage inspection at all important stages as well as final testing and inspection fall within this scope. The inspection shall be carried out by a third party inspection agency to be appointed by the Owner for indigenous supplies. The cost towards this inspection shall be borne by the Contractor.

- b) In the case of imported supplies: - For imported materials or non-indigenous supplies, the inspection shall be carried out by a foreign agency of repute to be appointed by the contractor as approved by the Owner. The cost of such inspection shall be borne by the Contractor.

16.0 OPERATION AND MAINTENANCE MANUALS:

- 16.1 For all the equipments supplied by the Contractor, he shall submit to the Owner ten sets of the O&M manuals. The manual shall contain the operational features of the equipment, DOs & DON'Ts, trouble shooting, maintenance schedules for preventive maintenance, detail dimensional drawings, cross sectional drawings, method of assembly etc. to make the Owner's staff acquainted with the equipment as well as to enable them to operate and maintain the same in prescribed manner. Manuals shall contain all information for ordering of the spares, like part name, part no., Drawing/material Specifications, address of the supplier with phone no. & fax no. etc. Contractor shall ensure that these O&M manuals are made available to the Owner well before starting of initial trials of equipment.

16.2 ERECTION MANUALS:

- 16.2.1 In order to enable the engineers of the Owner to supervise the works properly, Contractor shall furnish five copies of erection manuals depicting therein the erection procedure, special precautions to be taken, various clearance to be maintained, erection checks and tests to be carried out before the equipment is put to initial trials.

17.0 SUBMISSION AND APPROVAL OF DRAWINGS:

- 17.1 The contractor shall submit the drawings in sequential order to match with completion of milestone activity. The contractor shall submit all the G.A. drawings, mechanical, electrical and civil drawings, data sheets etc. for approval of the Owner along with the design calculations and general write up wherever involved. The drawings for all the systems shall be properly coordinated. While scrutinizing the drawings, the Owner shall indicate the corrections to be made in these drawings and documents, which the contractor shall incorporate or justify its correctness. The Contractor then shall submit the revised drawings for approval of the Owner. On approval of the same, Contractor shall furnish six copies and soft copy on CD of these approved drawings to the Owner as per the distribution to be intimated. Any delay in approval of drawings by Owner, due to submission of incorrect data, non-submission of data, non-updating the drawings in line with the corrections indicated shall be to the Contractor's account. During the currency of the contract, if any approved drawings are required to be modified, such details of



the modifications required to be carried out shall be separately maintained. On completion of all the works, the Contractor shall incorporate all the changes necessitated in the drawings and submit 6(six) sets of all the "As built" drawing for the records of the Owner. As the drawings shall be approved based on the basic information furnished by the Contractor, approval by the Owner shall not absolve the Contractor of his responsibilities towards correctness of design & performance of the equipment.

18.0 TEST REPORTS

- 18.1 On completion of tests of equipment at manufacturer's works, the Contractor shall furnish 4 copies of test certificates to the Owner for approval and subsequent despatch clearance. The test report shall invariably indicate identification data, including model no., sl. no. etc. of the equipment, method of application and duration of test along with test results. Only on approval of these test results by the Owner or Owner's representative, dispatch clearance will be issued for dispatch of material to site.

19.0 FIELD QUALITY PLAN

- 19.1 Erection shall be carried out as per ECC, manufacturer's manual, approved quality plan & best practices of the industry. After completing erection of individual equipment, the equipment shall be tested for starting up. The list of all the inspections, tests to be carried out before starting up of the equipment shall be mutually decided. Subsequent to these tests, the equipment shall be tried as a sub system and further as a system as a whole. All the inspections and tests to be carried during these stages shall be mutually decided and as per the best practices. This schedule of inspections and the tests shall be called as field quality plan and Contractor shall follow the same during various stages of erection, testing and operations.

20.0 COMMISSIONING AND HANDING OVER

20.1 INITIAL TRIAL:

On completion of erection of equipment, each item of the equipment shall be thoroughly cleaned and inspected jointly by the Owner / Consultant and Contractor for correctness and completeness of installation and acceptability for initial trials of the equipment by the Contractor & Owner. During the above joint walk down, the list of equipment deficiency & defects shall be prepared and for such a punch list, action shall be initiated by the Contractor in agreed time frame. The list of tests to be performed prior to initial trials shall be mutually agreed and included in the Field Quality Plan by Contractor. The purpose of these trials is to ensure integrity of each individual equipment for its operation in the system for initial operation.

20.2 INITIAL OPERATION:

After successful initial trials of all the individual equipment, all equipments shall be operated together as a system. The purpose of this initial



operation is to ensure integrity of all the sub-systems which compose the total system. Based on the observations made during initial operation, necessary corrections shall be effected in the equipment / systems to ensure proper integrated operation of the system. After satisfactory completion of initial operation for each equipment & sub-system, the complete equipment shall be considered ready for trial operation. During initial operation, any adjustments/calibrations to the instruments fitted in the new system shall be done in the presence of testing staff of Owner so as to enable them to familiarize themselves with its adjustments and maintenance. The Contractor has also to ensure that he trains Owner's Engineers at site dealing with this system in proper way.

20.3 TRIAL OPERATION:

- 20.3.1 After satisfactory initial operation, the plant shall be put on trial operation. The period of trial operation shall be Thirty (30) days of which minimum continuous seventy two (72) hours shall be at full load. During the period of trial operation, all the necessary adjustments in the plant / equipments shall be made by the Contractor to establish that the complete system as a whole with all sub-systems and with all standby equipment is ready for continuous operation. During these trials, all the standby equipments also shall be run alternatively and continuously for 14 days to prove their performance. During this period, the Contractor shall demonstrate capabilities of his supplied equipment as indicated in the specification or in subsequent discussions. Duration of Breakdown due to grid disturbances will not be reckoned as interruption.
- 20.3.2 A trial operation report comprising of dates and duration of trial, observations and recordings of various parameters to be measured shall be prepared by the Contractor and signed jointly by the Owner and the Contractor. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the trial operation. If the trial operation is established to be satisfactory, except for some minor adjustments, if any, the plant shall be taken over by the Owner for day to day operation and maintenance from the date of conclusion of trial operation. If the trial operation is not satisfactory, then based on the observations during trial operation, necessary modification / repairs to the plant / equipment shall be carried out by the Contractor and on completion of such works, the trial operation shall be repeated again on a date and for a period for 28 days as per clause no. 20.3.1 mentioned above.
- 20.4 After the trial operation is carried out successfully, to declare it as such, a joint protocol should be signed between TANGEDCO and the Contractor.
- 20.5 The goods supplied under the contract shall be fully insured up to 3 months from the date of taking over of the plant. However in case the trial operation is extended due to reasons attributable to the Owner, then the insurance policy shall be extended by the Contractor till successful completion of trial operation / taking over of the plant and the actual premium charges towards this extension of insurance policy shall be reimbursed by the Owner to the Contractor without any handling charges.



21.0 PERFORMANCE GUARANTEE TEST

- 21.1 After satisfactory completion of the trial operation, the performance test shall be conducted at site by the Contractor. Any preparations required for this test shall be carried out by the Contractor for which Owner will provide required shutdown. The duration of the Performance Guarantee Test of the Plant at the rated capacity shall be mutually agreed. However, a stability period of 2 hours before commencement of test and 2 hours test period followed by another 2 hours stable period shall be maintained. The PG test procedure should be submitted to the owner well in advance and got approved before the commencement of PG test. Performance Guarantee Test shall be conducted within 30 days of intimation from the Contractor about his readiness for conducting Performance Guarantee Test. These tests shall be binding on both the Owner and the Contractor to determine performance of the equipment/system with the performance guarantee data.
- 21.2 The tests shall be conducted at the specified load conditions or as near the specified conditions as practicable. The Owner/Contractor will apply agreed factors to compensate for deviation from the designed parameters. The suitable correction curves mutually agreed by the Owner and the Contractor shall be used.
- 21.3 All test instrumentation as required for the Performance Guarantee Test shall be arranged by the Contractor free of cost. Precision instruments required for Performance Guarantee Test shall, however, be arranged by the contractor. Calibration before and after test and installation of the test instrumentation for the test shall be the Contractor's responsibility. All test instrumentation shall be in accordance with the applicable code. All test instruments and calibration procedures shall be duly approved by the Owner. Batch calibration shall not be accepted. The test shall be commenced only after clearance of owner on the above vital issues.
- 21.4 Any special equipment, tools and tackles required for the successful completion of the performance tests shall be provided by the Contractor free of cost.
- 21.5 The performance guarantee figures of the equipment shall be proved by the Contractor during the Performance Guarantee Test.
- 21.6 Should the results of these tests show any decrease from guaranteed values, the Contractor shall modify the equipment within 90 days from the date of intimation by the owner as required to bring it to meet the guarantees. In such cases, the performance tests shall be repeated within one month from the date on which the equipment is made ready again for tests subject to grid requirements at that time. All costs of modifications including labour, material and the cost of additional testing to prove that equipment meets the guarantee shall be borne by the Contractor.
- 21.7 The provisions outlined in the ASME performance test code or other International and Indian approved equivalents shall generally be used as a



guide for all the above test procedures unless specified otherwise in the specification. The details of all measuring/recording meters, test instrumentation such as class of accuracy, make etc. shall be covered in the trial operation/ performance test reports. All the list of equipments, accuracy class and test certificates to be submitted and got approved by the owner before the commencement of trial operation.

PG test to be witnessed by the consultant and the owner.

- 21.8 The above shall be read in conjunction with Volume – I, Section 1, General Technical Specification on Performance Guarantee Test.

22.0 PERFORMANCE GUARANTEES, PENALTIES & CAPABILITY TESTS

- 22.1 The Contractor shall meet the Performance Guarantees as have been indicated in the Specifications and Schedule thereof.
- 22.2 The penalty for not meeting the performance guarantees during the Performance Guarantee Test shall be assessed and recovered from the Contractor. Such penalty shall be levied without limitations, in accordance with stipulations made in Technical Specification and shall be without prejudice to all the other conditions of the contract.
- 22.3 If the guarantees specified are not achieved by the Contractor within 90 days of notification by the Owner, he may at his discretion reject the equipment or accept it after levying and recovering suitable penalties.
- 22.4 In case there is shortfall in capability of equipment while demonstrating capability tests, the Contractor shall forth-with rectify his equipment within 90 days and re-perform the capability tests to Owner's satisfaction.
- 22.4.1 Any recoveries by the Owner from the Contractor due to shortfall in guaranteed performance shall be independent of provisions of clause no. 6.0 "Liquidated damages of Special Conditions of the Contract. "

23.0 PENALTY FOR POOR PERFORMANCE

- 23.1 The contractor shall furnish performance guarantee as have been specified in Guarantee Schedule under Technical Specification Vol-II. This guarantee shall be met by the Contractor.
- 23.2 The penalty for not meeting the performance guarantees during the Performance Guarantee Tests shall be assessed and recovered from the Contractor as under.

EVALUATION / LOADING CRITERIA & PENALTY TOWARDS SHORTFALL IN PERFORMANCE PARAMETERS:



Sl. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty shortfall for in performance
1.	Minimum Gross Turbine cycle heat rate at 105% TMCR after subtracting excitation power and power of TG integral auxiliaries with following conditions: 1. Cycle make-up : 0% makeup 2. Cooling water inlet temperature of 32.5 deg.C. 3. TDBFP's in operation. 4. Generator powerfactor of 0.85 (Gross Turbine cycle heat rate at 105% TMCR condition is guaranteed after accounting for pressure drop in main steam piping, Reheater system and all extraction steam piping from steam turbine to feed water heaters& deaerator)	Rs.112.74 lakhs per kCal/ kWh increase in heat rate over lowest quoted Heat Rate as base.	Rs. 112.74 lakhs per kCal / kWh or part thereof increase in heat rate from guaranteed value
2.	Minimum Gross Turbine cycle heat rate at 100% TMCR after subtracting excitation power and power of TG integral auxiliaries with following conditions: 1. Cycle make-up : 0% makeup 2. Cooling water inlet temperature of 32.5 deg.C. 3. TDBFP's in operation. 4. Generator powerfactor of 0.85 (Gross Turbine cycle heat rate at 100% TMCR condition is guaranteed after accounting for pressure drop in main steam piping, Reheater system and all extraction steam piping from steam turbine to feed water heaters& deaerator)	Rs. 428.41 lakhs per kCal/ kWh increase in heat rate over lowest quoted Heat Rate as base.	Rs. 428.41 lakhs per kCal / kWh or part thereof increase in heat rate from guaranteed value
3.	Total Auxiliary power consumption for	Rs.4,70,72,094 for every	Rs.4,70,72,094 for



Sl. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty shortfall for in performance
	the plant * (1600 MW) including balance of plant at 100% TMCR condition after subtracting excitation power and power of TG integral auxiliaries with following conditions: 1. Cycle make-up : 0% makeup 2. Cooling water inlet temperature of 32.5 deg.C 3. TDBFP's in operation 4. Generator power factor of 0.85	0.01 % increase (considering 5.5 % Auxiliary Power Consumption as base)	every 0.01 % increase or part thereof from guaranteed value
4.	Capitalization of losses of Transformers (applicable for each transformer separately for the transformers listed below) a) Generator Transformers b) Unit Transformers c) Station Transformers d) Standby/Maintenance Transformer Iron losses Copper losses Cooler pump/fan losses	Rs.3,49,880 /kW Rs.2,89,701 /kW Rs.2,79,904 / kW (considering lowest quoted values as base)	Rs.3,49,880 /kW Rs.2,89,701 /kW Rs.2,79,904 / kW Increase per kW or part thereof from guaranteed value
5.	Gross continuous TG power output at 105% TMCR after subtracting excitation power and power of TG integral auxiliaries with following conditions: (i) Cycle make-up : 0 % makeup (ii) Cooling water inlet temperature of 32.5 Deg C. (iii) TDBFP's in operation	-	Rs 10,55,668 for every kW or part thereof by which output determined by the tests fall short of guaranteed figure of 660 MW



Sl. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty shortfall for in performance
6.	(iv) Generator power factor of 0.85 Condenser Pressure in mm Hg (abs) for dual pressure condenser measured at 300mm above the top row of condenser tubes at 105% TMCR with following conditions. a) Cycle make-up : 1% makeup b) Cooling water inlet temperature of 32.5 deg.C.	-	Rs 97,755,231/- for every per mmHg (abs) increase in vacuum beyond the guaranteed figure.
7.	Steam generator efficiency with following conditions: i) 100% TMCR ii) Firing design coal iii) On Gross Calorific value (GCV) basis iv) At 30 deg C DBT and 75% RH ambient air conditions. v) Excess air at economizer outlet at 100% TMCR load 20% (min.) vi) Corrected flue gas temperature at air preheater outlet (at 100% TMCR) 125°C or as predicted by the Bidder whichever is higher vii) Unburnt fuel at all guaranteed efficiency load i.e. 1.0% (min.) or actual whichever is higher viii) With Out any heat credit	- Rs 9,33,52,000/for every 0.1% (zero point one percent) point shortfall in efficiency considering highest quoted efficiency as base.	Rs 9,33,52,000/for every 0.1% (zero point one percent) point shortfall in efficiency from guaranteed figure
8.	Steam generator efficiency with following conditions: i) 105% TMCR ii) Firing design coal iii) On Gross Calorific value (GCV) basis iv) At 30 deg C DBT and 75% RH	- Rs 2,33,28,000/for every 0.1% (zero point one percent) point shortfall in efficiency considering highest quoted efficiency as base.	Rs 2,33,38,000/for every 0.1% (zero point one percent) point shortfall in efficiency from guaranteed figure



Sl. No.	Variation Factor	Loading for evaluation of shortfall in performance	Penalty shortfall for in performance
	ambient air conditions. v) Excess air at economizer outlet at 105% TMCR load 20% (min.) vi) Corrected flue gas temperature at air preheater outlet (at 100% TMCR) 125°C or as predicted by the Bidder whichever is higher vii) Unburnt fuel at all guaranteed efficiency load i.e. 1.0% (min.) or actual whichever is higher viii) With Out any heat credit		
9.	Boiler Maximum Continuous Rating (BMCR) in TPH of steam at rated steam parameters at superheater outlet & rated steam parameters at reheater outlet with following conditions. a) Any combination of mill working as per Owner choice. b) With range of coal specified.	-	Rs. 22,000,000/- for every 1T/hr shortfall in steam generator output from the guaranteed value.
10.	Life of coal Pulverizer wear parts, in hours of operation, for the entire range of coal characteristics specified. (To be demonstrated as indicated in Volume III).	-	To be calculated as indicated in Volume III.

Note: All above loadings & penalties as mentioned in Col. 3 & 4 shall be calculated on pro-rata basis.

The penalty indicated above is in addition to the liquidated damages as stipulated in clause no.6.0 of this Section.

* The guaranteed auxiliary power consumption shall be furnished as per list at Volume – I, Section 5, Schedule – 15A Guaranteed Auxiliary Power Consumption of Tender document. Bidder shall list out any additional continuous working equipment in addition to the item listed in Schedule – 15A, which are required for the plant to operate at 100% TMCR load.



The bidders are advised to quote practical and realistic performance guarantee values in the bid, failing which the bid is liable for rejection.

24.0 FINAL ACCEPTANCE:

- 24.1 In case Performance Guarantee Test cannot be carried out at specified time due to reasons attributable to Owner, the Plant shall be taken over 180 days after the intimation from the Contractor provided the Owner is satisfied about his readiness for conducting the Performance Guarantee Test. In such case, the Owner shall give an adhoc final acceptance certificate for the purpose of triggering the Guarantee/Defect Liability period which will be subject to revision based on actual PG test results. In such an eventuality, the Owner shall give a notice to the Contractor of his readiness to give necessary inputs to enable the Contractor to do the Performance Guarantee Test, in which case the Contractor shall arrange the Performance Guarantee Test within 30 days on receipt of such notice without any additional financial implication to the Owner.
- 24.2 On conducting the Performance Guarantee Test, if it is established to the satisfaction of the Owner that the equipment is performing as specified in the Technical Specifications, the Owner shall issue to the Contractor a final acceptance certificate indicating the date from which the equipment has been taken over.
- 24.3 Such a certificate shall be given within 30 days after satisfactory completion of the performance guarantee test and PG test results are furnished by the Contractor to prove the achievement of the assured PG values. Owner shall not delay the issuance thereof on account of minor omissions or defects which do not affect the safe and reliable operation and/or cause any risk to the equipment. Such certificate shall, however, not relieve the Contractor of any of his obligations which otherwise survive by the terms and conditions of the contract.



ANNEXURE-H

GENERAL TECHNICAL REQUIREMENTS (AS APPLICABLE)

1.00.00 INTRODUCTION

This part covers technical requirements, which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.

2.00.00 BRAND NAME

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Owner to determine that the products proposed are equivalent to those named.

3.00.00 BASE OFFER & ALTERNATE PROPOSALS

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice may also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Owner. Sufficient amount of information for justifying such proposals shall be furnished to Owner along with the bid to enable the Owner to determine the acceptability of these proposals.

4.00.00 COMPLETENESS OF FACILITIES

4.01.00 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.02.00 All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.00.00 CODES & STANDARDS

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

- (a.) Bureau of Indian Standards (BIS)
- (b.) Indian electricity act
- (c.) Indian electricity rules
- (d.) Indian Explosives Act
- (e.) Indian Factories Act and State Factories Act
- (f.) Indian Boiler Regulations (IBR)
- (g.) Regulations of the Central Pollution Control Board, India
- (h.) Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- (i.) Pollution Control Regulations of Department of Environment, Government of India
- (j.) State Pollution Control Board.
- (k.) Rules for Electrical installation by Tariff Advisory Committee (TAC).
- (l.) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- (a.) Japanese Industrial Standards (JIS)
- (b.) American National Standards Institute (ANSI)
- (c.) American Society of Testing and Materials (ASTM)
- (d.) American Society of Mechanical Engineers (ASME)

- (e.) American Petroleum Institute (API)
- (f.) Standards of the Hydraulic Institute, U.S.A.
- (g.) International Organisation for Standardization (ISO)
- (h.) Tubular Exchanger Manufacturer's Association (TEMA)
- (i.) American Welding Society (AWS)
- (j.) National Electrical Manufacturers Association (NEMA)
- (k.) National Fire Protection Association (NFPA)
- (l.) International Electro-Technical Commission (IEC)
- (m.) Expansion Joint Manufacturers Association (EJMA)
- (n.) Heat Exchange Institute (HEI)

- 5.03.00 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, alongwith the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned else where in the specification together with the complete word to word translation of the standard that is normally not published in English.
- 5.04.00 As regards highly standardized equipment such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.
- 5.05.00 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
- 5.06.00 Two (2) English language copies of all-national and international codes and/or standards used in the design of the plant, equipment, civil and structural works shall be provided by the Bidder to the Owner within two calendar months from the date of the Notification of Award.
- 5.07.00 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Owner shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Bidder to bring to the notice of the Owner such changes and advise Owner of the resulting effect.
- 6.00.00 EQUIPMENT FUNCTIONAL GUARANTEE**

- 6.01.00 The Equipment and Auxiliaries shall be capable of continuous operation in frequency range of 47.5 to 51.5 Hz.
- 6.02.00 The functional guarantees of the equipment under the scope of the Contract is given elsewhere in the technical specification. These guarantees shall supplement the general functional guarantee provisions covered under General Conditions of Contract.
- 6.03.00 Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Bidder as specified elsewhere in this specification.

7.00.00 DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.01.00 Design of Facilities

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Bidder shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinate performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.02.00 Maintenance and Availability Considerations

Equipment/facilities offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the Bidder for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the Bidder for lifting the equipment and accessories covered under the specification.

8.00.00 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY BIDDER

8.01.00 Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required ensuring a completely engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope.

The Bidder shall furnish engineering data/drgs. in accordance with the schedule of information as specified in Technical Specification and data sheets.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of documents is given in Annexure-I attached with Chapter 3.

8.03.00 The documentation that shall be provided by the Bidder is indicated in various sections of specification. The documentation shall include but not be limited to the following:

Basic Engineering Documentation

Prior to commencement of the detailed engineering work, the Bidder shall furnish a Plant Definition Manual within 4-6 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

- i. System description of all the mechanical, electrical, control & instrumentation & civil systems.
- ii. Technology scan for each system / sub-system & equipment.
- iii. Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.
- iv. Optimization studies including thermal cycle optimization.
- v. Sizing criteria of all the systems, sub-systems including various piping systems/ equipment/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.
- vi. Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.
- vii. Operation Philosophy and the control philosophy of the Main Plant and other plants.

- viii. General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Owner's scope. This drawing shall also be furnished in the form of floppy discs to the Owner for engineering of areas not included in Bidder's scope.
- ix. Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the Bidder.
- x. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xi. The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Owner.
- xii. After approval of Plant Definition Manual / Design Basis Report, Bidder shall furnish detailed technical specification of all system / packages of the Plant.
 - i. Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.
 - ii. Flow diagrams, Process & Instrumentation Diagrams alongwith write-up and system description.
 - iii. Start-up curves for turbine, boiler and both turbine and boiler combined together as a unit for various start-ups, viz. cold, warm and hot start-up.
 - iv. Piping isometric, composite layout and fabrication drawings.
 - v. Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.
 - vi. Technical data sheets for all bought out and manufactured items. Bidder shall use the specifications as a base for placement of orders on their sub-vendors.
 - vii. Detailed design calculations for components, system/sub-system,, piping etc., wherever applicable including sizing calculations for all auxiliaries as per criteria specified elsewhere in specification.
 - viii. Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.
 - ix. Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.

- x. Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).
- xi. Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.
- xii. Comprehensive list of all terminal points which interface with Owner's facilities giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc.
- xiii. Power supply single line diagram, block logics, control schematics, electrical schematics, etc.
- xiv. Protection system diagrams and relay settings.
- xv. Interconnection diagrams.
- xvi. Cable routing plan.
- xvii. Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
- xviii. Alarm and annunciation list and alarms & trip set points.
- xix. Sequence and protection interlock schemes.
- xx. Type test reports and power system stability study report.
- xxi. Control system configuration diagrams and card circuit diagrams and maintenance details.
- xxii. Detailed software manuals & source software listing.
- xxiii. Detailed flow chart for digital control system.
- xxiv. Mimic diagram layout.
- xxv. Civil Task drawings(for the Engineering by Owner),Design and Drawings for the Civil & Structural works in the scope of the Bidder.
- xxvi. Model study reports wherever applicable.
- xxvii. Functional & guarantee test procedures and test reports.

- xxviii. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.
- xxix. Documentation in respect of commissioning as listed out elsewhere in this specification.
- xxx. The Bidder while submitting the above documents / drawings for approval / reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.

8.03.01

Instruction Manuals

The Bidder shall submit to the Owner, draft Instruction Manuals for all the equipment covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalization and approval of the Owner the Instruction Manuals shall be submitted as indicated in Annexure-I. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Owner. The Instruction Manuals shall comprise of the following.

Erection Manuals

The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

- a) Erection strategy.
- b) Sequence of erection.
- c) Erection instructions.
- d) Critical checks and permissible deviation/tolerances.
- e) List of tool, tackles, heavy equipment like cranes, dozers, etc.
- f) Bill of Materials
- g) Procedure for erection.
- h) General safety procedures to followed during erection/installation.
- i) Procedure for initial checking after erection.
- j) Procedure for testing and acceptance norms.
- k) Procedure / Check list for pre-commissioning activities.
- l) Procedure / Check list for commissioning of the system.

- m) Safety precautions to be followed in electrical supply distribution during erection

Operation & Maintenance Manuals

- i. The operating and maintenance instructions together with drawings (other than shop 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 give a step by step procedure for all operations likely to be carried out during the life of the plant / equipment including, operation, maintenance, dismantling and repair including periodical activities such as chemical cleaning of the generator. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Owner.
- ii. If after the commissioning and initial operation of the plant, the manuals require any modification / additions / changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Owner for records.
- iii. A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.
- iv. The manuals shall include the following :
 - a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
 - b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.
 - c) Where applicable, fault location charts shall be included to facilitate finding the cause of maloperation or break down.
- v. Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. system/equipment/assembly/sub-assembly - wise required for the complete plant.
- vi. On completion of erection, a complete list of bearings / equipment giving their location, and identification marks etc. shall also be furnished to the Owner indicating lubrication method for each type/category of bearing.

8.03.02

Plant Handbook

The Bidder shall submit to the Owner a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipment and systems covering the complete project including

1. Design and performance data.
2. Process & Instrumentation diagrams.
3. Single line diagrams.
4. Sequence & Protection Interlock Schemes.
5. Alarm and trip values.
6. Performance Curves.
7. General layout plan and layout of main plant building and auxiliary buildings.
8. Important Do's & Don't's

The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Owner's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.03.03 Project Completion Report

The Bidder shall submit a Project Completion Report at the time of handing over the plant.

8.03.04 Drawings

- (a.) All documents submitted by the Bidder for Owner's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-I. The soft copies to be supplied shall be either in CDs, or through direct transfer via E-mail, etc. depending upon the nature/volume/size of the document. The drawings submitted for approval could be in the Image form.
- (b.) Final copies of the approved drawings shall be submitted on CD-ROM along with the requisite number of hard copies as per Annexure-I.
- (c.) The completed plant documentation with equipment drawings, data sheets, P&ID, BOQ, schematics, logic diagrams, test reports and quality plan, etc. shall be furnished to Owner.
- (d.) All documents/text information shall be in latest version of MS Office.

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- (e.) All drawings submitted by the Bidder including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.
 - (f.) Each drawing submitted by the Bidder (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, Consultant, name of the Project, system designation, the specifications title, the specification number, drawing/document number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
 - (g.) The Bidder shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Owner. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".
 - (h.) Similarly, all the drawings/ documents submitted by the Bidder during detailed engineering stage shall be stamped "FOR APPROVAL" or "FOR INFORMATION" prior to submission.
 - (i.) The furnishing of detailed engineering data and drawings by the Bidder shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Owner will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipment provided by others and external connections & dimensions which might affect plant layout. The review by the Owner should not be construed to be a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Owner / Project Manager shall not relieve the Bidder of any of his responsibilities and liabilities under this contract.
 - (j.) After the approval of the drawings, further work by the Bidder shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.
 - (k.) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Bidder's risk. The Bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/system at a later date, the Bidder may do so, but such

changes shall promptly be brought to the notice of the Owner indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.

- (l.) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Owner prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/representative of Owner based on requirements of such piping indicated in approved / finalized Flow Scheme / Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.
- (m.) Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the Bidder well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.
- (n.) As Built Drawings

After final acceptance of individual equipment/system by the Owner, the Bidder will update all original drawings and documents for the equipment/ system to “as built” conditions.

- (o.) Drawings must be checked by the Bidder in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Owner. In case drawings are found to be submitted without proper endorsement for checking by the Bidder, the same shall not be reviewed and returned to the Bidder for re-submission. The Bidder shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/drawings at site which are needed as an input to the engineering. The Bidder shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Owner's scope and submit all necessary drawings/ documents for the same.
- (p.) The Bidder shall submit adequate prints of drawing/data/document for Owner's review and approval. The Owner shall review the drawings and return one (1) copy to the Bidder authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Bidder to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.

- (q.) All engineering data submitted by the Bidder after final process including review and approval by the Owner shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Owner in writing.

8.04.00 Engineering Information Submission Schedule

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Owner. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

- (a.) Information that shall be submitted for the approval of the Owner before proceeding further, and
- (b.) Information that would be submitted for Owner's information only.

The Engineering Information Schedule shall be updated monthwise.

The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.

8.05.00 Engineering Progress and Exception Report

8.05.01 Report giving the status of each engineering information including

- (a.) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission
- (b.) Drawings which were not submitted as per agreed schedule.

8.05.02 The draft format for this report shall be furnished to the Owner within four (4) weeks of the award of the contract, which shall then be discussed and finalized with the Owner.

8.06.00 Co-Ordination Meetings

8.06.01 The Bidder shall be called upon to organize and attend monthly Design/ Co-ordination Meetings with the Owner/Owner's representatives, Project Consultant during the period of contract. The Bidder shall attend such meetings at his own cost at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.

- 8.06.02 The Bidder should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Bidder shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Bidder will be reviewed by the Owner as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Owner shall then be discussed across the table during the above co-ordination Meetings wherein best efforts shall be made by both sides to ensure the approval of the drawing.
- 8.06.03 The Bidder shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Bidder shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
- 8.06.04 Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.
- 8.06.05 Any delays arising out of failure by the Bidder to incorporate Owner's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Bidder to alter the Contract completion date.
- 8.07.00 **Design Improvements**
- The Owner or the Bidder may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.
- If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Bidder proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.
- 8.08.00 **Equipment Bases**
- A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Owner. Each base plate which support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.
- 8.09.00 **Protective Guards**
- Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.
- 8.10.00 **Lubricants, Servo Fluids and Chemicals**

- 8.10.01 The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. Consumption of all these consumables during the initial operation and final filling after the initial operation shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers.
- 8.10.02 As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.
- Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.
- 8.11.00 **Lubrication**
- 8.11.01 Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.
- 8.12.00 **Material of Construction**
- 8.12.01 All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilized for various components shall be those which have established themselves for use in such applications.
- 8.13.00 **Rating Plates, Name Plates & Labels**
- 8.13.01 Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Owner.
- 8.13.02 Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Owner or as detailed in appropriate section of the technical specifications.
- 8.13.03 Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear sides.

- 8.13.04 Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with epoxy. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.
- 8.13.05 Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support/hanger.
- 8.13.06 Valves, steam traps and strainers shall be identified by Owner's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.
- 8.13.07 Safety and relief valves shall be provided with the following :
- (a.) Manufacturer's identification.
 - (b.) Nominal inlet and outlet sizes in mm.
 - (c.) Set pressure in Kg/cm² (abs).
 - (d.) Blowdown and accumulation as percentage of set pressure.
 - (e.) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.
- 8.13.08 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.
- 8.13.09 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system

8.14.00 **Tools and Tackles**

The Bidder shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Bidder shall also ensure that these tools and tackles are not used by

him during erection, commissioning and initial operation. For this period the Bidder should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Owner.

8.15.00 **Welding**

8.15.01 If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipment to be performed by others the requirements shall be submitted to the Owner in advance of commencement of erection work.

8.16.00 **Colour Code for all Equipment/ Piping/ Pipe Services**

8.16.01 All equipment/ piping/ pipe services are to be painted by the Bidder in accordance with Owner's standard colour coding scheme, which will be furnished to the Bidder during detailed engineering stage.

8.17.00 **Protection and Preservative Shop Coating**

8.17.01 **Protection**

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or overground environment as the case may be.

8.17.02 **Preservative Shop Coating**

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer.

Transformers and other electrical equipment if included shall be shop finished with one or more coats of primer and two coats of high grade epoxy. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Owner at a later date.

8.17.03 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Bidder after obtaining specific approval of the Owner regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on

surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Owner.

8.17.04 All other steel surfaces which are not to be painted shall be coated with suitable rust preventive compound subject to the approval of the Owner.

8.17.05 All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Owner. Lube oil piping or carbon steel shall be pickled.

8.17.06 Painting for Civil structures shall be done as per relevant part of technical specification.

9.00.00 QUALITY ASSURANCE PROGRAMME

9.01.00 The Bidder shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Bidder's works or at his sub-Bidder's premises or at the Owner's site or at any other place of work are in accordance with the specifications. Such programs shall be outlined by the Bidder and shall be finally accepted by the Owner/authorized representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001. A quality assurance programme of the Bidder shall generally cover the following:

- (a.) His organization structure for the management and implementation of the proposed quality assurance programme
- (b.) Quality System Manual
- (c.) Design Control System
- (d.) Documentation and Data Control System
- (e.) Qualification data for bidder's key personnel.
- (f.) The procedure for purchase of materials, parts, components and selection of sub-Bidder's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- (g.) System for shop manufacturing and site erection controls including process, fabrication and assembly.
- (h.) Control of non-conforming items and system for corrective actions and resolution of deviations.
- (i.) Inspection and test procedure both for manufacture and field activities.
- (j.) Control of calibration and testing of measuring testing equipment.
- (k.) System for Quality Audits.

- (l.) System for identification and appraisal of inspection status.
- (m.) System for authorising release of manufactured product to the Owner.
- (n.) System for handling, storage and delivery.
- (o.) System for maintenance of records, and
- (p.) 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.

9.02.00 **General Requirements - Quality Assurance**

- 9.02.01 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of 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 duly approved by the Owner. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Owner for approval. Schedule of finalisation of such quality plans will be finalised before award. Monthly progress reports on MQP/FQP submission/approval shall be furnished.
- 9.02.02 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/ Sub-Bidder's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. Compact Disc or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.
- 9.02.03 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 starting from receipt of materials/equipment at site.
- 9.02.04 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 Owner's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Owner shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in

presence of the Owner's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Owner in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner along with technical justification for approval and dispositioning.

- 9.02.05 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Owner's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).
- 9.02.06 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.
- 9.02.07 The Bidder shall submit to the Owner Field Welding Schedule for field welding activities in the enclosed format No.: QS-01-QAI-P-02/F3. The field welding schedule shall be submitted to the Owner along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
- 9.02.08 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 welding/brazing procedures shall be submitted to the Owner or its authorised representative for approval prior to carrying out the welding/brazing.
- 9.02.09 All brazers, welders and welding operators employed on any part of the contract either in Bidder's/sub-Bidder's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Owner.
- 9.02.10 Welding procedure qualification & Welder qualification test results shall be furnished to the Owner for approval. However, where required by the Owner, tests shall be conducted in presence of Owner/authorised representative.
- 9.02.11 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

- 9.02.12 Unless otherwise proven and specifically agreed with the Owner, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
- 9.02.13 No welding shall be carried out on cast iron components for repair.
- 9.02.14 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
- 9.02.15 All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.
- All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested.
- 9.02.16 The Bidder shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors bought out items (BOI). All the sub-Bidder proposed by the Bidder for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Bidder and finalised with the Owner, shall be subject to Owner's approval. The Bidder's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Owner for approval within the period agreed at the time of pre-awards discussion and identified in review category prior to any procurement. Monthly progress reports on sub-Bidder detail submission / approval shall be furnished. Such vendor approval shall not relieve the Bidder from any obligation, duty or responsibility under the contract.
- 9.02.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Owner, the Bidder's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-Bidder shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Owner and such approved Quality Plans shall form a part of the purchase order/contract between the Bidder and sub-Bidder. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Owner on the monthly basis by the Bidder along with a report of the Purchase Order placed so far for the contract.

- 9.02.18 Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their sub-Bidder's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.
- 9.02.19 The Bidder shall carry out an inspection and testing programme during manufacture in his work and that of his sub-Bidder's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Bidder shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
- 9.02.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Bidder in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
- 9.02.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
- 9.02.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/ authorised representative.
- 9.02.23 Burn in and Elevated Temperature Test Requirement for Electronics Solid State Equipment

All solid state electronic systems/equipment shall be tested as a complete system/equipment with all devices connected for a minimum of 168 hours (7 Days) continuously under energized conditions prior to shipment from manufacturing works, as per the following cycle.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours of the total 168 hours of testing, the ambient temperature shall be maintained at 50 deg.C. The equipment shall be interconnected with devices which will cause it to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10 deg.C above the ambient temp. at 50 deg.C.

Burn in Test Cycle

The 48 hours elevated temperature test shall be followed by 120 hours of burn in test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

In case the Bidder/ sub-Bidder is having any alternate established procedure of eliminating infant mortality components, the detail procedures followed by the Bidder/ sub- Bidder along with the statistical figures to validate the alternate procedure to be forwarded.

The Bidder/Sub-Bidder shall carry out routine test on 100% item at Bidder/sub-Bidder's works. The quantum of check/test for routine & acceptance test by Owner shall be generally as per criteria/sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check/test for routine / acceptance test shall be as agreed during detailed engineering stage.

9.03.00 QA Documentation Package

The Bidder shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (?) mark.

9.03.01 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.

9.03.02 Typical contents of QA Documentation is as below:-

- (a.) Quality Plan
- (b.) Material mill test reports on components as specified by the specification and approved Quality Plans.
- (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

- (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- (e.) Heat Treatment Certificate/Record (Time- temperature Chart)
- (f.) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
- (g.) CHP / Inspection reports duly signed by the Inspector of the Owner and Bidder for the agreed Customer Hold Points.
- (h.) Certificate of Conformance (COC) wherever applicable.
- (i.) MDCC

9.03.03 Similarly, the Bidder shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

9.03.04 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

- (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.
- (b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
- (c.) If a decision is made despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.

9.03.05 Transmission Of QA Documentation

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Owner.

For the particular case of phased deliveries, the complete quality document to the Owner shall be issued not later than 3 weeks after the date of the last delivery of equipment.

9.04.00 Project Manager's Supervision

9.04.01 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section General Conditions of Contract, the Bidder shall proceed to comply with the Project Manager's decision.

9.04.02 The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

- (a.) Interpretation of all the terms and conditions of these documents and specifications:
- (b.) Review and interpretation of all the Bidder's drawing, engineering data, etc:
- (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract :
- (d.) Inspect, accept or reject any equipment, material and work under the contract.
- (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates
- (f.) Review and suggest modifications and improvement in completion schedules from time to time, and
- (g.) Supervise Quality Assurance Programme implementation at all stages of the works.

9.05.00 Inspection, Testing And Inspection Certificates

9.05.01 The word 'Inspector' shall mean the Project Manager and/or his authorized representative and/or an outside inspection agency acting on behalf of the Owner to inspect and examine the materials and workmanship of the works during its manufacture or erection.

9.05.02 The Project Manager or his duly authorized representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all

reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Bidder shall obtain for the Project Manager and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.

- 9.05.03 The Bidder shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the 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 two (2) copies.
- 9.05.04 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the 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 Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
- 9.05.05 When the factory tests have been completed at the Bidder's or sub-Bidder's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Project Manager /Inspector. Project Manager /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.
- 9.05.06 In all cases where the contract provides for tests whether at the premises or works of the Bidder or any sub-Bidder, the Bidder, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Bidder and shall give facilities to the Project Manager/Inspector or to his authorized representative to accomplish testing.
- 9.05.07 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed Quality Assurance Programme forming a part of the contract.

- 9.05.08 To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 9.05.03- of this chapter, 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.
- 9.05.09 All inspection, measuring and test equipment used by Bidder shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by the Owner. Wherever asked specifically, the Bidder shall re-calibrate the measuring/test equipment in the presence of Project Manager/Inspector.
- 9.06.00 **Associated document for quality assurance programme:**
- 9.06.01 List of items requiring quality plan and sub supplier approval. (Annexure-III).
- 9.06.02 Status of items requiring Quality Plan and sub supplier approval. (Annexure-IV).
- 9.06.03 Field Welding Schedule (Annexure-V).
- 9.06.04 Manufacturing Quality Plan (Annexure-VI).
- 9.06.05 Field Quality Plan (Annexure-VII).
- 10.00.00 PRE-COMMISSIONING AND COMMISSIONING FACILITIES**
- (a.) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Owner and the Bidder for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Bidder's quality assurance programme as well as those included elsewhere in the Technical Specifications.
- (b.) The Bidder's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.

It will be the responsibility of the Bidder to assess and furnish a list of all commissioning spares required for successful commissioning of all the equipment covered under the contract. Such a list shall be furnished by the Bidder within 12 months from the date of LOA, separately for each equipment and shall be reviewed by the Owner and discussed for mutual agreement. The commissioning spares will be so identified as not to allow the trial operation to suffer for want of such commissioning spares. The identification of commissioning spares will not in any way relieve the Bidder of any of his responsibilities of satisfactory performance under the provisions of other conditions of contract. All the commissioning spares shall be deemed to be included in scope of the Bidder as a part of the respective equipment package at no extra cost to the Owner.

- (c.) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Owner six months prior to the respective implementations. The Owner will approve final verification of cleanliness.
- (d.) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
- (e.) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Owner's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] approved by the Owner.
- (f.) The Bidder during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.
- (g.) Bidder shall furnish the commissioning organization chart for review & acceptance of Owner at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain :
 - (1.) Biodata including experience of the Commissioning Engineers.
 - (2.) Role and responsibilities of the Commissioning Organisation members.
 - (3.) Expected duration of posting of the above Commissioning Engineers at site.

10.02.00 Initial Operation

- a) On completion of all pre-commissioning activities / tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.
- b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.
- c) The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.
- d) The Bidder shall intimate the Owner about the commencement of initial operation and shall furnish adequate notice to the Owner in this respect.
- e) Any loss of generation due to constraints attributable to the Owner shall be construed as Deemed Generation.
- f) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Bidder. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Bidder to the full satisfaction of the Owner to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for withholding the aforesaid permission.

10.03.00 **Guarantee Tests**

- a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Bidder in presence of the Owner. The Bidder's Commissioning, Start-up Purchaser shall make the unit ready to conduct such test. Such test will be commenced and completed as per schedule indicated in Vol I GCC
- b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.
- c) For performance/ demonstration tests instrumentations, of accuracy class, to the approval of the Owner shall be used. The numbers and location of the instruments shall be as per the specified test codes. In

addition the values of parameters shall be logged from the information system provided under Owner's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.

- d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Bidder, free of cost.
- e) The Guarantee tests and specific tests to be conducted on equipment have been brought out in detail elsewhere in the specification.

11.00.00 TAKING OVER

Upon successful completion of Initial Operations and all the tests other than guarantee tests conducted to the Owner's satisfaction, the Owner shall issue to the Bidder a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Owner delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Bidder of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

12.00.00 TRAINING OF OWNER'S PERSONNEL

12.01.00 The scope of service under training of Owner shall include a training module in the areas of Operation & Maintenance.

Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Owner:

- (a.) Training for Steam Generator Equipment
- (b.) Training for TG and related equipment.
- (c.) DDCMIS
- (d.) Training for Electric Power Supply systems
- (e.) Training for HT motor
- (f.) Training for power cycle piping/critical piping.

The above training shall be provided taken by the EPC Bidder in one of the reference power plant.

12.02.00 The scope of services under training shall also necessarily include training of Owner's Engineering personnel covering a training module of upto 52 man months. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training

on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Owner's Engineering personnel is attached as Annexure-II.

Four (4) man month and two (2) man month training for Purchasers Engineering Personnel on the offered CFD modelling code for SG & ESP including alternative geometry modelling technique to be provided.

- 12.03.00 Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Owner's approval. Consolidated training period included above (i.e. 35 and 52 man months respectively for O&M and Engineering) is indicative only. Owner reserves the right to reappropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.
- 12.04.00 Clause 12.02.00 & 12.03.00 shall be applicable for domestic bidders. For foreign bidders refer Vol I GCC.
- 12.05.00 Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.
- 12.06.00 In all the above cases, wherever the training of Owner's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Owner's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.
- 12.07.00 Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Owner reserves the right to include or exclude these item(s) during place of Award. All expenses except travelling expenses shall be borne by the contractor.

13.00.00 SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

- (a.) Working platforms should be fenced and shall have means of access.
- (b.) Ladders in accordance with Owner's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

14.00.00 NOISE LEVEL

The equivalent 'A' weighted sound pressure level measured at a height of 1.0 m above floor level in elevation and at a distance of one (1) meter horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA except for

- (a.) Safety valves and associated vent pipes for which it shall not exceed 105 dBA.
- (b.) Regulating drain valves in which case it shall be limited to 90 dBA.
- (c.) TG unit in which case it shall not exceed 90 dBA.
- (d.) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 85 dBA.

15.00.00 PACKAGING AND TRANSPORTATION

All the equipment & spares 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. Each spare shall be clearly marked or labeled on the outside of the packing with its description. When more than one spare part is packaged in a single case, a general description of the contents shall be shown on the outside of such a case and other packages must be suitably marked and numbered for the purpose of identification. All cases, containers or packages, are liable to be opened for such examination as may be considered reasonable by the Engineer. In case of equipment supplied with grease/lubricants from imported origin, the supplied shall clearly indicate the indigenous equivalent of the grease/lubricant and source of supply so as to enable the Owner to procure these items from indigenous sources. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Bidder shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting dispatch of equipment. Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & pre-assembly to bare minimum. The Owner's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

16.00.00 ELECTRICAL ENCLOSURE

All electrical equipment and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specification.

17.00.00 INSTRUMENTATION AND CONTROL

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

- 17.01.00 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.

All scales and charts shall be calibrated and printed in Metric Units as follows:

a)	Temperature	-	Degree centigrade (deg C)
b)	Pressure	-	Kilograms per square centimeter (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
c)	Draught	-	Millimeters of water column (mm wc).
d)	Vacuum	-	Millimeters of mercury column (mm Hg) or water column (mm Wcl).
e)	Flow (Gas)	-	Tonnes/ hour
f)	Flow (Steam)	-	Tonnes/ hour
g)	Flow (Liquid)	-	Tonnes / hour
h)	Flow base	-	760 mm Hg. 15 deg.C
i)	Density		Grams per cubic centimeter.

- 17.02.00 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plug-in connection at rear.

- 17.03.00 All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalized & components shall be of industrial grade or better.

18.00.00 ELECTRICAL NOISE CONTROL

The equipment furnished by the Bidder shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Bidder's equipment, which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-801- 2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems.

19.00.00 INSTRUMENT AIR SYSTEM

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc. shall be as per the details furnished elsewhere.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

20.00.00 TAPPING POINTS FOR MEASUREMENTS

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Bidder will be intimated about thread standard to be adopted.

The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Bidder.

- (a.) Temperature test pockets with stub and thermowell
- (b.) Pressure test pockets

21.00.00 ELECTRONIC MODULE/COMPONENT DETAILS

The Bidder shall have to furnish all technical details including circuit diagrams, specifications of components, etc., in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments, peripherals etc.

It is mandatory for the Bidder to identify clearly the custom built ICs used in the package. The Bidder shall also furnish the details of any equivalents of the same.

22.00.00 ENVIRONMENTAL MONITORING & CONTROL MEASURES

Bidder to note that MOEF has declared Manali area as critically polluted area and also imposed certain restrictions on consideration of developmental projects.

Concerned authorities have been addressed to have self monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF and also to furnish the action plan ie., for the establishment of self monitoring system. It is also directed to undertake Environmental Audit (EA) to ascertain the compliance level of standards notified by MOEF.

In this context it is to be noted that our proposed project is also located in the said critically polluted cluster. Though environmental clearance for the said project has been obtained the Controlling Authorities will be highly keen and keep a tight vigil on the availability/provision of self monitoring system (for Air, Water & Land) so as to ascertain the level of compliance of standards prescribed by MOEF.

Environmental Clearance:

The environmental clearance of the project is at an advanced stage

Hence, it is stated that the implementation of Environmental measures including self monitoring system (for air, Water and land) , especially in the following areas have to be ensured by the bidder without any exception:

- Continuous Air quality monitoring stations
- Online monitoring system
- Effluent Treatment plant
- Sewage treatment plant
- Optimum use of land area
- 100% Ash collection & utilisation
- Green Belt Development.

ANNEXURE-I

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS (sets)	NO. OF CD- ROMs (sets)
1.	PLANT DEFINITION MANUAL-	-	3 CD-ROMs
2.	Drawings "FOR APPROVAL"	10	Soft Copy
3.	Drawings "FOR INFORMATION"	10	Soft Copy
4.	Drawings "FINAL APPROVED DRAWING"	8	Soft Copy
5.	Drawings "AS BUILT "	8	3 CD-ROMs
6	DATASHEETS,DESIGNCALCULATIONS,PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i) For Approval	10	SOFT COPY
	ii) FINAL	8	3 CD-ROMs -
	iii) Analysis reports of equipment/ piping/ structures components/ systems employing software packages as detailed in the specifications		
	a) Input	10	SOFT COPY
	b) Output	10	SOFT COPY
	c) Drawings/ Sketches	10	SOFT COPY
7	Erection manual "FINAL"	8	3CD ROMS
8	Operation & Maintenance manual	10	3CD ROMS
9	Plant Hand Book "DRAFT"	6	SOFT COPY
10	Plant Hand Book "FINAL"	15	3CD ROMS
11	Commissioning and Performance Procedure manual	10	3CD ROMS
12	Performance and Functional Guarantees test report	6	3CD ROMS
13	Progress Reports	6	3CD ROMS
14	Project completion report	10	3CD ROMS
15	QA programme including	1	

S. NO.	DESCRIPTION OF MANUALS	NO OF PRINTS (sets)	NO. OF CD- ROMs (sets)
	Organization for implementation and QA system manual (with revision-servicing)		
16	Vendor details in respect of proposed vendors including Bidder's evaluation report.	1	
17	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc.		
	(i) For review/comment	3	
	(ii) For final approval	4	1 set CD ROMS
18	Welding Manual, Heat Treatment Manuals,	4	
	Storage & preservation manuals		
	Final	4	2 CD ROMS
19	Monthly Vendor Approval and QP approval status	2	1 CD ROM
20	QA Documentation Package for items / equipment manufactured and dispatched to site	2	2 CD ROMS
21	QA Documentation Package for field activities on equipment/systems at site	2	2 CD ROMS

ANNEXURE-II

(Total within 52 man months)

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit Manufacturer's Work	Operation & Maintenance Of Plant	
STEAM GENERATOR	Thermal design and hydraulic circulation balance	Familiarization with various system and equipment	Manufacturing processes of pressure parts, and equipment	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues	
	Combustion and Air & gas weight calculation	Performance data collection analysis and review	Welding process		
	Pressure part calculation	O&M feed back	Testing facilities	Familiarization of special maintenance techniques.	
	Pressure part and strength calculation	Operation history of various equipment and system	Product development in process	Special tool and tackles familiarization	
	Tube metal temp. calculation and selection. Performance calculation Duct design. Pressure part	Failure analysis	Future plan for technology induction R&D work inprogress		

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit Manufacturer's Work To	Operation & Maintenance Of Plant	
	Equipment and system sizing and selection of mills, fans, airpreheater, soot blowers, dampers, valves heater, soot blowers, dampers, valves, feeders, burners startup system, fuel firing system, draft plant				
	Flow scheme develop- ment of air & flue gas, fuel oil, auxiliary steam, main and reheat steam feed water.				
	Layout of over all plant, steam generator area, pressure part arrangements, platforms, equipment, piping and duct, coal pipe, flue gas ducts, bunker arrangement, valves and damper, ESP area, cable & piping tressels etc.				
	Erection strategies, erection procedures				
	Performance and demonstration tests.				
MANDAYS	120	20	20	20	
CFD model development and validation for Steam Generator	Familiarisation of fundamentals and basis for the development of the CFD models.				
	Solving of set of simple problems by Em- ployer's engineers with the help of trainer.				

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit Manufacturer's Work	To	Operation & Maintenance Of Plant
	Hands on experience on the development of detailed/realistic CFD models for the steam generator and ESP. The Bidder/trainer shall develop CFD models for SG & ESPs per the Contract requirement with complete association of the Owner's engineers.				
	Validation of the above CFD model for SG & ESP by Bidder in association with the Owner's Engineers.				
MANDAYS	120 for SG and 60 for ESP	-	-	-	-

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work		
TURBINE GENERATOR AND IT'S INTEGRAL AUXILIARIES	Turbine cycle optimization and turbine performance in off design condition.	Familiarization of power plants of various makes of turbines for super critical units	Manufacturing processes of turbine		
	Rotor design and strength calculation	Collection of data for analysis of availability of turbines	Assembly of turbine		
	Rotor dynamic behavior studies wrt natural frequency, critical speed, vibration etc.	Comparative studies for integral systems of turbine	Testing of turbines		
	Blade profile/root design and blade strength design, blade vibration analysis	O&M history/problems related to turbine	Product development in process		
	Casing & diaphragm design	Failure analysis	Future plan for technology induction		
	Labyrinth seal selection & design for different turbine configurations		R&D work in progress		
	Selection of turbine type (i.e. Tandem vs cross compounding, separate HP/IP vs combined HP/IP, material of construction etc.)				

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work		
	Design principle for Up rating/down rating of existing design/ modules for the specific project.				
	Selection of nos., type and arrangement of bearings, load calculation on bearings, bearing oil flow calculation Selection, design and control principle for Turbine governing system Performance calculation Steam path audit Layout principle of various equipment's of TG and its integral system Latest technological advancements				
MANDAYS	45	10	10		
Boiler Feed Pumps	Techno-economic syudies for Selection of BFP Configuration and its drive	Familiarization of power plants of various makes of feed pumps	Manufacturing process of various components of BFP		
	Criteria for selection of boiler	Data collection of BFP	Assembly of BFP		

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work		
	Feed Pump parameters Rotor design, strength calculation and rotor dynamic behavior studies wrt critical speed, vibration etc	parameters and configuration Collection of data for analysis of availability of BFP	Testing, capabilities of BFP at works wrt performance, NPSH, thermal shock, dry run, visual cavitation, string test, axial thrust measurement		
	Impeller design and its hydraulic behavior Role of critical parameters such as NPSH(R), Suction specific speed, running clearances, speed etc. in design of feed pumps Material selection of BFP components Guiding factors for selection of BFP seals Computation of axial thrust under various flows Performance calculation Transient analysis in pump	O&M history/problems related to BFP Comparative studies for various types of BFP& its features	Product development in process Future plan for technology induction R&D work in progress		

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
MANDAYS	suction piping wrt NPSH margin Latest technological trends in BFP design	5	10	
	Selection of condenser type and its optimization wrt temp rise across condenser, pressure drop in condenser, surface area etc.	Comparative studies of salient features	Manufacturing process of various components of condenser Assembly	
	Techno economic studies for Selection of condenser tube material and other parts depending on water quality Condenser support selection & design Sizing of condenser w.r.t. super critical units Latest technological trends in condenser arrangement and design Condenser vacuum system design	Collection of data for analysis of availability of Condenser O&M history/problems related to condenser	Testing capability at works Product development in process Future plan for technology induction R&D work in progress	

PRODUCT	AREAS OF TRAINING REQUIREMENT					Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work			
MANDAYS	10	5	5			
Feed Regenerative Equipment's	Thermal and mechanical design calculation of heaters	Comparative studies of salient features	Manufacturing process of various components of heaters			
	Basis of selecting horizontal/vertical heaters	Analysis of data	Assembly			
	Selection of TTD and DCAs for various heaters, and their effect on turbine heat rate	O&M history/problems related to heaters	Testing capability at works			
	Configuration of HP heaters (2x50% v/s100% capacity)		Product development in process			
	Sizing criteria for De-aerator/Heaters		Future plan for technology induction			
	Selection of tube & tube sheet material of heaters		R&D work in progress			
	Latest technological trends in heaters design					
MANDAYS	15	10	10			
3-dimensional CFD modeling	CFD model development and validation of design data for steam turbine, BFP, CEP, condenser, heaters etc.					

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant	
MANDAYS	20				
Compressors	Equipment Theory & Maintenance Practice				
MANDAYS	16	-----	4		
Ash Handling System	Equipment Theory & Maintenance Practice				
MANDAYS	16	4	4		
Coal Handling System	Equipment Theory & Maintenance Practice				
MANDAYS	20	5	5		
H ₂ Plant	Equipment Theory & Maintenance Practice				
MANDAYS	10	3	3		
Condensate Polishing Unit	Equipment Theory & Maintenance Practice				
MANDAYS	15	5	5		

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant	
CONTROL & INSTRUMENTATION					
	Hardware & Software organization of the system Basis of selection of H/W memory sizing Operating system features, interface with other system, openness & inter- operability Upgradability System testing features	Operational feedback			
MANDAYS	24	6		16	
DDCMIS-Man Machine Interface Engineering & Application Software	Specific system customisation	Operation feedback			
	Various system modules & interface with OS				
	Database organization & development				
	Development of mimics				
	Other application like calculations, logs historical storage functionalities & use				
MANDAYS	40	6		8	

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Manufacturer's Work		
DDCMIS - Control System Hardware	Basic design features for system & its modules	Operation feedback	Manufacturing processes special attention to handling of the modules Maintenance facilities		
	System capabilities & system design techniques				
	Communication with MMI & other system				
MANDAYS	24	5	10		
DDCMIS-Control system Application Software	Database structure Organisation & inter- face between application program & database	Operational feedback	System integration & System capabilities testing		
	Application for implementation of Control functions				
	Study of standard algorithms & development of new algorithms				
MANDAYS	18	4	4		
DDCMIS - Control Loop Study Loop Study	General description of closed loop controls of thermal power plant	Specific operational feedback			
	Critical analysis of few control loops e.g., TSCS Stress Control boiler startup control etc.				

PRODUCT	AREAS OF TRAINING REQUIREMENT					Operation & Maintenance Of Plant
	Product Design	Plant Visit	Visit To Work	Manufacturer's		
MANDAYS	12	4				
DDCMIS-Burner Management System	Hardware logic, NFPA/ VDE requirements other safety standard	Operational feedback	Manufacturing precautions for handling the system	procedure & precautions for handling the system		
	Flame scanner location		System testing facilities			
MANDAYS	16	6		6	12	
DDCMIS - EHTC, Turbine stress control system, protection system & ATRS	Basic design concept & features	Operational feedback	Manufacturing precautions for handling the system	procedure & precautions for handling the system		
	Logics of turbine stress control system Implementation of failsafe philosophy in turbine protection system			System testing facilities		
MANDAYS	16	6		6	12	
Furnace and Flame Viewing System.	Theory & principle of operation	Operational feedback				
	Details of software & methods of modification/ customisation					
Misc. systems for SG/TG C&I						

PRODUCT	AREAS OF TRAINING REQUIREMENT						Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Product Design	Plant Visit						
MANDAYS	6	3						
BOP (DDCMIS)	Hardware organization					Manufacturing process of PLC hardware		
	Operating system features							Integration & testing facilities
	Data base organization							
	Logic/loop algorithm							
	Development of control logic & loop s/w & MMI application development							
MANDAYS	24	-				6		
BOP System Controller								
1) Hard Ware	Equipment Theory & Maintenance Practice							
MANDAYS	30	10				10		
2) Soft Ware	Equipment Theory & Maintenance Practice							
MANDAYS	30	10				10		
VMS								
1) Hardware	Equipment Theory &							

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Work	Manufacturer's	Operation & Maintenance Of Plant
	Maintenance Practice				
MANDAYS	12	-	6		
2)Vibration Analysis	Equipment Theory & Maintenance Practice				
MANDAYS	12	-	6		
Analyser					
Water & Gas	Equipment Theory & Maintenance Practice				
MANDAYS	20	-	8		
PADO: System Engineering	Equipment Theory & Maintenance Practice				
MANDAYS	6	3	3		
PADO: Operation & Analysis	Equipment Theory & Maintenance Practice				
MANDAYS	18	6	-		
Actuators	Equipment Theory & Maintenance Practice				
MANDAYS	18	-	6		
Simulator	Equipment Theory &				

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant	
	Maintenance Practice				
MANDAYS	16	-	4		
Networking / MIS	Equipment Theory & Maintenance Practice				
MANDAYS	12	-	4		
Electric Power Supply System	Theory & design features		Manufacturing/assembly process		
			Testing methodology		
MANDAYS	5	2			

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant	
(ELECTRICAL) GENERATOR	(a) Design aspects of the following areas	- Operational feed back	(a) Manufacturing process for		
	- Insulation system	- Familiarisation with different sub-systems	- Core		
	- Cooling medium & arrangement		- Winding bars		
	- Winding & core support systems		- Assembly		
	b) Design aspects of other auxiliary systems		(b) Testing facilities		
MANDAYS	30	15	15		
Generator Excitation System including AVR.	Design features of various sub-systems	- Operational feed back	- Manufacturing process& facilities for testing various equipment of excitation system		
	Excitor	- Familiarisation with various equipment functioning at reference plants			
	PMG				
	Transformer				
	Controllers & different limiters etc.				
	PSS & associated system studies				
MANDAYS	30	15	15		

PRODUCT	AREAS OF TRAINING REQUIREMENT				
	Product Design	Plant Visit	Visit To Work	Manufacturer's	Operation & Maintenance Of Plant
Boiler Feed pump H.T. Motor	Design Criteria for the Stator core & wdg Rotor core & wdg Insulation system Cooling arrangement	Operational back feed	Manufacturing facilities	process & test	
MANDAYS	20		5		
POWER TRANSFORMER	Equipment Theory & Maintenance Practice				
MANDAYS	12	-	4		4
UPS/BATTERY CHARGER	Equipment Theory & Maintenance Practice				
MANDAYS	8	-	4		4
GIS	Equipment Theory & Maintenance Practice				
MANDAYS	24	4	12		24
SAS	Equipment Theory & Maintenance Practice				
MANDAYS	12	-	6		6

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
CRITICAL PIPING & POWER CYCLE PIPING	Design familiarization for critical piping of supercritical Plant	Familiarization with feed back (in super critical plant) on failure analysis and vibration analysis of piping.	Cold Setting of spring hanger	
	Optimization study for sizing including pressure drop calculation and selection of single or double lead together with Owner's engineers Design and stress analysis of lines with Expansion Joints together with Owner's engineers Design and stress analysis of piping systems with two phase flow involving Owner's engineers Transient analysis and optimum sizing of feed suction piping together with Owner's engineers.	Study of Feed back regarding hanger setting strategies and practice	Cyclic tests carried on spring hangers. Cyclic tests carried on expansion joints Manufacturing process of critical piping components and appreciation of their testing facilities at shop	

PRODUCT	AREAS OF TRAINING REQUIREMENT			
	Product Design	Plant Visit	Visit To Manufacturer's Work	Operation & Maintenance Of Plant
	Static and dynamic analysis of critical piping including seismic and other occasional load analysis (safety valve blowing condition). A joint activity together with Owner's engineers. Study and collection of data pertaining to special welding requirements (pre and post weld heat treat ment and electrode selection criteria etc.) of materials used in high temp piping system. Study and collection of data on special requirements in case of welding dissimilar metals and electrode selection criteria			
MANDAYS	45	10	10	

ANNEXURE-III

		Project : Stage : Package : Supplier : Bidder No. :		LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL SUB-SYSTEM:				DOC. NO.:			
		REV. NO.:									
		DATE :									
		PAGE : OF									
S. N.	Item	QP/ Cat.	Insp.	QP No.	QP Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status/ category	Sub-supplier Details submission schedule	Remarks
LEGENDS											
1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY the Owner) A – For these items proposed vendor is acceptable to the Owner. To be indicated with letter “A” in the list alongwith the condition of approval, if any. DR – For these items “Detailed required” for the Owner review. To be identified with letter “DR” in the list. NOTED – For these items vendors are approved by Main Supplier and accepted by the Owner without specific vendor approval from the Owner. To be identified with “NOTED.” 2. QP/INSPN CATEGORY: CAT-I : For these items the Quality Plans are approved by the Owner and the final acceptance will be on physical inspection witness by the Owner. CAT-II : For these items the Quality Plans approved by the Owner. However no physical inspection shall be done by the Owner. The final acceptance by the Owner shall be on the basis review of documents as per approved QP. CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by the Owner shall be on the basis certificate of conformance by the main supplier.											
UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.											

ANNEXURE-IV

[illegible]

ANNEXURE-V

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

ANNEXURE-VI

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:															
				ITEM :		QP NO.: REV.NO.: DATE: PAGE: OF....		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY M C N											
		SUB-SYSTEM:				TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		REMARKS											
SL. NO		CHARACTERISTICS		CLASS		3.		4.		5.		6.		7.		8.		9.		10.		11.	
1.		2.		3.		4.		5.		6.		7.		8.		9.		10.		11.			

SIGNATURE	P: PERFORM VERIFICATION.	W: WITNESS AS	AND	V: APPROPRIATE,	OWNER USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL
	CHP: THE OWNER SHALL IDENTIFIED IN COLUMN "N"							

ANNEXURE-VII

MFGR.'s LOGO		SUPPLIER'S NAME AND ADDRESS		FIELD QUALITY PLAN					PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:							
				ITEM : SUB-SYSTEM :		QP NO.: REV.NO.: DATE: PAGE: OF....							REFEREN CE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMAR KS
						TYPE OF CHECK	CLASS# OF CHECK	QUANT UM OF CHECK								
SL NO	ACTIVITY AND OPERATION	CHARACTERISTICS INSTRUMENTS	1	2	3	4	5	6	7	8	9	10				
1.	2.															
				LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS #: A = CRITICAL, B=MAJOR, C=MINOR;					DOC. NO.: REV.....							
MANUFACTURER/ SUB-SUPPLIER		MAIN- SUPPLIER							FOR THE							

SIGNATURE	'A' SHALL BE WITNESSED BY THE OWNER FQA, 'B' SHALL BE WITNESSED BY OWNER'S ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY ERECTION SUPPLIER (A & B CHECK SHALL BE OWNER CHP STAGE)	OWNER USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL
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ANNEXURE-J

13.0 LP PIPING, VALVES & SPECIALITIES

13.1 Equipment sizing Criteria

- 13.1.1 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.
- 13.1.2 For all LP piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.
- 13.1.3 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following.

a) Water Application

		Water Velocity in m/sec		
	Pipe Size	Below 50 mm	50-150 mm	200 mm & above
a)	Pump suction	-----	1.2-1.5	1.2-1.8
b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
c)	Header	----	1.5-2.4	2.1-2.4

The pipes in CW, ACW & DMCW system shall be designed to maintain a maximum velocity of 2 m/s inside the pipelines at pump discharge.

Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value.

i)	Carbon steel pipe	100
ii)	CI Pipe/Ductile Iron	100
iii)	Rubber lined steel pipe	120
iv)	Stainless steel pipe	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/sump/reservoir from which the pumps draw water.

Pumps for desalination service shall be designed considering 10% margin on flow and friction head over the actual requirement.

b) Compressed Air Application

Compressed air – 15.0 m/sec. (under Average Pressure & Temp. conditions)

- 13.1.4 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.
- 13.1.5 Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.
- 13.1.6 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.
- 13.1.7 Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.
- 13.1.8 High points in piping system shall be provided with vents alongwith valves as per the system requirement. Low points shall be provided with drains alongwith drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.
- 13.1.9 Material of construction for pipes carrying various fluids shall be as specified elsewhere.
- 13.1.10 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.
- 13.1.11 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.
- 13.1.12 Threaded joints shall be provided with Teflon sealant tapes.
- 13.1.13 Following types of valves shall be used for the system/service indicated.

System	Type of Valves					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & Vents		x	x	x		
Fuel oil		x	x	x	x	x

In water service, valves above 200 NB size shall be butterfly valves.

- 13.1.14 Recirculation pipes alongwith valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation

diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.

13.1.15 All Piping 450 NB & Above shall be designated as Large dia Piping.

13.2.00 TECHNICAL SPECIFICATION

13.1.00 GENERAL

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers/supports, tanks etc.

13.2.00 Pipes and fittings

13.2.1 All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as adhered to. The bidder shall furnish the pipe sizing / thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.

13.2.2 Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.

13.2.3 Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.

13.2.4 Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).

13.2.5 Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.

13.2.6 The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/expansion joint etc. shall be provided as may be necessary depending on layout.

- 13.2.7 Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.
- 13.2.8 For rubber lined ERW pipes, beads shall be removed.
- 13.2.9 Inspection holes shall be provided at suitable locations for pipes 800 NB and above as required for periodic observations and inspection purposes.
- 13.2.10 At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.
- 13.2.11 For large size pipes/duct, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.

Transient analysis / surge analysis wherever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems such as CW/ ACW/ Raw Water etc.

13.3.00 Material

- 13.3.1 Alternate materials offered by Bidder against those specified shall either be equal to or superior to those specified, the responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.
- 13.3.2 No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.
- 13.3.4 All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockiest are not acceptable.
- 13.3.5 All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable reference to enable identification of the certificate that certifies the material.
- 13.3.6 Material of construction for pipes carrying various fluids shall be as follows:

.	Service	Pipes	Fittings
1.	Circulating Water (CW) - condenser risers including header near condenser upto terminal point	IS 3589 FABRICATED FROM IS 2062 PLATES – INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT	
2.	ACW	300 NB & BELOW – SS 316L ABOVE 300 NB -	

.	Service	Pipes	Fittings
		ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING OF 1500 MICRONS DFT	
3.	RO Stage II Reject, Guard pond inlet & discharge, Piping from Reject sump,. Ash water piping using sea water and all other sea water applications.	UPTO 150 NB - ASTM A 312 TP 316 L (ERW)/ DUPLEX SS 200 NB & ABOVE - ERW IS 1978 (OR) API5L (OR) IS 3589 FABRICATED FROM IS 2062- Internally lined with Corrocoat or polyureA Coating inside of 1500 microns DFT/ GRP/ FRP	
4.	Filtered Water, service water, AHP Seal Water, HVAC Make up, Air Pre-Heater Wash water, Passivated DM Water and clarifier sludge.	IS-2062 Gr. B/ASTM-A-36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr. 410/IS-1239 Heavy. 150 NB & above pipes shall be spiral welded.	
5.	RO Stage II Permeate, Dematerialized water, (condenser Make up water, Boiler fill and Deaerator Fill water) & DMCW overhead tank make-up water	Stainless steel to ASTM A-312, Gr. 304 seamless/ welded	
6.	Drinking water	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.	
7.	Instrument air & plant air.	ASTM A-53 type E Gr. B galvanized /IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to SI-4736 or equivalent.	
8.	Fuel Oil piping	API5L	

.	Service	Pipes	Fittings
9.	HOSES FOR HFO TANKER HEATING (STEAM/ CONDENSATE)	CARBON STEEL – ELECTRO ZINC PLATED	
10.	FUEL OIL UNLOADING LINES	IS1239 / IS1978 / API5L Gr.B (ERW) / IS3589 FABRICATED FROM IS 2062 PLATES	Screwed fittings of GI as per IS 1239 Heavy. Galvanization shall be as per IS 4736.
11.	FUEL OIL PUMP DISCHARGE LINES	ASTM A 106 GR B	
12.	PSF/ UF Feed/ Permeate/ Backwash/ Chemical Backwash/ Chemical Cleaning/ Effluent water (Upto 150 NB) (Pipes & Fittings)	CPVC ON 10 Sch 40	CPVC PN 10
13.	PSF/ UF Feed// Chemical Backwash/ Chemical Cleaning/ Effluent water (> 150 NB)	GRP	GRP PN 10
14.	Sodium Hypochlorite/ All Chemical Dosinf lines (pipes & Fittings)	CPVC Sch 80 ASTM	CPVC Sch 80 ASTM

- 13.3.7 In water lines, pipes upto 150 mm NB shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B/IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS: 1239 Grade heavy except for dematerialized water and condensate spill lines.
- 13.3.9 Pipes of above 150 mm NB shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr. 410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. B/ASTM-A-36. However, larger pipes, i.e. 1000 mm NB and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. B and shall meet the requirements of AWWA-M-11(for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/ surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).
- 13.3.10 In dematerialized water service, the pipes upto 50 NB shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65 mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.
- 13.3.11 Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.
- 13.3.12 Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410/IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally

reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B/IS: 3589, Gr. 410/IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).

13.3.13 Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.

13.3.14 Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.

13.3.15 If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.

13.4.0 Piping Wall Thickness

13.4.1 The calculation of wall thickness required for pipelines subject to internal and/or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc., and the same shall be subject to approval by Purchaser. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.

13.4.2 In case of carbon steel materials, the nominal wall thickness of pipeline shall not be less than the minimum acceptable values given below:

NB mm (inch)	15 (1/2)	30 (3/4)	25 (1)	32 (1¼)	40 (1.5)	50 (2)	65 (2.5)	80 (3)	100 (4)	125 (5)
Min. thickness, mm	3.2	3.2	3.6	3.6	3.6	3.6	3.6	4.0	4.5	5.4
NB mm (inch)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	
Min. thickness, mm	5.4	6.35	6.35	6.35	7.1	7.1	7.1	8.0	8.0	

> NB 600 mm to NB 900 mm	-	8.0 mm
> NB 900 mm to NB 1200 mm	-	10.0 mm
> NB 1200 mm to 1400 mm	-	12.0 mm
> NB 1400 mm to 1600 mm	-	14.0 mm
> NB 1600 mm to NB 2200 mm	-	16.0 mm
> NB 2200 mm	-	18.0 mm

13.5.00 Piping Layout

13.5.1 Piping shall be grouped together where practicable and routed to present a neat appearance.

13.5.2 Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.

- 13.5.3 Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8 m above roadways/railways. When several pipelines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. If the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.
- 13.5.4 Pipelines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipe and submit to Employer for approval.
- 13.5.5 All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc.
- 13.5.6 Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.
- 13.5.7 Piping shall generally be routed above ground but where specifically indicated / approved by the project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.
- 13.5.8 Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.
- 13.5.9 All local instruments shall be located on pipelines as to render them observable from the nearest available platforms.
- 13.5.10 Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or approved filling compound.
- 13.6.00 Slope/Drains and Vents**
- 13.6.1 Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent shall not be less than 15 mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15 mm for line size up to 150 mm, not less than 20 mm up to 300 mm and not less than 25 mm for 350 mm to 600 mm pipes and not less than 50 mm for 600 mm and above pipes.
- 13.6.2 Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.
- 13.7.0 Pipe Joints**

In general all water lines 65 mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50 mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.

13.7.1

Screwed

- (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise.
- (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes or fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, alongwith the nascent threaded metal portion at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.
- (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.
- (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate pasts. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.
- (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to

inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

13.7.2 Welded

- (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

13.7.3 Flanged

- (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.
- (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.
- (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

13.8.00 Bends/elbows/mitre bends/Tees/Reducers & other fittings

13.8.1 Unless otherwise specified elbows shall be of long radius type.

13.8.2 For pipe sizes up to 65 Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.

13.8.3 For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 250 Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. Bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

13.8.4 Mitre bends are not acceptable in case of rubber lined mild steel pipes.

13.8.5 For pipe fittings such as reducers and tees, the material shall be to ASTM-A-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fittings shall conform to the dimensional standard of ANSI B-16.9.

However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.

For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.

- 13.8.6 Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea Water application, if any) Class-S, for sizes upto and including 50 mm NB, i.e. the fitting shall be of seamless construction.

However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.

- 13.8.7 In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

13.9.00 Flanges

- 13.9.1 Flanges shall be slip on type. Welding of flanges in tension is not permitted.

- 13.9.2 All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent. For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc flanges & bolts & nuts shall be SS 316 L construction.

13.10.00 Specific technical requirement of laying buried pipe with anti corrosive treatment

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

13.10.1 Trenching

- (a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.
- (b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.
- (c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000 mm between the top of the pipe and finished grade.
- (d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with IS: 5822 to provide an acceptable bed for placing the pipe.
- (e) Coating and Wrapping shall be done as under.

13.10.2 Preparation and cleaning of piping

- (a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power

cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.

- (b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.
- (c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230 mm for joints, which shall be coating manually at site after laying, welding and testing the pipe.

13.10.4 Trench bed preparation and back filling

Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.

13.10.5 Laying of galvanized steel (GI) pipes

All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joints shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and "anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

13.11.00 Cleaning and Flushing

13.11.1 All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.

13.11.2 Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.

13.11.3 After erection, all water lines shall be 1.2-1.5 times the operating velocities in the pipelines.

13.11.4 All compressed air pipe work shall be cleaned by blowing compressed air.

13.12.00 Painting of Pipes

13.12.1 Buried Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Tests to be carried out after application: Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.

Tests to be carried out after application: Bond/ Adhesion test, Holiday test

13.12.2

Overground Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.

- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

13.12.3 Other requirements

- (a) Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.
- (b) The color of the finish paint shall be as per approved color-coding.
- (c) If finish paint was applied in shop, one coat of finish paint shall be applied at site.
- (d) The dry film thickness of paint shall not be less than 0.15 mm.

13.12.4 Color code for identification

The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.

13.13.00 Specification for hangers and supports

- 13.13.1 All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.
- 13.13.2 While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.
- 13.13.3 Hanger for piping 65 mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.
- 13.13.4 Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS: 226/ or equivalent. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. The structural steel work shall be as per IS: 800/BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.
- 13.13.5 The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.
- 13.13.6 The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.
- 13.13.7 All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.
- 13.13.8 At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.
- 13.13.9 All components of hangers/support shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.

13.14.00 Design/Construction/Material Particulars of Gate/Globe/Check Valves/Globe Stop Valve/Butterfly Valve

13.14.1 GENERAL

- (a) All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate.
- (b) The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- (c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
- (d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.
- (e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.
- (f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.
- (g) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350 mm and above either bevel or spur gearing shall be provided to facilitate manual operation.
- (h) The valves coming in vacuum lines shall be of extended gland type and / or water sealed.
- (i) The actuator-operated valves shall be designed on the basis of the following:
 - (1) The internal parts shall be suitable to support the pressure caused by the actuators.
 - (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 - (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.
 - (4) All actuators operated valves shall open/close fully within time required by the process.
- (j) Valves coming under the purview of IBR shall meet IBR requirements.
- (k) Gate/slucice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:
 - (1) Hand wheel
 - (2) Position indicator (for 65 NB & above valve size)

- (l) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.
- (m) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening/closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600 mm NB.
- (n) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.
- (o) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.
- (p) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.
- (q) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer.
- (r) All valves except those with rising stems shall be provided with continuous mechanical position indicator; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.
- (s) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS-1538 for fitting shall be applicable.

13.14.2

VALVE BODY MATERIAL

Valve body material for various services shall be as follows:

Valve body material for water application like DM Cooling Water (Passivated DM Water) (DMCW), RO Stage I Permeate, AHP Seal Water, APH/ ESP Wash, Service Water, Potable Water, HVAC Make UP shall be cast iron for sizes 65 NB and above; gun-metal/ Forged Carbon Steel for sizes 50 Nb and below.

Valve body material for sea water application like Circulating Water. Auxiliary Coling water, Blowdown, CT make up, sea water Intake, Guard pond inlet & Discharge, Ash Water using sea water, RO Stage II reject, RO Stgae I reject, Reject Sump discharge and all other sea water applications shal be Duplex Stainless Steel for all sizes.

For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.

DM water: SS body and disc alongwith SS internals.

Condensate: Cast Carbon Steel/Forged Carbon Steel.

13.14.2.1

The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

Standards and Codes

AWWA-C-504	Rubber seated butterfly valves
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.
BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valves
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves
ANSI B 16.34	Standard for valves
API-594	Standard for Dual-check valves
API-600	Steel gate valves
ANSI-B-16.10	Valves face to face and other relevant dimension
API-598	Valves inspection test

13.14.2.2 End Connections

The end connections, shall comply with the following:

Socket welding (SW) – ANSI B 16.11

Butt Welding (BW) – ANSI B 16.25

Threaded (SC) – ANSI B 2.1

Flanged (FL) – ANSI B 16.5 & AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges)

13.14.2.3 All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).

13.14.2.4 All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.

13.14.2.5 All gun metal body valves shall have screwed ends.

13.14.2.6 All flanged end valves/specialties shall be furnished alongwith matching counter flanges, fasteners, gaskets etc. as required to complete the joints

13.15.00 Check Valves

13.15.1 Check valves shall comply with the following characteristics:

- (a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);
- (b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.
- (c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.

13.15.2 Drilling on flanges of flanged valves must correspond tot eh drilling on flanges of the piping system on which the valves are to be installed.

13.15.3 All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.

13.15.4 Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.

13.16.00 Globe Valves

13.16.1 The globe valves shall have the following characteristics;

Straight conveyed flow

Right angle

Preferably, the valves shall be of the vertical stem type.

- 13.16.2 Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.
- 13.16.3 The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.
- 13.16.4 For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.
- 13.16.5 All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.
- 13.17.00 Gate valves**
- All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.
- Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.
- 13.18.00 Air Release Valve**
- (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.
 - (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.
 - (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260 and spindle shall conform to high tensile brass.
 - (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/butterfly valve.
- 13.19.00 Butterfly Valves**
- 13.19.1 Design/Construction**
- (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations,

in order to establish the integrity of the fabricated valve body under the system operating pressure condition.

- (1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable.
- (2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.
- (3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.
- (4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.
- (5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.
- (6) The operating mechanism shall be mounted directly on or supported from the valve body.
- (7) All valves shall be complete with:
 - Position indicator (located in a visible place)
 - Arrow indicating the flow direction;
 - Adjustable mechanical stop limiting devices to prevent over
 - Travel of valve disc in open/close position.
 - All valves shall be "tight shut off"
- (8) Hand operated valves shall have the following
 - Local hand controls
 - The hand controls shall close the valve with clockwise rotation.

The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions.

The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.

Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300 mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.

Valves-350 Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

Valves-350 Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque. It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

13.19.2 Material of Construction (Butterfly Valves)

Materials and other design details shall be as indicated below:

(a) Cast Iron Butterfly valves

Body & Disc	ASTM A48, Gr. 40 with 2% Ni/
	IS: 210. Gr. FG-260, with 2%
	Ni and epoxy coated
Shaft	BS 970 431 S: 291/EN 57, or
	AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
Seal	Nitrile Rubber
Companion Flanges	IS 2062
External hardware	SS 316

	Internal hardware	SS 316
(b)	Duplex Stainless Steel Butterfly valves (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water (Sea water) etc.)	
	Body & Disc	Duplex Stainless Steel
	Shaft	Duplex Stainless Steel.
	Seat ring	Duplex Stainless Steel
	Seal	Nitrile Rubber
	Companion Flanges	Duplex Stainless Steel
	External hardware	Duplex Stainless Steel
	Internal hardware	Duplex Stainless Steel
(c)	Stainless Steel Butterfly Valves	
	Body & Disc	ASTM A 351, Gr. CF8M/ASTM-A-182-Gr. 304
	Shaft	ASTM A 182, Gr. 316/ASTM-A-479 Gr. 316/Equivalent
	Disc & Seat Rings	EPT/BUNA-N/Neoprene
	Companion Flanges	SS 304
	External hardware	SS 316
	Internal hardware	SS 316
(d)	Carbon Steel Butterfly Valves	
	Body & Disc	ASTM A 216, Gr. WCB
	Shaft	ASTM A 182, Gr. 304/ASTM-A-479 Gr. 304/Equivalent
	Disc & Seat Rings	EPT/BUNA-N/Neoprene
	Companion Flanges	IS 2062
	External hardware	SS 316
	Internal hardware	SS 316

13.19.3 Proof of Design Test (Type Test) for Butterfly Valves

Proof of Design (POD) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual POD test shall be conducted by the bidder in the presence of Employer's representative.

All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of POD test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the POD test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of POD test of AWWA-C-504.

13.20.00

MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)

(a) The materials shall generally comply with the following:

(1) Cast Steel Valves

Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent
Companion Flanges	IS 2062
External hardware	SS 316
Internal hardware	SS 316

(2) Stainless Steel Valves

Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304
Disc	-do-
Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479 Gr. 316 or Integral with body
Companion Flanges	SS 304
External hardware	SS 316
Internal hardware	SS 316

(3) Cast Iron Valves

Body & bonnet 260	BS 1452 Gr. 14/IS-210 Gr. FG
Seating surfaces and rings	13% chromium steel/13% Chrome overlay
Disc for non-return valves Hinge pin for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260 AISI 316
Stem for gate globe valves	13% chromium steel or Equivalent

Back Seat	13% chromium steel / 13% Chrome overlay
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Companion Flanges	IS 2062
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External hardware	SS 316
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Internal hardware	SS 316
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(4) Gun Metal Valves

Body and bonnet	IS 318 Gr. 2/Equivalent Standard
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Trim	-do-
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Companion Flanges	IS 2062
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External hardware	SS 316
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Internal hardware	SS 316
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(5) Duplex Stainless Steel (All Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)

Body & bonnet	Duplex Stainless Steel
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Disc for non-return	Duplex Stainless Steel
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Stem	Duplex Stainless Steel
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Trim.	Duplex Stainless Steel
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Companion Flanges	Duplex Stainless Steel L
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External hardware	Duplex Stainless Steel
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Internal hardware	Duplex Stainless Steel L
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(b) Cast iron body valves shall have high alloy steel stem and seat.

(c) Material for counter flanges shall be the same as for the piping except for sea water application.

13.21.00 Float Operated Valves

(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.

(b) DESIGN AND CONSTRUCTION FEATURES

The following design and construction feature of the valve shall be the minimum acceptable.

(c) Valves shall be right-angled or globe pattern.

- (d) Valves shall be balance piston type with float ball.
- (e) Leather liner shall not be provided.
- (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and float shall be of copper with epoxy painting of two (2) coats. For all sea water applications the complete valve shall be SS 316 L construction.
- (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.
- (h) The valves shall have flanged connections.

13.22.00 PAINTING OF VALVES:

Two (2) coats of primer followed by three (3) coats of epoxy of approved color code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the contractor by repainting with compatible painting primer and enamel to the satisfaction of the project manager.

13.23.00 RUBBER EXPANSION JOINTS

- 13.23.1 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.
- 13.23.2 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.
- 13.23.3 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.
- 13.23.4 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.
- 13.23.5 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.
- 13.23.6 Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipelines.
- 13.23.7 The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.
- 13.23.8 The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.

- 13.23.9 All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr. B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.
- 13.23.10 The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.
- 13.23.11 All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
- 13.23.12 Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.
- 13.23.13 Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
- 13.23.14 Bidder to note that any metallic part which comes in contact with DM / Corrosive water shall be of stainless steel material.
- 13.23.15** **For all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc the bolts & nuts, stretcher plates and companion flanges shall be SS 316 L.**

13.24.00 STRAINERS

13.24.1 Simplex type

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition fitted with a removable plug. The material of construction of various parts shall be as follows:

- | | |
|----------------------|---|
| (a) Body | IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)
Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc) |
| (b) Strainer Element | Stainless steel (AISI 316)

Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT |

		make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
	(c) End connection	Screwed upto 50 mm Nb, and flanged above 50 mm Nb
13.24.2	Duplex type	
	(a)	The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow. 2 x 100% automatic self cleaning filters shall be provided for each unit in the ACW discharge header.
	(b)	Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.
	Body	IS: 318, Gr. 2 Up to 50 mm Nb, and IS:210, Gr. FG 260 of ASTM-A-515 Gr. 75/IS-2062 Gr. B and internally epoxy-painted above 50 NB. SS 316 L (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
	Strainer element	Stainless steel (AISI 316) for normal water/ Duplex Stainless Steel (all Sea Water applications including guard pond, reject sump, CW, ACW, CT make Up, Sea Water Intake, RO Stage I Reject, RO Stage II Reject, Ash water etc)
	End connection	Screwed up to 50 mm NB, and Flanged above 50 NB. Gasket shall be of full face type
	(c)	The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.
	(d)	The size of the strainer and the flow direction will be indicated on the strainer body casting.
	(e)	Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.
13.24.3	Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.	

ANNEXURE-K

PAINTING

1.0 SCOPE

This section defines the technical requirements for surface preparation, selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The bidder shall submit a detailed painting procedure for approval of owner/ owner's representative after the award of contract.

The following surface and material shall require painting:

- a. All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
- b. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
- c. All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting :

- a. Non-ferrous materials
- b. Austentic stainless steel
- c. Plastic and / or plastic coated materials
- d. Insulated surface of equipment and pipes except color coating wherever required.
- e. Painted equipment like blowers, pumps, valves etc. with finishing coats in good condition and with matching color code.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of pipelines
IS:1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)

IS:2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS:2932	:	Enamel Synthetic exterior (a) Undercoating (b) finishing
IS:4682	:	Code of practice for lining of vessels & equipment
SIS 559000	:	Swedish standard for blasting
ISO 8504-2	:	Preparation of steel substrates before application of paints and related products. Surface preparation methods Part 2 Abrasive blast cleaning
ISO 8501-1	:	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
SIS 05 5800	:	Surface preparation by acid pickling
SSPC SP08	:	Surface preparation by acid pickling
IS 2629	:	Recommended practice for hot dip galvanizing of iron and steel
ASTM A780	:	Standard practice for repair of damaged galvanized coatings
SSPC	:	Steel structures painting council
NACE	:	National association of Corrosion Engineers
DIN	:	Deutsehes Institute for Normung
BS	:	British Standard
ASTM	:	American Society for Testing material
AWWA	:	American Water works association

3.0 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical derusters or rust converters shall not be applied. Acid cleaning is subject to approval of Purchaser/ Purchaser's representative.

3.1 BLASTING

The surface of the part/ component shall be blasted before the coating material is applied.

Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air above 1100C. Blasting activity shall be performed at temperatures 30C above dew point and substrata temperature between 50C & 500C and relative humidity not exceeding 85% shall be maintained during painting. Necessary safety precautions for equipment and operator shall be adhered to and shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work.

Abrasive used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives are chilled iron grit, shot steel, malleable iron grit and shots of non metallic abrasive (aluminum oxide, copper slag, garnet etc.).

The grade of blasting shall be performed in line with the approved painting scheme.

The nature, quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the required surface profile depth and cleanliness.

Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

The grades of surface finish

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2½	Sa 2½	SP10	2
Commercial Blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting

(a) Blasting according to SIS 055900, Grade Sa 2½

Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer coat shall be 15-25 µm.

3.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

3.3 Cleaning

Removal of impurity

	Impurity	Removal
a)	Dust, Loose deposits	Vacuum cleaning, brushing
b)	Adhesive deposits	Power brushing
c)	Oils, greasy impurities	Wet Blasting, Use of Detergent Additives by agreement
d)	Salt deposits	Rinsing
e)	Markings (eg felt up pen)	Organic solvents to manufacturer's specifications eg Trichloro trifluoro ethane and solvents containing acetone (renew solvent and rag frequently)

3.4 Acid Pickling

Prior to galvanizing the surface preparation shall be done by acid pickling as per SSPC-SP-08.

4.0 PROCESSING

4.1 General Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature shall be + 5°C and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3°C above dew point.

4.2 Application Procedure

The primer shall be applied by means of brush or by spary. The top coats shall be applied by means of brush, roller or spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

4.3 Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning according coating manufacturers specification. The final top shall be reapplies completely.

4.4 Uncoated Surfaces

Moving parts of machines (e.g stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating upto a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

4.5 Bond Strength

The pill off stress determined using the pull off test method for adhesion shall not be less than 1.5 N/mm², according to ISO 4624.

5.0 SURFACE CONDITIONS OF COATING SURFACES

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

6.0 COATING SYSTEMS

6.1 General Requirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating this

specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of top coats shall be in accordance with sub clause suggested colour codes for painting (Sub Clause 6.8)

6.2 Standard Coating System (External Coatings)

(a) Steel Surfaces

- (i) All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.
- (ii) Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted as explained in clause 3.1 to Sa 2½ finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.
- (iii) Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.
- (iv) Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- (v) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

(b) Gratings and Step Threads

(i) Surface Preparation

Gratings and step threads shall be cleared by acid pickling as per SSPC-SP-08

(ii) Hot Dip galvanizing

The hot dip galvanizing shall be done as per IS 2629. The average mass of coating shall be 610 gm/m².

(iii) Post Treatment

Immediately after galvanizing post treatment such as chromating shall be applied to retard white rust attack.

(iv) Touch up mechanical damages

The repair of damages coatings shall be done as per the recommended practice ASTM A780.

6.3 Painting of Indoor components such as valves, pumps, motors, electrical parts, tanks etc.

At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

At Site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

6.4 Painting of Outdoor equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature upto 120°C as per clause 6.1 & 6.3. However

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

6.5

Special Coating

(a) Parts exposed to temperatures above 120°C, upto 200°C, not insulated

(i) At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½ and ISO 8501-1:1958. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to ISO 8501-1:1989, grade St 3 touch up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50µm.

Intermediate Coat

1 pack silicon acrylic dry film thickness 35 µm.

Final Coat

1 pack silicon acrylic, dry film thickness as 35µm.
Total system dry film thickness 145µm.
Final coat according to colour code.

(b) **Parts exposed to temperatures above 200°C, upto 400°C, not insulated**

(i) **At Works**

Surface Preparation

Blasting according to ISO 8501-1:1958 grade Sa-2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) **At Site**

Pretreatment

Derusting of all mechanical damages, according to standard Sa 2½ to ISO 8501-1:1988. Touch up with coating system according to manufacturer's recommendations.

(c) **Insulated parts continuously exposed to condensing water or parts exposed to temperatures**

For parts that are provided with insulation on site.

(i) **Insulated parts exposed to condensing water**

At Works

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm

(ii) **Insulated parts exposed to temperatures**

Parts exposed to temperatures upto < 400°C

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.

Parts exposed to temperature above 400⁰C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and superheaters, reheaters etc)

Temporary Primer

Varnish

(d) Intermittent exposure due to condensing water/ chemicals (Indoors)

(i) At Works

Surface Preparation

Blasting according to Sa 2½ and ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two layers of Zinc phosphate primer, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 50µm.

Total system dry film thickness 205µm.

When exposed o weathering, weather resistance finish coat shall be applied.

(e) Water Exposure

(i) At Site/ Works

Pretreatment

Removal of all welding pearls.

Blasting according to Sa 3 to ISO 8501-1:1988

Coat

4 coats 2 pack coal tar epoxy, dry film thickness 125 µm each.

Total system dry film thickness 500µm

Touch up after erection as required.

6.6 Painting of Pipes

6.6.1 Buried Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

6.6.2 Overground Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

6.7 Internal Coatings

6.7.1 Tanks (Internal surfaces) as specified in relevant sections of specification

Industrial deionised, demineralised and potable water upto 60°C pH range 4.5-9.5

Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry film thickness >75µm.

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat.

In case of service or potable water tanks, the coating material selected shall not taint the water. The paint system shall conform to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work.

QA/ QC Procedure including pinhole inspection, shall be submitted for approval by Owner/ Owner's representative.

6.6.2 Rubber Lining of Pipes, Valves and Tanks for DM Water

Pretreatment

Blasting according to Sa 2½ and ISO 8501-1:1988

Rubber Lining

Hard rubber 5 mm for DM water applications as IS – 4682

6.7 Painting for Electrical items

6.7.1 All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate/ oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing epoxy paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5/ RAL 7032 for all switchboard/ MCC/ Distribution boards, control panels etc.

6.7.2 All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.

6.7.3 Painting of I & C equipment : Epoxy coating required for all I & C equipment.

6.8 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2.	Boiler casing, ducting	Nut Brown	413	-	-

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
3.	Crane				
3.1	Crane structure	Golden Yellow	356	Black	-
3.2	Trolley & hook	Crimson	540	-	-
4.	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.	Switchgear	Light grey (Powder coated)		-	-
8.	Control & relay panels	Light grey (Powder coated)	631/70 78 of IS 1650	-	-
9.	Turbines	Light Grey	631	-	-
10.	Generators & Exciter	Light Grey	631	-	-
11.	Transformers	Aluminum	-	-	-
12.	Machinery guards	Signal red	537	-	-
13.	Piping (without insulation and cladding)				
13.1	Water System				
a	Boiler feed	Sea Green	217	-	-

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
b	Condensate	Sea Green	217	Light Brown	410
c	DM Water	Sea Green	217	Light Orange	557
d	Soft Water	Sea Green	217	French Blue	166
e	Bearing Cooling Water	Sea Green	217	French Blue	166
f	Potable & filtered Water	Sea Green	217	French Blue	166
g	Service and clarified water	Sea Green	217	French Blue	166
h	Cooling water	Sea Green	217	French Blue	166
l	Sea Water	Sea Green	217	White	-
14.	Ash Transmitting Vessels and pipe lines	Aluminium	-	-	
15.	Air System				
15.1	Station air	Sky blue	101	-	-
15.2	Control air	Sky blue	101	White	-
16.	Oil system				
16.1	Fuel oil	Light brown	410	French	166
16.2	Light oil (HSD)	Light Brown	410	Brilliant green	221
16.3	Lubricating oil	Light brown	410	Light grey	631
16.4	Transformer oil	Light brown	410	Light orange	557
17.	Gas System				
17.1	Carbon dioxide	Canary yellow	309	Light grey	631
17.2	Hydrogen	Canary yellow	309	Signal red	537
18.	Fire services	Fire red	536	-	-
19.	Effluent pipes	Black	-	-	-
20.	Vacuum pipes	Sky blue	101	Black	-

Notes :

1. This colour code basically refers to IS:2379 for piping with necessary modifications

2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.

9.11.00

Painting

- a) All steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.
- b) Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted to Sa-2½ finish as per SIS05-5900. Primer paint shall be zinc silicate of approved brand. Dry film thickness of each primer coat shall be 50 microns.
- c) Finish paint shall be 2 coats of High built epoxy finish of approved brand. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 300 microns. All paints shall be of approved brand and shade as per the OWNER's requirement.
- d) Joints to be site welded shall have no paint applied within 100 mm of welding zone.

Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

- e) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly.

Surfaces inaccessible after erection including top surfaces offloor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

9.12.00

Fabrication of Structural Steel Work

9.12.01

The details of fabrication, shop testing and delivery to site of structural steel work including supply of all consumable stores, bolts, nuts, washers, electrodes and other materials as required including field connections are indicated below to be performed by the contractor:

- a. Preparation & submission of complete detailed fabrication drawings and erection marking drawings as required including design calculations.



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
2X800 MW UPPUR STPP**

SPECIFICATION NO. PE-TS-425-160-A001

Section-I

SHEET 1 OF 3

DRAWINGS/DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

S.No.	BHEL DRGNO	DRG TITLE	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI	CATEGORY
1	PE-V0-425-160-A002	GA OF WATER AND AIR LINE VALVES	12	A-CUST
2	PE-V0-425-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR	10	A-CUST
3	PE-V0-425-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM	4	A-CUST
4	PE-V0-425-160-A005	INSTRUMENT SCHEDULE	10	I-CUST
5	PE-V0-425-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	4	A-CUST
6	PE-V0-425-160-A007	DETAILED BOM	20	I-BHEL
7	PE-V0-425-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)	6	I-CUST
8	PE-V0-425-160-A009	P G TEST PROCEDURE	20	A-CUST
9	PE-V0-425-160-A010	P & I DIAGRAM OF MRS COMPRESSOR	10	A-CUST
10	PE-V0-425-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY	4	A-CUST
11	PE-V0-425-160-A012	WELDING PROCEDURE SPECIFICATION	6	A-CUST
12	PE-V0-425-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE	8	A-CUST
13	PE-V0-425-160-A014	LAYOUT OF COMPRESSOR HOUSE	10	A-CUST
14	PE-V0-425-160-A015	QAP OF MS STRUCTURAL STEEL/ PLATES	6	A-CUST
15	PE-V0-425-160-A016	CABLE TRAY, EARTHING LAYOUT	10	A-CUST
16	PE-V0-425-160-A017	QAP OF SELF MANUFACTURED- CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL	8	A-CUST
17	PE-V0-425-160-A019	G.A OF MRS BUNKER	6	A-CUST
18	PE-V0-425-160-A020	QAP OF MS ERW PIPE	10	A-CUST
19	PE-V0-425-160-A021	QP FOR COMPRESSOR	10	A-CUST
20	PE-V0-425-160-A022	TRENCH AND INSERT DETAIL OF MRS	8	A-CUST
21	PE-V0-425-160-A023	QP FOR KNIFE GATE/PLATE VALVE	10	A-CUST
22	PE-V0-425-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER	10	A-CUST



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
2X800 MW UPPUR STPP**

SPECIFICATION NO. PE-TS-425-160-A001

Section-I

SHEET 2 OF 3

23	PE-V0-425-160-A025	GA OF KNIFE GATE/PLATE VALVE	8	I-CUST
24	PE-V0-425-160-A026	QP FOR BAG FILTER	10	A-CUST
25	PE-V0-425-160-A027	G.A OF BAG FILTER	8	I-CUST
26	PE-V0-425-160-A028	QP FOR METALLIC EXPANSION BELLOW	10	A-CUST
27	PE-V0-425-160-A030	QP FOR RUPTURE DISC	10	A-CUST
28	PE-V0-425-160-A031	QP FOR CHAIN PULLEY BLOCK	10	A-CUST
29	PE-V0-425-160-A032	QP FOR WATER AND AIR LINE VALVES	10	A-CUST
30	PE-V0-425-160-A033	QP FOR COMPRESSOR MOTOR	10	A-CUST
31	PE-V0-425-160-A034	G.A OF METALLIC EXPANSION BELLOW	8	I-CUST
32	PE-V0-425-160-A035	G.A. OF RUPTURE DISC.	8	I-CUST
33	PE-V0-425-160-A036	QAP of INSTRUMENTS (PG/PS/PT/TS/TG/SV)	12	A-CUST
34	PE-V0-425-160-A037	GA OF CHAIN PULLEY BLOCK	8	I-CUST
35	PE-V0-425-160-A040	TYPE TEST CERTIFICATE/PROCEDURE FOR MOTORS	10	A-CUST
36	PE-V0-425-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR	10	A-CUST
37	PE-V0-425-160-A044	QP FOR SUMP PUMP WITH MOTOR	12	A-CUST
38	PE-V0-425-160-A045	GA, TECHNICAL DATA SHEET AND WIRING DIAGRAM OF SUMP PUMP	10	I-CUST
39	PE-V0-425-160-A046	ELECTRICAL LOAD LIST	6	I-G-P
40	PE-V0-425-160-A047	TECHNICAL DATA SHEET OF TEMPERATURE SWITCH, TEMPERATURE GAUGE, PRESSURE SWITCH, PRESSURE GAUGE, SOLENOID VALVE , LEVEL SWITCH , AIR FILTER REGULATOR	10	I-CUST
41	PE-V0-425-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O List	10	A-CUST
42	PE-V0-425-160-A051	CABLE INTERCONNECTION DIAGRAM	14	I-CUST
43	PE-V0-425-160-A052	PAINTING SCHEDULE	8	I-CUST
44	PE-V0-425-160-A053	PIPING AND VALVE SCHEDULE	8	I-CUST
45	PE-V0-425-160-A054	CABLESCHEDULE -SIGNAL AND CONTROL	12	I-CUST
46	PE-V0-425-160-A055	OPERATION AND MAINTENANCE MANUAL	24	I-CUST

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.



TITLE

**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM
2X800 MW UPPUR STPP**

SPECIFICATION NO. PE-TS-425-160-A001

Section-I

SHEET 3 OF 3

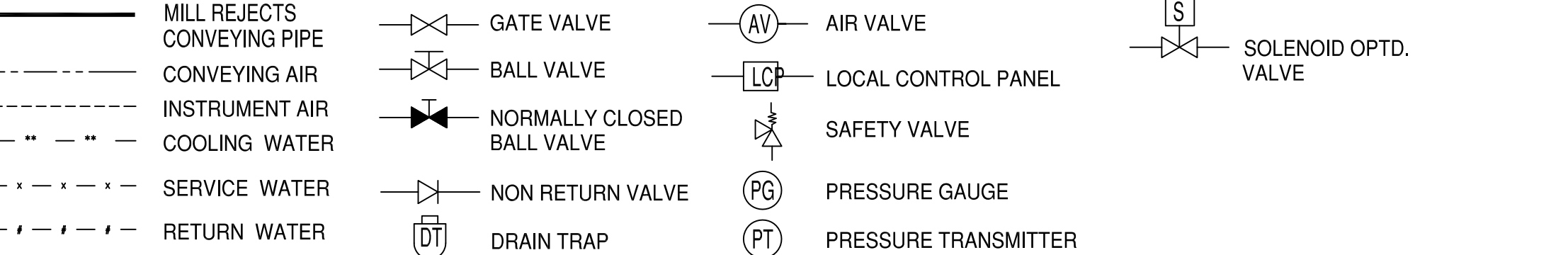
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:
 - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.
 - f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
 - g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
 - h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
 - i) 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.
 - j) Bidder to follow the following the drawing submission schedule:
 - k) 1st submission of drawings from date of LOI as per the submission schedule.
 - l) Every revised submission incorporating comments – within 7 days.
 - m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.



TITLE
2X800 MW UPPUR STPP
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-425-160-A001
SECTION - I
REV 00
Sub Section -IA **Date Nov 2017**

ANNEXURE – M
INPUT DRAWINGS

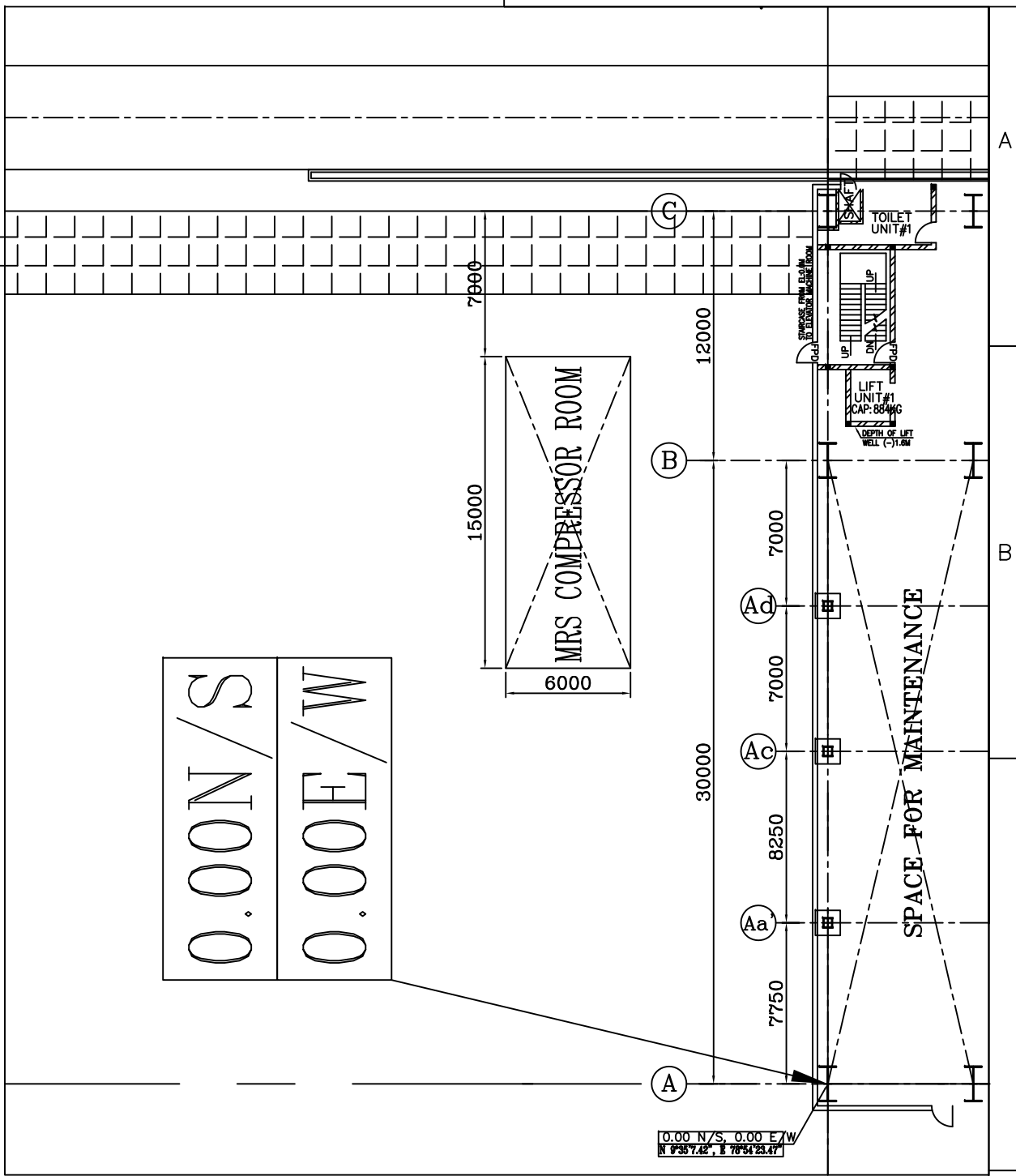
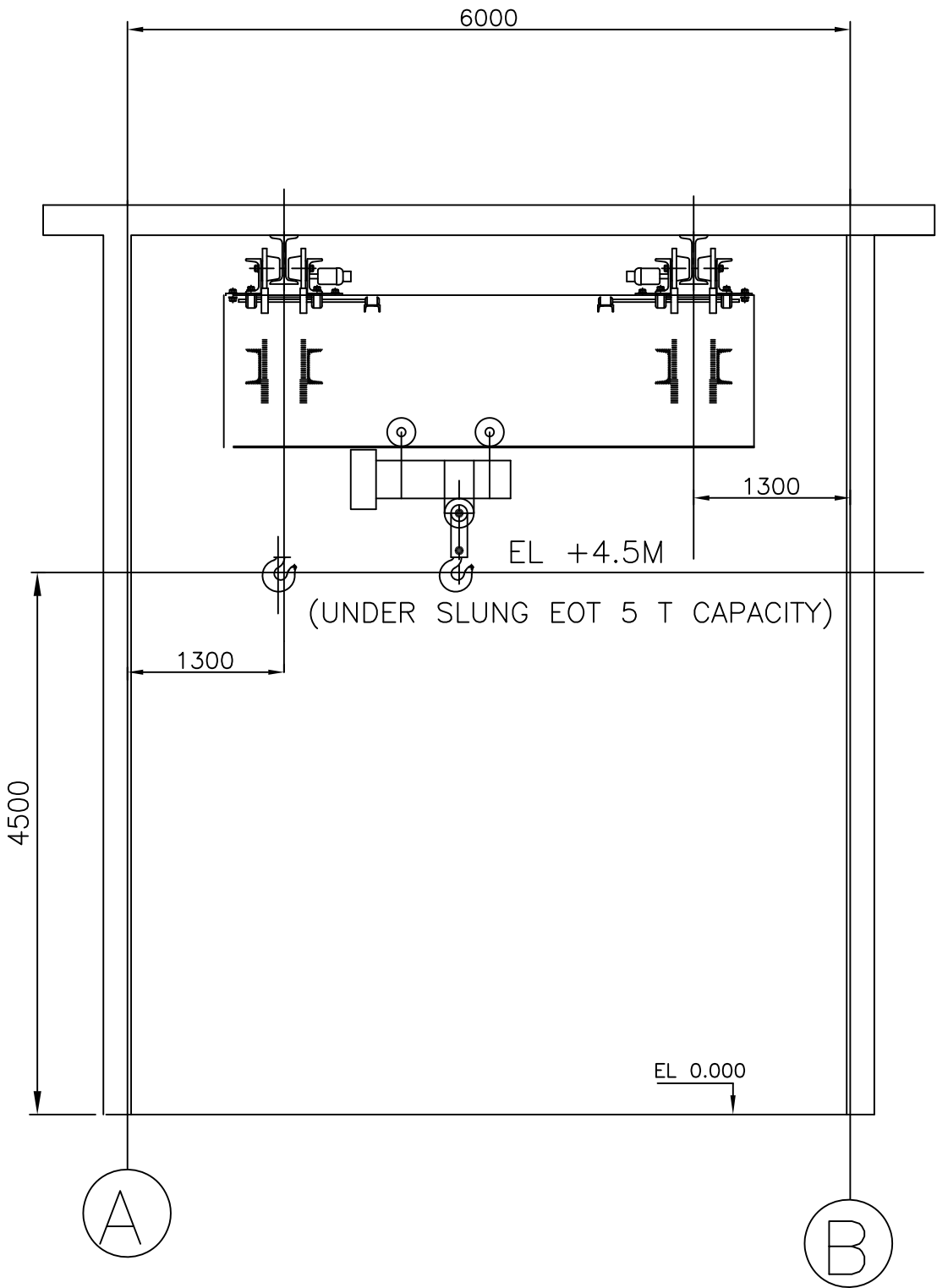
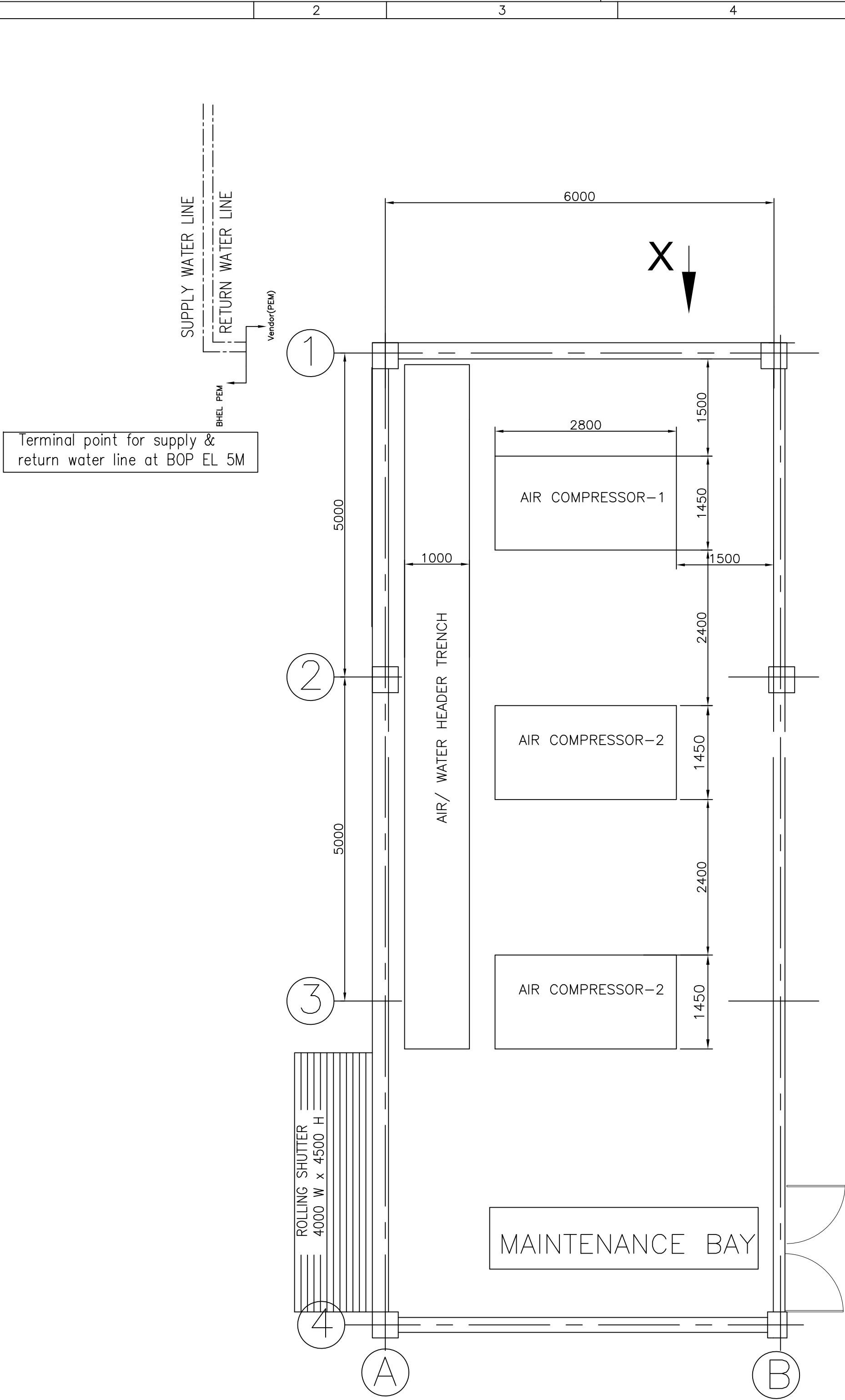


1. THE DRG INDICATES BROAD SCOPE & WORKING PRINCIPAL OF THE SYSTEM. FLOW DIAGRAM SHALL BE READ IN CONJUNCTION WITH DESIGN MEMORANDUM.

CUSTOMER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5th Floor, Western Wing, NPKRR Maaligol, 144, Anna Sala, Chennai-600002
CONSULTANT	TRACTEBEL ENGINEERING PVT. LTD. 
PROJECT	2X800 MW SUPERCritical COAL BASED UPPUR TPP 
BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NODA	
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.	
TITLE FLOW DIAGRAM OF MILL REJECT HANDLING SYSTEM	

COPY RIGHT AND CONFIDENTIAL
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it must not be used directly or indirectly in any way detrimental to the interest of the company.

COMPUTER FILE NAME:



NOTES:—

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METERS.
2. DIMENSIONS ARE INDICATIVE LIKELY TO CHANGE BASED ON COMPRESSOR MODEL.
3. ALL ELEVATION MARKED ARE W.R.T. TG HALL FINISHED

FLOOR ELEVATION OF EL 0.00M WHICH CORRESPONDS TO RL (+) 5.8 M

REFERENCE DRAWING :—

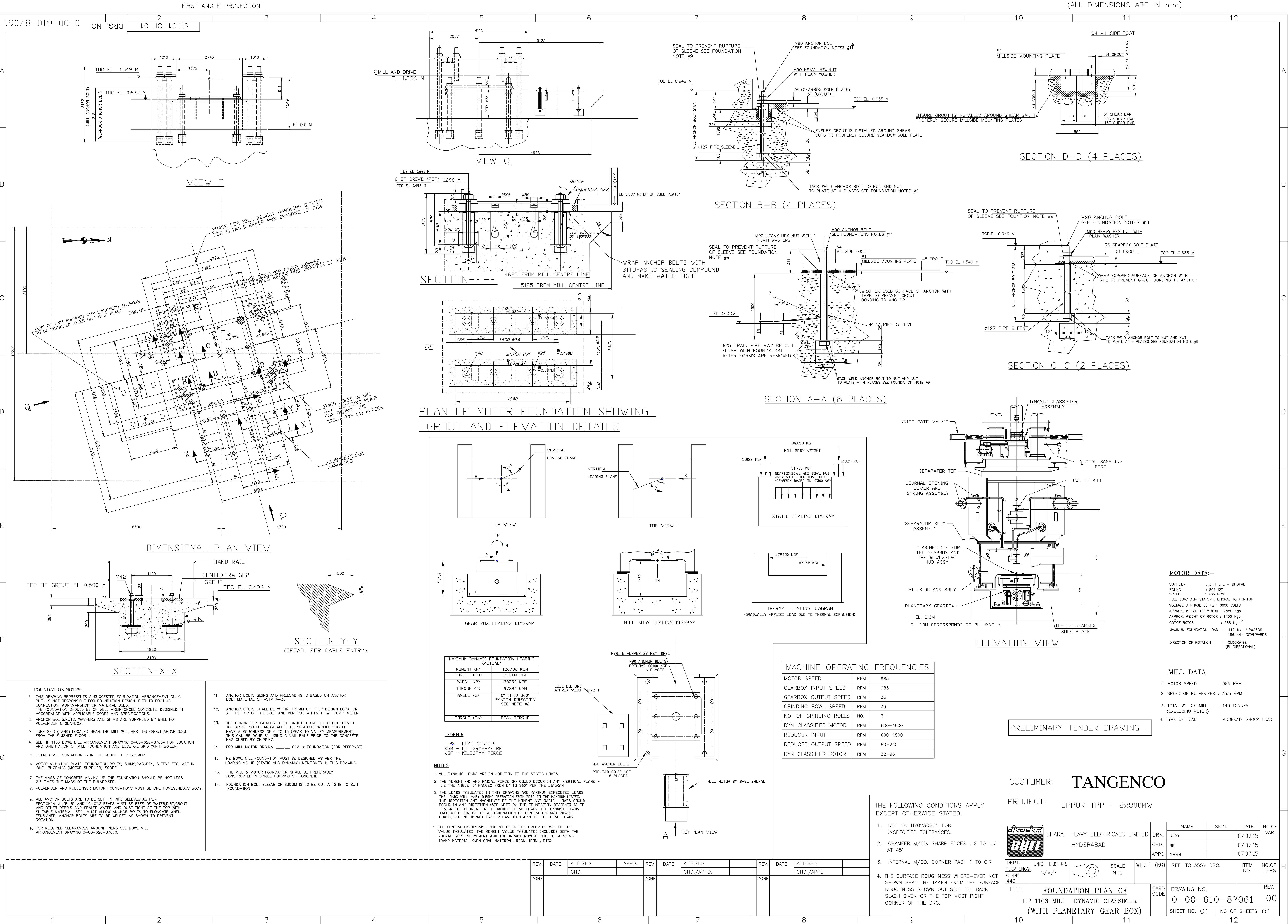
1) MAIN EQUIPMENT PLANT LAYOUT	PE-DG-425-100-M002
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JOB No.		425									
STATUS		PROJECT									
CONTRACT											
TO											
No.OFF											
REV		DATE			ALTD		CHD			APPD	

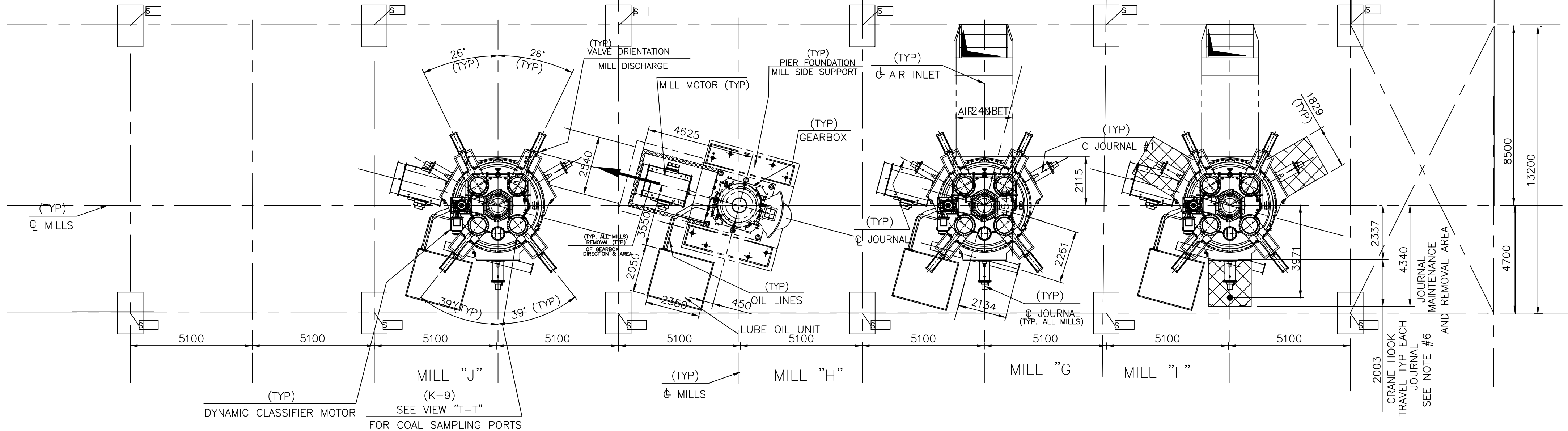
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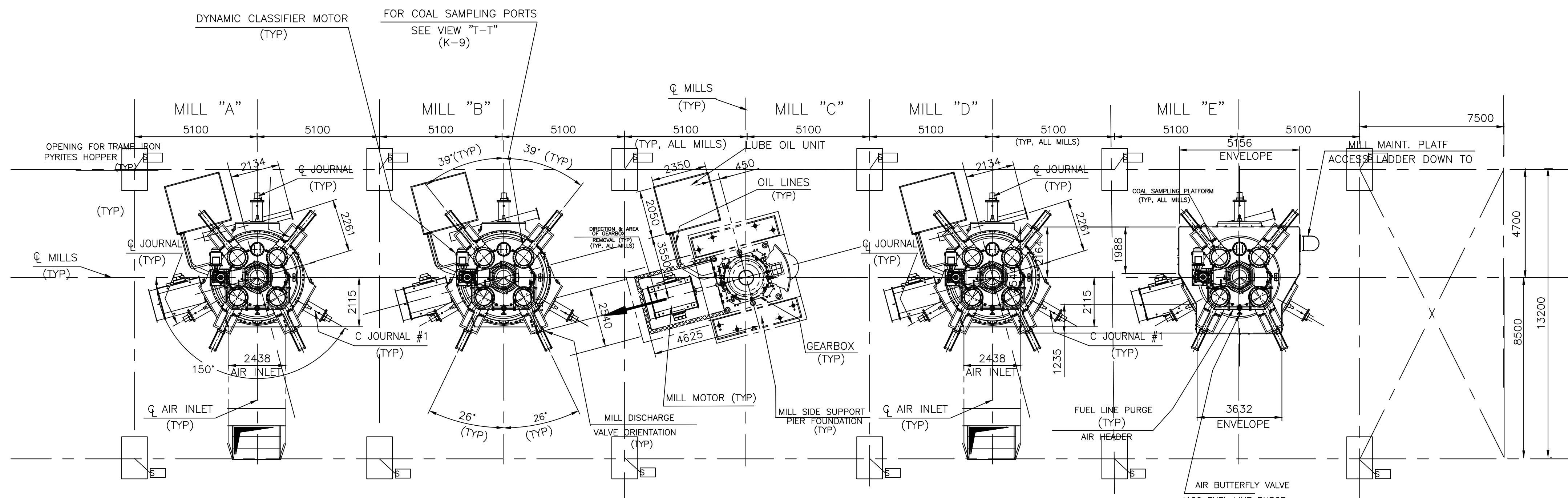
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REF. DRG. NO.
COMPUTER FILE NAME



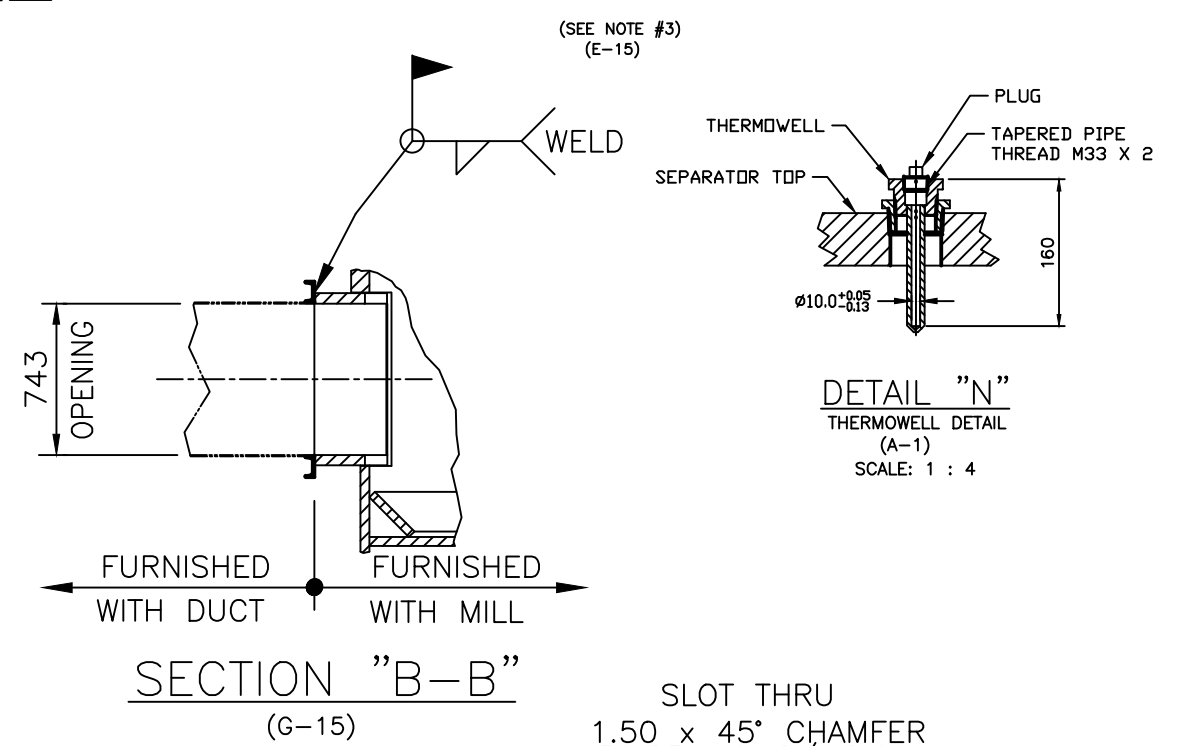
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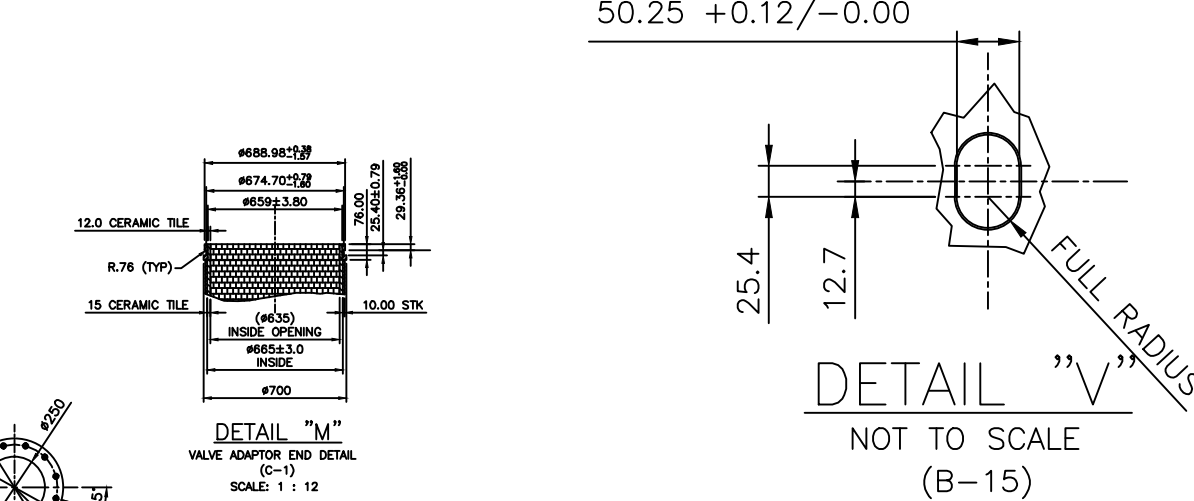
DYNAMIC CLASSIFIER MOTOR SEE VIEW "T-T"
FOR COAL SAMPLING PORTS



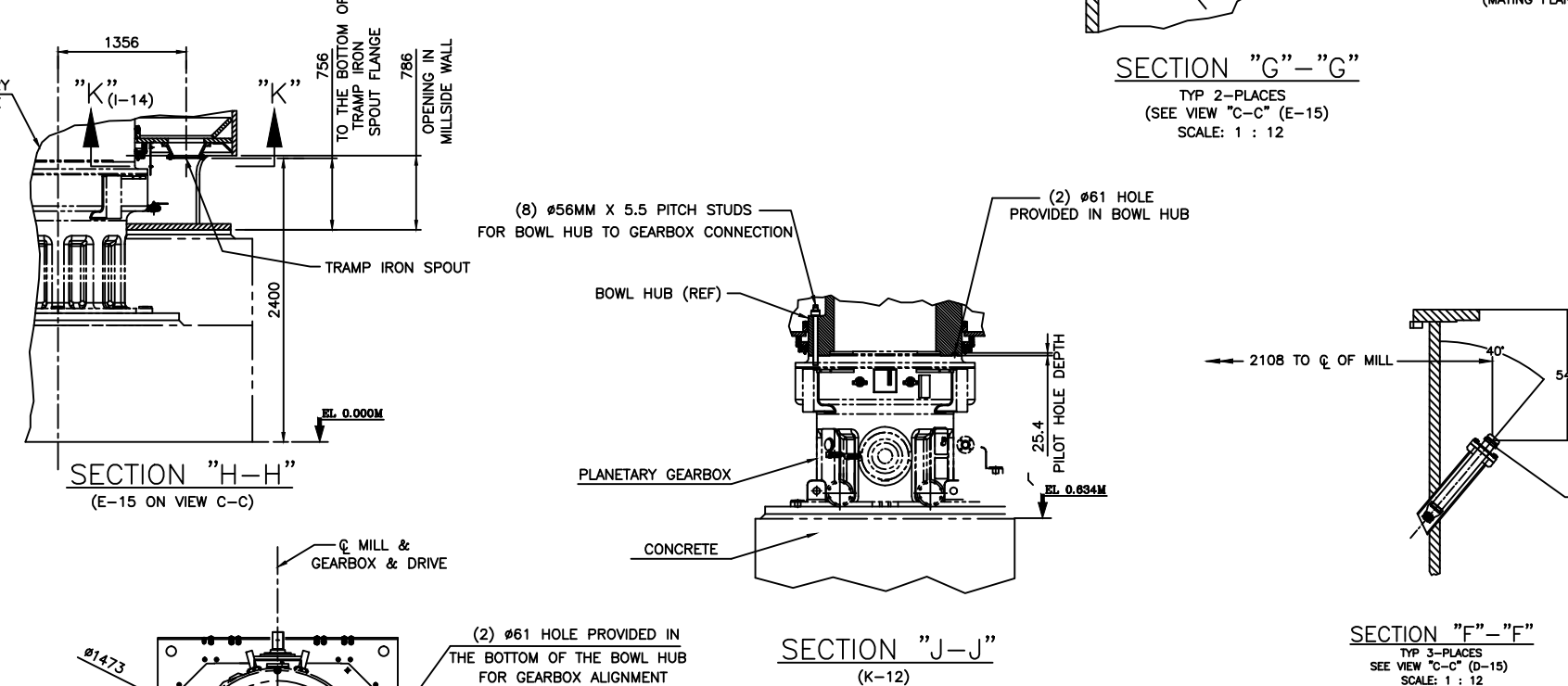
KEY PLAN - MILL ARRANGEMENT



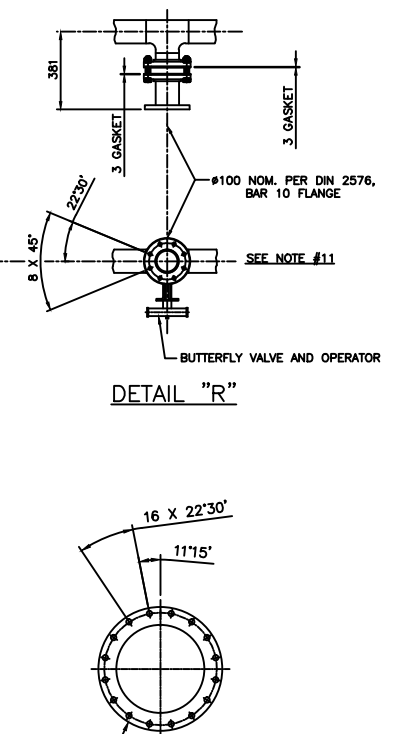
SECTION "B-B"
(G-15)



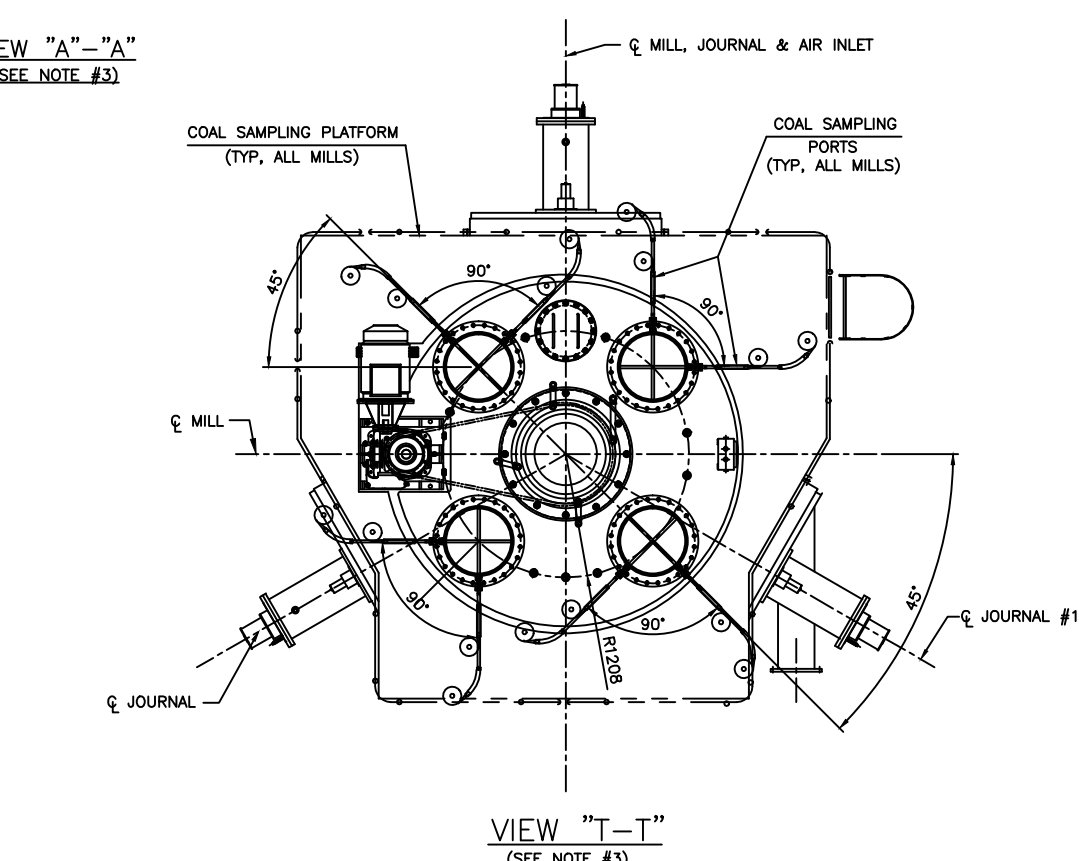
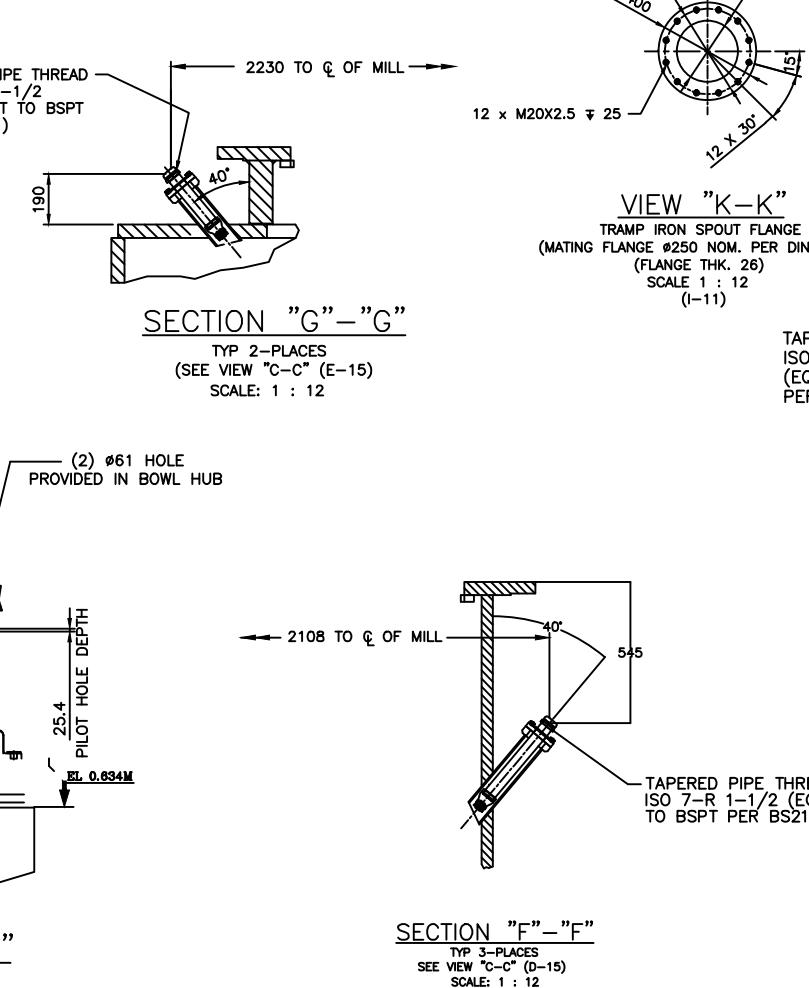
DETAIL "V"



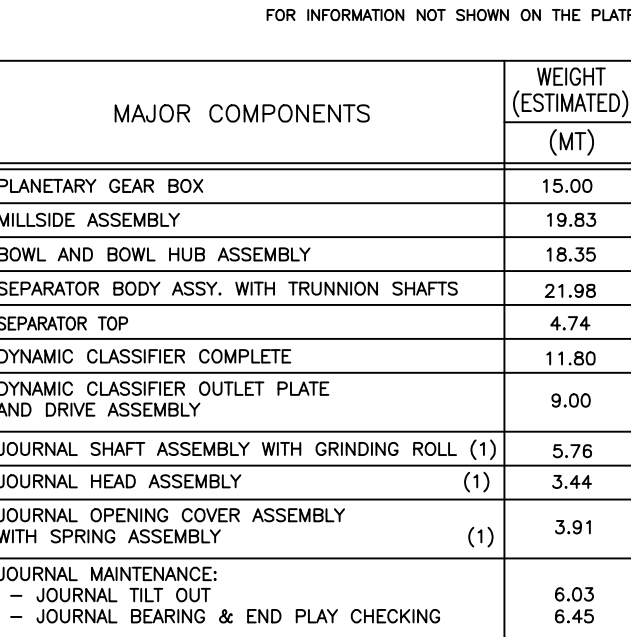
SECTION "S"-"S"
TP 3-PLACES



VIEW "P-P"
(B-3 & C-8)

VIEW "T-T"
(SEE NOTE #3)

SECTION "F" - "F"
TYP. 3-PLACES
SEE VIEW "O-O" (D-15)
SCALE: 1" = 12'



FOR INFORMATION NOT SHOWN ON THE PLATFORM - SEE KEY PLAN -MILL ARRANGEMENT

REV.	DATE	ALTERED	CHECKED	APPROVED	REV.	DATE	ALTERED	CHECKED	APPROVED
REV.	DATE	ALTERED	CHECKED	APPROVED	REV.	DATE	ALTERED	CHECKED	APPROVED

REFERENCE DRAWINGS:

1. BOILER GA ELEVATION DRAWING NO. 0-00-022-XXXXX & BOILER PLAN SECTION DRAWING NO. 0-00-022-XXXXX
2. MILL FOUNDATION PLAN DRG. NO. 0-00-610-87061.

PRELIMINARY TENDER DRAWING

CUSTOMER: TANGENCO

PROJECT : UPPUR TPP - 2x800MW

 BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD		DRN. <u>UDAY REDDY</u> CHD. <u>RR</u> APPD. <u>M RAO</u>	NAME SIGN.	DATE 07.10.15 07.10.15 07.10.15	NO. OF V. OF
DEPT. 446 P.O.V. ENGG.	 SCALE NTS	WEIGHT (KG) N.A.	REF. TO ASSY DRG. N.A.	ITEM NO.	NO. OF ITEMS
TITLE GENERAL ARRANGEMENT OF HP 1103 MILL - DYNAMIC CLASSIFIER WITH (PLANETARY GEARBOX)			DRAWING NO. 0-00-620-87070		REV. 00
SHEET NO. 01			NO. OF SHEETS 01		

THE FOLLOWING CONDITIONS APPLY
EXCEPT OTHERWISE STATED.

1. REF. TO HY0230261 FOR

2. CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0
AT 45°.

4. THE SURFACE ROUGHNESS WHERE-EVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE

ROUGHNESS SHOWN OUT SIDE THE BACK
SLASH GIVEN OR THE TOP MOST RIGHT
CORNER OF THE DRG.

60.0N
165.0W

360.0S
165.0W

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

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400S

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375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E

400S

60.0N
375.0E

360.0S
375.0E

360.0S
165.0W

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200E

400E

400S

60.0N
375.0E

360.0S
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360.0S
165.0W

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200E

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60.0N
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360.0S
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60.0N
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360.0S
375.0E

360.0S
165.0W

0.0E/W

200E

400E



TITLE
2X800 MW UPPUR STPP
MILL REJECT SYSTEM (PNEUMATIC TYPE)
SPECIFIC TECHNICAL REQUIREMENTS

SPECIFICATION NO. PE-TS-425-160-A001
SECTION: I
REV 00
Sub-Section: IB
Date Nov 2017

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR MILL REJECT SYSTEM 2X800 MW UPPUR STPP	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : C
		REV NO. : 00 DATE :
		SHEET : 1 OF 2

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Mill reject system.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**

Refer “Electrical Scope between BHEL and Vendor”.

3.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc. is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 **List of enclosures:**

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Datasheets & quality plan for motors.
- c) Electrical Load data format (Annexure –II)
- d) BHEL cable listing format (Annexure –III)