

1X660 MW BHUSAWAL TPP UNIT # 6.

MAHARASHTRA STATE POWER GENERATION CORPORATION LIMITED

***TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS TANKS***

SPECIFICATION NO. : PE-TS-415-167-A001



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



1X660 MW BHUSAWAL TPP UNIT # 6.

SPECIFICATION No: PE-TS-415-167-A001

MISCELLANEOUS TANKS

REV. 01

DATE: 21.11.2019

SECTIONS	TITLE	PAGE NO.
SECTION - I	SPECIFIC TECHNICAL REQUIREMENT	
SECTION – IA	SPECIFIC TECHNICAL REQUIREMENT – MECHANICAL	3
	SCOPE OF ENQUIRY / INTENT OF SPECIFICATION	4-5
	PROJECT INFORMATION AND SITE SPECIFIC SEISMIC STUDY REPORT	6-11
	SCOPE OF WORKS, EXCLUSIONS AND TERMINAL POINTS	12-18
	CUSTOMER SPECIFICATION FOR MISC. TANKS	TECHNICAL REQUIREMENT GENERAL TECHNICAL REQUIREMENT
		19-34 35-124
	QUALITY ASSURANCE AND INSPECTION REQUIREMENT	125-128
	ANNEXURE I- MAKES OF SUB-VENDOR ITEMS	129-133
	ANNEXURE II- DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT	134-137
SECTION- IB	DATA SHEET A and GA DRAWINGS OF MISCELLANEOUS TANKS	138-146
	DATASHEET FOR PIPES, FITTINGS, VALVES, PLATES, LEVEL GAUGE, PAINTING SPECIFICATION	147-149
SECTION - II	STANDARD TECHNICAL SPECIFICATIONS	
SECTION - IIA	STANDARD TECHNICAL SPECIFICATIONS-MECHANICAL	150-159
SECTION - IIB	SITE STORAGE AND PRESERVATION GUIDELINES	160-175
SECTION- IIC	FORMAT FOR OPERATION AND MAINTENANCE	176-179
SECTION - III	DOCUMENTS TO BE SUBMITTED BY BIDDER	
SECTION - IIIA	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	180-181
SECTION - IIIB	COMPLIANCE CUM CONFIRMATION CERTIFICATE	182-184
SECTION - IIIC	PRE-BID CLARIFICATION SCHEDULE	185-186
SECTION - IIID	SCHEDULE OF TECHNICAL DEVIATION	187-188



1X660 MW BHUSAWAL TPP UNIT # 6.

SPECIFICATION No: PE-TS-415-167-A001

MISCELLANEOUS TANKS

REV. 01

DATE: 21.11.2019

Sub section -IA
Specific Technical Requirement (Mechanical)

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION I SECTION – IA	
		REVISION 01	DATE: 21.11..2019

1.0

SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION

1.1

This specification includes, but not limited to Supply part, Services part and Mandatory spares comprising of design (i.e. Preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor’s works, painting, maintenance tools & tackles (as applicable), mandatory spares along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, fabrication, assembly, erection & commissioning, final painting at site, minor civil work and carrying out Performance guarantee / Functional / Demonstration tests at site (as applicable) and handover in flawless condition of Miscellaneous Tanks turnkey package specified for **1X660 MW BHUSAWAL TPP UNIT # 6** complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.

1.2

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

1.3

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

1.4

The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5

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

1.6

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

1.7

While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders’ responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION I SECTION – IA	
		REVISION 01	DATE: 21.11..2019

prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

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

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

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

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

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

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

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

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

Note:

Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- 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://dmsserver.bhelpem.com/Wrench%20Web%20Access/Login.aspx>).

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 19 of 555
1.0 <u>INTRODUCTION</u> The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder. 2.0 <u>APPROACH TO SITE</u> Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway. 3.0 <u>LAND</u> Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land. 4.0 <u>SOURCE OF COAL</u> Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tipplers and will be either bunkered or stacked in the stock pile at site. 5.0 <u>SOURCE OF WATER</u> The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 20 of 555
6.0 <u>ASH DISPOSAL AREA</u> The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.		
7.0 <u>PROJECT INFORMATION</u>		
7.1	Client / Owner	: Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	: Procon Engineers, Navi Mumbai (Division of Nimoto Consulting Engineers Pvt. Ltd.)
7.3	Project Title	: BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	: Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	: Bhusawal
7.6	Nearest Airport	: Aurangabad
7.7	Nearest Harbour	: Mumbai
7.8	Access Roads	: NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	: 210 M
7.10	Longitude/latitude	: 75°51'10" East /21° 02' 30" North
7.11	Seismic Zone	: Zone III as per IS:1893
7.12	<u>AMBIENT TEMPERATURE</u>	
7.12.1	Mean of daily maximum temperature	: 48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	: 18 °C (during January)
7.12.3	Highest temperature recorded	: 48.7°C

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 21 of 555
7.12.4	Lowest temperature recorded : 13°C	
7.13	Wet bulb temperature : 27°C (Maximum)	
7.14	Rainfall : 112 mm average annually	
7.15	Wind Speed : 0 to 39 Km/hr	
7.16	Wind direction : East North East to West South West	
	<u>ELECTRICAL</u>	
7.17	<u>MAIN POWER SOURCE FROM GRID</u>	
7.17.1	Rated Voltage : 400kV	
7.17.2	Voltage variation : ± 10 %	
7.17.3	Frequency Variation : ± 5 %	
7.17.4	Rated Short Circuit : 50 kA, Three Phase Symmetrical Level	
7.18	<u>AUXILIARY POWER SUPPLY</u>	
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:	
7.18.1	Motors above 1000 kW & other Power devices : 11kV,3Ph,3wire,50Hz system	
7.18.2	Motors below 1000 kW & above 160kW & other power devices : 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively earthed	
7.18.3	Motors upto 160 kW & other power devices : 415V, 3 ph, 4 wire 50 Hz	
7.18.4	Motor Starting Methods : Direct on Line	
7.18.5	(a) Lighting fixtures, Space heaters, and single Phase motors : 240V, 1 phase, 50 Hz Supply through suitably rated transformers to limit the short circuit level to 9kA – 1 sec.	

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	MASTER SPECIFICATIONS	Page 22 of 555
(b) Control & : 240V, 1 Phase, 50 Hz from UPS Instrumentation 7.18.6 Short circuit levels of 11kV, 3.3 kV and 415V system equipments The equipment shall be suitable for the following short circuit levels (a) 11kV Switchgears : 44 kA/3 sec (b) 3.3kV Switchgears : 40 kA/3sec (c) 415V PCC/ : 50 kA/1sec PMCC/ MCC (d) Lighting : 9 kA/1sec Distribution Boards & 240V A.C. supply 7.18.7 Auxiliary DC supply The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc. (a) Voltage : (i) 220V DC for utility purpose (ii) 24V DC for Control and Instrumentation (b) Voltage variation : + 10 %, - 15 % 7.18.8 Emergency power supply (a) Purpose : (i) Standby power to normal incomer of emergency MCC (ii) Alternate power source to Fire water Pumps (b) Rated voltage and frequency : 415 V, 3 phase, 3 wire, 50 Hz.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3
REV: R0	MASTER SPECIFICATIONS	Page 24 of 555

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION –I, SECTION – IA	
		REVISION 01	DATE: 21.11.2019

1.0

SCOPE OF SUPPLY

1.1

Steel tanks fabricated and supplied at site under this specification shall be as per enclosed DATA SHEET and GA drawing for Miscellaneous tanks. Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.

1.2

a)

The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in the enclosed DATA SHEET and GA drawing for Miscellaneous tanks.

b)

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

c)

The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

d)

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

e)

Pad plates on the tanks for supporting outside piping shall be provided by the bidder. Details of the pad plates (sizes, quantity etc.) shall be informed to bidder during detail engineering.

f)

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

g)

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

h)

Void.

1.3

The scope of works shall also include supply and installation of special accessories as indicated in DATA SHEET and GA drawing for miscellaneous tanks. The necessary fixtures and other accessories for mounting these special fittings shall be included in the scope of work of the bidder.

1.4

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

1.5

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

1.6

a)

Sampling Connection with isolation valve of size 25 NB for each tank.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION –I, SECTION – IA	
		REVISION 01	DATE: 21.11.2019

b) Drain valve of size 100 NB for CST tank, 100 NB for DM water storage tank and 80 Nb for SW storage tank shall be provided by the bidder unless otherwise indicated in the DATA SHEET and GA drawing for Miscellaneous tanks.

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

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

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

1.9 All valves shall be of stainless steel construction as per section -IB for Condensate Storage Tank & DM water storage tank.

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

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

1.11 Void.

1.12 Painting of the tanks is included in bidder’s scope of work. Painting specifications of storage tanks / seal pot / NaOH / KOH breather are given under painting specification. Any modification in painting requirement found applicable during detained engineering, shall be under bidder’s scope without any commercial implication.

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

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

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

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION –I, SECTION – IA	
		REVISION 01	DATE: 21.11.2019

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

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

2.2 Erection & Commissioning of Tanks.

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

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

2.5 Inspection & testing and carrying out demonstration test.

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

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

3.0 DESIGN CONSIDERATIONS

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

3.2 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650 and as per the design code indicated in DATA SHEET and GA drawing for Condensate Storage Tank, DM Tank and service water tank.

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

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

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

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

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

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

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION –I, SECTION – IA	
		REVISION 01	DATE: 21.11.2019

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

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

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

3.12 Bidder shall furnish the STAAD calculation along with the roof structure calculation during detail engineering for checking the stability of roof.

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

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

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

3.16 All materials, furnished shall conform to the latest editions of America National Standard Code for Pressure piping, Power piping, ANSI B311.1, ANSI B16.11, ASME Boiler and Pressure Vessel Codes, IBR and other applicable ASME, ANSI and Indian Standards. Schedule numbers, sizes and dimensions of all carbon steel, stainless steel and alloy seamless steel pipe shall confirm to ANSI B.36.10 and of stainless steel pipe shall confirm to ANSI B 36.19 unless otherwise specified.

4.0 WELDING

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

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

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

5.0 TEST AND INSPECTION

5.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant’s approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION –I, SECTION – IA

REVISION 01

DATE: 21.11.2019

procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial implication.

- 5.2 DPT / MPI on all welds (100%).
- 5.3 All cross / Tee joints and butt welds to be 10% Radio graphed.
- 5.4 For the offered tanks, fill test shall be carried out for at least 24 hours. Atmospheric storage tanks on inside surface shall be leak tested before painting.
- 5.5 All quality plans / checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.

6.0 MANDATORY SPARES:

Mandatory spares shall be supplied by bidder as indicated below:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	Level gauges for DM Water Storage tank	1 nos.
2	Level gauges for Condensate Water Storage tank	1 nos.
3	Level gauges for Service Water Storage tank	1 nos.

7.0 LIST OF COMMISSIONING SPARES:

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

8.0 TERMINAL POINTS

- Matching counter flanges for all nozzles mounted on the tank and its accessories. However, counter flanges for all nozzles and valves of tank shall be provided by the bidder.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION –I, SECTION – IA	
		REVISION 01	DATE: 21.11.2019

- Drain pipe of seal pot and NaOH breather pots.

9.0 EXCLUSIONS

MS plates for shell, roof and bottom of tanks, Tank foundation & associated civil works, LTs are excluded from bidder’s scope of work.

10.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

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

11.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under SECTION –IA during detail engineering for approval / information / reference (as the case may be): -

12.0 OTHER TECHNICAL REQUIREMENTS

- 1) 15 days’ time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 2) Bidder to depute competent designer (s) at BHEL’s office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.
- 4) Commercial implication includes price implication as well as delivery implication.
- 5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).
- 6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code.
- 7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.
- 8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL’s price format only along with the final price bid.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6		SPECIFICATION NO. PE-TS-415-167-A001	
			SECTION –I, SECTION – IA	
			REVISION 01	DATE: 21.11.2019
			9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL. 10) All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder. 11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only. 12) Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.	



TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I SECTION – IA

REVISION 01

DATE: 21.11..2019

CUSTOMER SPECIFICATION

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 197 of 328

VOLUME III I
SECTION-3/D
MISCELLANEOUS STORAGE TANKS

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 198 of 328

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 199 of 328

CONTENTS

<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>
1.0	GENERAL INFORMATION
2.0	CODES AND STANDARDS
3.0	SCOPE OF WORKS
4.0	DESIGN AND CONSTRUCTION
5.0	PAINTING
6.0	DRAWING, DATA AND INFORMATION
DATASHEET-A	MISCELLANEOUS STORAGE TANKS
ANNEXURE-I	SCHEDULE OF MISCELLANEOUS STEEL TANKS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 200 of 328

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 201 of 328

1.0 GENERAL INFORMATION

This section covers the design, supply of miscellaneous steel storage and all accessories as required, paints and protective paintings as specified and as required, fabrication, erection, painting, testing and associated civil works.

2.0 CODES AND STANDARDS

2.1 Steel Storage Tanks

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

- | | | |
|-------|--|---|
| 2.1.1 | IS-805 | : Code of practice for use of steel in gravity water tank. |
| 2.1.2 | IS-803 | : Code of practice for use of Vertical Storage Tank. |
| 2.1.3 | IS-816 | : Code of practice for use of metal arc welding for general construction in mild steel. |
| 2.1.4 | IS-9595 | : Code of procedure for manual metal arc welding of mild steel. |
| 2.1.5 | BS EN 12285-1 : 2003
BS EN 12285-2 : 2005 | : Carbon steel welded horizontal cylindrical tank |
| 2.1.6 | IS-10987 | : Horizontal Cylindrical storage tank for Petroleum products. |

3.0 SCOPE OF WORK

3.1 The details of Miscellaneous steel tanks (minimum) for storage of water at atmospheric pressure to be fabricated and erected under this section of specification are given as follows:

- | | |
|-------|--|
| 3.1.1 | Two (2) Potable water Tanks shall be installed on the roof of Deaerator Floor. |
| 3.1.2 | Two (2) Service water tanks shall be located on the roof of Deaerator Floor. |
| 3.1.3 | Two (2) DM water storage tanks shall be located in the vicinity of DM plant. |

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 202 of 328
3.1.4	One (1) Condensate Storage Tank near Compressor House	
3.1.5	Two (2) De-Mineralized Circulating Water Storage tanks (One common for SG & TG Auxiliaries shall be installed on the Auxiliaries PRDS floor & One for Ash Handling Plant on AHP Air compressor room.)	
3.2	The connections, accessories and fittings to be supplied with each tank shall be as specified and as required. Tank connections shall be provided with suitable counter flanges with necessary bolts, nuts & gaskets.	
3.3	The tank, where applicable, shall be complete with supporting structure, legs or pedestals, base plate, anchor bolts, nuts & sleeves etc, as required.	
3.4	The special fittings e.g. conservation vent valves, level indicators etc shall also be supplied by the Contractor.	
3.5	Preparation of detailed design, fabrication drawings, bill of materials, tag and piece numbers, welding procedure etc. Stiffeners where not specified and other structural framing for supporting tank shell shall be designed by the Contractor including supply of materials for the same.	
3.6	This specification covers supply of steel plates, structural steel, pipes etc, as required.	
3.7	The scope of work under this specification includes excavation and backfilling work required for installation of pipes running underground.	
3.8	All pipe supports, thrust blocks, etc. as required shall be properly designed and constructed by the Contractor in accordance with approved drawings. Necessary steel work at supports shall also be supplied, fabricated and erected by the Contractor.	
3.9	The final fixing grout over the concrete support or through the opening left in the concrete work shall also be done by the Contractor.	
4.0	<u>DESIGN AND CONSTRUCTION</u>	
4.1	Tanks shall be suitably constructed for safe, proper and continuous storage of liquid described. The design code, material standard, minimum plate	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 203 of 328
thickness, size and other details shall be as per the specified Codes and Standards, as applicable. 4.2 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature. 4.3 Vessel seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessels consisting of more than two sections, longitudinal seams shall be offset. 4.4 Where possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer. 4.5 Due consideration for wind load and/or earthquake effect shall be given in the design of tanks. Data for wind load and earthquake shall be taken as indicated in the Volume-II of this specification. Maximum allowable stresses for design loadings combined with wind or earthquake shall not exceed 133% of stress permitted for the design loading condition but in no case shall exceed 80% of specified minimum yield strength of the material. 4.6 Except where otherwise indicated in the Owner's drawings/ specifications, if the stiffening of the shell and/or roof is necessary, the same shall be stiffened from outside. 4.7 Reinforcement pads in tank connections shall be provided as per applicable code & the reinforced connection shall be completely preassembled into a shell plate. The completed assembly including the connection shall be thermally stress-relieved as per API Standard 620, if specified. 4.8 All welding shall be done as per IS-816, IS-817 and IS-9595, latest revision as applicable. All welds are to be continuous welds. Bidder shall clearly state in his offer the make and type of welding rods proposed by him for fabrication. Inspection of welding shall be carried out in accordance to IS-822, IS-9595. Welding sequence shall be adopted in such a way so as to minimise the distortion due to welding shrinkage, Contractor shall indicate in his Drawing the sequence of welding proposed by him duly approved by Owner/Consultant.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 204 of 328
4.9	<u>TANK CONNECTIONS</u>	
4.9.1	Bidder shall furnish all piping material required for the tank connections.	
4.9.2	Unless otherwise specified, for all flanged connections Bidder shall furnish suitable counter flanges and the necessary nuts, bolts, gaskets etc.	
4.9.3	Flange faces of all nozzles shall be machined and square with the vessel centerlines.	
4.9.4	Unless otherwise stated, bolts and nuts shall be of hexagonal head conforming to IS-1367, latest revision. The material and thickness of gaskets shall be suitable for the specified service. On completion of hydraulic test, Contractor shall replace the gaskets used during testing at his own cost.	
4.9.5	All tanks shall be provided with connections for drains, vents and overflow.	
4.10	<u>ACCESSORIES</u>	
4.10.1	Level Indicator Float operated or tubular gauge glass type indicator of high grade workmanship shall be provided on each tank. Tank of height not exceeding 3 m shall have tubular gauge glass and others shall have float operated level Indicator. For tubular gauge glass, isolating valves and protective guards against mechanical shock shall be provided.	
4.10.2	Level Switch Where specified, level switch of approved make & type shall be furnished along with instrument root valves. Repeat accuracy of operation shall be $\pm 1\%$ of the full range. At least two level switches, one for High level actuation and other for Low Level actuation, shall be provided for each tank.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 205 of 328
4.10.3	Where the tank height exceeds 2 M, vertical ladder is to be provided with cage.	
4.10.4	Top Manhole shall be provided in all tanks. Manhole size shall be 600 NB (minimum). The tank shall be provided with accessories as indicated in the Specification. All the accessories shall conform to relevant Indian Standards. The following broad guidelines are given for some of the accessories.	
4.11	When installation of tank is specified the recommendation regarding installation in BS EN 12285-1 & BS EN 12285-2 shall be followed in general. In addition to those recommendations, the following shall also be taken care of.	
4.12	The finished tank grade for cylindrical tank shall be crowned from the outer periphery to the centre with a slope. The sloping factor shall be taken as 1:36 unless otherwise specified	
5.0	<u>PAINING</u>	
5.1	Surface preparation: Internal - Sand blasting and External - wire brushing.	
5.2	Primer	(a) Internal - epoxy based Zn rich primer (b) External - Synthetic Red lead
5.3	Finish Coat	(a) Internal - Coal tar epoxy (b) External - Synthetic enamel
5.4	Outside of bottom surface shall have 3 coats of Bitumastic paints.	
6.0	<u>DRAWINGS, DATA AND INFORMATION</u>	
6.1	For Drawing, Data and Information required along with BID, please refer Volume-VIII.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 206 of 328

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS		Page 207 of 328

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS		Page 208 of 328
SR. NO.	ITEM		
1.7.3	Design standard	:	IS-5620
1.7.4	Size	:	To be decided by bidder.
1.7.5	Materials of construction		
(a)	Gate	:	Fabricated from IS-2062 Gr. A
(b)	Gate frame	:	C.I. IS-210 Gr. 260
(c)	Seal	:	EPDM
(d)	Seal plate	:	Bronze/ brass
(e)	Guide	:	IS-2062 Gr. A
1.8	<u>STATIC SCREENS</u>	:	
1.8.1	Number	:	Eight (8) (One at the downstream of each gate)
1.8.2	Duty	:	Continuous
1.8.3	Size	:	To be decided by bidder
1.8.4	Materials of construction		
(a)	Screen	:	SS-304, 14 BWG Wire net with 20 mm opening.
(b)	Gate frame	:	IS-2062 Gr. A
2.0	<u>FILTERED WATER STORAGE TANK FOR NON-DM</u>		
2.1	Number	:	One (1)
2.2	Type	:	Closed type
2.3	Material of construction	:	RCC
2.4	Effective capacity	:	45000 m ³ (between maximum and minimum water level).
2.5	Overall dimensions	:	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS		Page 209 of 328
SR. NO.	ITEM		
2.6	Level switch, level transmitter, alarm, indicator and controller provided	:	Yes
2.7	<u>ISOLATION GATES</u>		
2.7.1	Number	:	Two (2) (One isolation gate between two compartments).
2.7.2	Duty	:	Continuous
2.7.3	Design standard	:	IS-5620
2.7.4	Size	:	To be decided by bidder
2.7.5	Materials of construction		
(a)	Gate	:	Fabricated from IS-2062 Gr. A
(b)	Gate frame	:	C.I. IS-210 Gr. 260
(c)	Seal	:	EPDM
(d)	Seal plate	:	Bronze/ brass
(e)	Guide	:	IS-2062 Gr. A
3.0	<u>FILTERED WATER STORAGE TANK FOR DM</u>	:	
3.1	Number	:	One (1)
3.2	Type	:	Closed type
3.3	Material of construction	:	RCC
3.4	Effective capacity	:	900 m ³
3.5	Level switch, level transmitter, alarm, indicator and controller provided	:	Yes

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 / D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 210 of 328

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-I
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3 /D
REV: R0	MATERIAL HANDLING AND MISCELLANEOUS EQUIPMENTS	Page 211 of 328

ANNEXURE-I

SCHEDULE OF MISCELLANEOUS STEEL TANKS

Sr. No.	Description	Shape	Size	Nominal Capacity (m ³)	Numbers Reqd.
(1)	DM water storage tank in the vicinity of DM plant	Vertical Cylindrical	By Bidder	850	2
(2)	Condensate Storage Tank near Compressor House	Vertical Cylindrical	By Bidder	1000	1
(3)	DMCW Make up tanks	By Bidder	By Bidder	By Bidder	2
(4)	Service Water Storage Tank	Vertical Cylindrical	By Bidder	75	2
(5)	Potable water Storage Tank	Vertical Cylindrical	By Bidder	25	2

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 61 of 555
VOLUME II SECTION – 4 GENERAL TECHNICAL REQUIREMENTS		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 62 of 555

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II																																								
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4																																								
REV: R0	MASTER SPECIFICATIONS	Page 63 of 555																																								
<u>CONTENTS</u> <table><tr><td><u>CLAUSE NO.</u></td><td><u>DESCRIPTION</u></td></tr><tr><td>1.0</td><td>CODES AND STANDARDS</td></tr><tr><td>2.0</td><td>RESPONSIBILITY FOR DESIGN</td></tr><tr><td>3.0</td><td>NAME PLATES (RATING PLATES)</td></tr><tr><td>4.0</td><td>SAFETY AND SECURITY</td></tr><tr><td>5.0</td><td>GUARDS</td></tr><tr><td>6.0</td><td>LOCATION AND LAYOUT REQUIREMENTS</td></tr><tr><td>7.0</td><td>OPERATION, MAINTENANCE AND AVAILABILITY CONSIDERATIONS</td></tr><tr><td>8.0</td><td>MATERIALS</td></tr><tr><td>9.0</td><td>LUBRICATION</td></tr><tr><td>10.0</td><td>LUBRICANTS & CONTROL FLUIDS</td></tr><tr><td>11.0</td><td>OPERATION AND MAINTENANCE</td></tr><tr><td>12.0</td><td>PLANT LIFE AND MODE OF OPERATION</td></tr><tr><td>13.0</td><td>PACKAGING & MARKING</td></tr><tr><td>14.0</td><td>PROTECTION</td></tr><tr><td>15.0</td><td>PAINTING</td></tr><tr><td>16.0</td><td>COLOUR CO-ORDINATION AND FINISH</td></tr><tr><td>17.0</td><td>ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT</td></tr><tr><td>18.0</td><td>INSPECTION AND TESTING</td></tr><tr><td>19.0</td><td>TRAINING OF OWNER'S PERSONNEL</td></tr></table>			<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	1.0	CODES AND STANDARDS	2.0	RESPONSIBILITY FOR DESIGN	3.0	NAME PLATES (RATING PLATES)	4.0	SAFETY AND SECURITY	5.0	GUARDS	6.0	LOCATION AND LAYOUT REQUIREMENTS	7.0	OPERATION, MAINTENANCE AND AVAILABILITY CONSIDERATIONS	8.0	MATERIALS	9.0	LUBRICATION	10.0	LUBRICANTS & CONTROL FLUIDS	11.0	OPERATION AND MAINTENANCE	12.0	PLANT LIFE AND MODE OF OPERATION	13.0	PACKAGING & MARKING	14.0	PROTECTION	15.0	PAINTING	16.0	COLOUR CO-ORDINATION AND FINISH	17.0	ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT	18.0	INSPECTION AND TESTING	19.0	TRAINING OF OWNER'S PERSONNEL
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II										
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4										
REV: R0	MASTER SPECIFICATIONS	Page 64 of 555										
<table><tr><td><u>CLAUSE NO.</u></td><td><u>DESCRIPTION</u></td></tr><tr><td>ANNEXURE–A</td><td>LIST OF STANDARDS FOR REFERENCE</td></tr><tr><td>ANNEXURE–B</td><td>CRITERIA FOR LAYOUT</td></tr><tr><td>ANNEXURE–C</td><td>BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS</td></tr><tr><td>ANNEXURE–D</td><td>SPECIFIC LAYOUT CONSIDERATIONS</td></tr></table>			<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	ANNEXURE–A	LIST OF STANDARDS FOR REFERENCE	ANNEXURE–B	CRITERIA FOR LAYOUT	ANNEXURE–C	BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS	ANNEXURE–D	SPECIFIC LAYOUT CONSIDERATIONS
<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>											
ANNEXURE–A	LIST OF STANDARDS FOR REFERENCE											
ANNEXURE–B	CRITERIA FOR LAYOUT											
ANNEXURE–C	BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS											
ANNEXURE–D	SPECIFIC LAYOUT CONSIDERATIONS											

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 65 of 555
1.0 <u>CODES AND STANDARDS</u> 1.1 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure to this Section and mentioned in detailed Specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible, had there been a Standard Specification. 1.2 Where the Bidder proposes alternative codes or standards, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification. 1.3 Wherever specified or required, the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Bidder. 1.4 In the event of any conflict between the codes and standards referred above and the requirements of this specification, the requirements, which are more stringent, shall govern. 1.5 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing, the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect. 1.6 Successful Bidder shall furnish two (2) sets of latest of national/international codes and standards to owner.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 66 of 555
2.0 <u>RESPONSIBILITY FOR DESIGN</u> 2.1 The Bidder shall assume full responsibility for the design of the whole and every part of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work. 2.2 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar or more arduous conditions elsewhere, at least for continuous two (2) years in two different power stations. 2.3 The successful bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice. 2.4 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants. 2.5 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back etc are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions etc shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation. 3.0 <u>NAME PLATES (RATING PLATES)</u> 3.1 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of Plant in a conspicuous position. These plates shall		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 67 of 555
	be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of Plant has been designed to operate.	
3.2	Items such as valves etc which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.	
3.3	All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.	
3.4	The size and location of nameplates shall be subject to Approval of the Engineer.	
4.0	<u>SAFETY AND SECURITY</u>	
4.1	The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.	
4.2	Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.	
4.3	Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA and TAC etc as necessary shall be followed in all respects.	
4.4	The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 68 of 555
minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.		
5.0	<u>GUARDS</u>	
5.1	Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.	
5.2	Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.	
5.3	All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.	
5.4	Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.	
5.5	Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.	
6.0	<u>LOCATION AND LAYOUT REQUIREMENTS</u>	
The majority of plant and equipment shall all be of indoor installation. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment / components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 69 of 555
given under the various equipment and system specifications as well as those stipulated in Annexure-B attached to this section. Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the powerhouse as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered. Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner / Engineer find the proposal more attractive in terms of techno-economic consideration. 6.1 While developing the layout of buildings the following criteria shall be given effect: 6.1.1 The minimum width of clear access corridors around equipment shall be one (1) meter. 6.1.2 Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified. 6.1.3 The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification. Finished Grade Level (FGL) above Mean Sea Level (MSL) for the plant area, CHP area and for PWS area inside plant to be developed. Mean sea level for the plant is 210 m. 6.1.4 The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 70 of 555
6.1.5	There shall be at least two (2) main access doors, one on either side of each building, of which one shall be minimum three (3) meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.	
6.1.6	All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.	
6.1.7	All rail/road crossings for pipe/cable racks shall be done with minimum Seven (7) meters headroom from top of rail/road to bottom of rack. Similarly, top cover over underground pipes/cables shall be minimum one (1) meter.	
6.1.8	Cubicle for operating personnel shall be located at safe place near the equipment.	
6.1.9	Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.	
6.1.10	Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered as far as possible. Any departure from this suggestive layout is primarily not recommended.	
6.2	The following requirements for equipment layout shall be complied with:	
6.2.1	The regular basement floor is not acceptable in Boiler & Mill Bunker bay building. Further, local pits/trenches shall be avoided as far as possible.	
6.2.2	Mills shall be located by the side of Boiler. The width of Mill/Bunker building shall be 12.5 M and the length of the same shall be 10.5 M per Mill. A clear walkway of 1200 mm (min) shall be ensured between the mills/ its foundation/ mill reject vessel edge and inner face of mill bay column. Raw coal bunker shall be circular in shape unless otherwise approved.	

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 71 of 555
6.2.3	Interconnecting walkways (minimum 2 m width) between main plant building and boiler (on either side of boiler) at Ground, Mezzanine, Operating, PRDS and Deaerator floor levels shall be provided. Also inter-connecting platform between Boiler and Coal Tripper floor level and roof of Mill maintenance floor level, Feeder floor level, Bunker Building at Mill bay shall be provided. Number of interconnecting platforms between Boiler and Coal Bunker building for each level / floor specified above shall be two (2) on each side of Boiler i.e. four (4)/floor.	
6.2.4	Two of the landing levels of the Goods Elevator shall preferably coincide with the feeder and tripper floor elevations. In case of difference in levels, electric hoists to shift goods from elevator floors to feeder/ tripper floors shall be provided.	
6.2.5	Fuel Oil (F.O.) piping shall be routed over trestles. The headroom for F.O. trestle in Boiler/ESP/ID fan/Chimney area shall be 8.0 M till the road behind chimney and 7.0 M in CD bay area. The headroom for F.O. trestle in outlying area shall be 3.0 M except at rail/road crossing where the headroom shall be 8.0 M.	
6.2.6	Clear walkways along A-row & B-row of TG building shall be provided as indicated below: (a) 1.5 m at all levels of AB Bay. (b) 3.5 m along B-row at operating floor level for interconnection with service Building & in front of control room.	
6.2.7	The layout of the steam turbine unit shall permit sufficient lay down area for all the parts/components to enable carrying out maintenance and overhauling operations.	
6.2.8	Steam turbine and generator (except stator) and other equipments located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. For all other equipment/components, suitable handling arrangement for erection and maintenance shall be provided.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 72 of 555
6.2.9	In TG bay at crane rail level, walkway with handrails is envisaged for entire column sectional depth for full length of the building. In addition, it shall be ensured that on A-row and B-row columns, through walkway (without hindrance) of minimum 600 mm clear width is available from the face of the column to the handrail of the platform.	
6.2.10	Layout of facilities and equipment shall allow removal of Generator Stator, Generator transformers, Station & Unit transformers without disturbing equipments, piping, cabling, duct routed in the area.	
6.2.11	Adequate space and handling arrangement shall be provided for handling/removal of pumps, heaters, heat-exchanger, fans, mills during maintenance.	
6.2.12	Valves shall be located in accessible positions and operating/maintenance platforms shall be provided along with approach ladders & handrails for the same.	
6.2.13	While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.	
6.2.14	Each equipment room shall be provided with alternate exits in case of fire/accidents as per requirements of factory Act and Statuary bodies/Insurance companies.	
6.2.15	All other safety requirements as per the factories Act, Rules/regulations made under Electricity Act, 2003 and applicable codes/standards shall be observed while developing the layout.	
7.0	<u>OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS</u>	
7.1	Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 73 of 555
7.2	Ample space for ease of operation and maintenance including equipment removal, tube bundle / cartridge / rotor pulling etc shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.	
7.3	Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part. Suitable beams, hooks etc. for this purpose shall be provided in the Buildings.	
7.4	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, accessories covered under this specification.	
7.5	All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where ever feasible, common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.	
8.0	<u>MATERIALS</u>	
8.1	In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/ fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal. All materials shall be new, and shall be of the quality most suited to the proposed application.	
8.2	In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or International codes of practice. Where such standards or codes of practice are not available, sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 74 of 555
All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.		
8.3	All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.	
9.0	<u>LUBRICATION</u>	
9.1	Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.	
9.2	Non ferrous capillary tubing shall be used throughout.	
9.3	Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.	
9.4	All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.	
9.5	All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.	
9.6	The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.	
10.0	<u>LUBRICANTS AND CONTROL FLUIDS</u>	
10.1	The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of unit.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 75 of 555
10.2	The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognized standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.	
10.3	No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.	
11.0	<u>OPERATION AND MAINTENANCE</u>	
11.1	The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimized. The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.	
11.2	Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.	
11.3	All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further, identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.	
11.4	All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.	

 MAHARASHTRA STATE POWER GENERATION CO. LTD.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II												
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4												
REV: R0	MASTER SPECIFICATIONS	Page 76 of 555												
11.5	On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.													
11.6	All equipment and major valves should be provided with adequate maintenance approach and facility.													
12.0	<u>PLANT LIFE AND MODE OF OPERATION</u>													
	The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended. The critical components of the major equipments like Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations. The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand. The units shall also be suitable for two shift operation, if required. The expected start-ups should be considered as minimum (Based on HPT metal temperature) <table><tr><td>(a)</td><td>Cold start-up (>50 hrs. shutdown)</td><td>:</td><td>20 per year</td></tr><tr><td>(b)</td><td>Warm start-up (between 10 to 50 hrs. of shutdown)</td><td>:</td><td>40 per year</td></tr><tr><td>(c)</td><td>Hot start-up (Less than 10 hrs. shutdown)</td><td>:</td><td>180 per year</td></tr></table> The allowable stresses shall be so selected so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall		(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year	(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year	(c)	Hot start-up (Less than 10 hrs. shutdown)	:	180 per year
(a)	Cold start-up (>50 hrs. shutdown)	:	20 per year											
(b)	Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year											
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 78 of 555
road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only. The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition, the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material. For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect. Specification of Packaging and Marking has been described in detail in Volume I: General Condition of Contract of the Specification. 14.0 <u>PROTECTION</u> Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted. Electrical equipment controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 79 of 555
openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense. 15.0 <u>PAINTING</u> 15.1 <u>GENERAL</u> All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects. All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 80 of 555
windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval. 15.2 <u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay. 15.3 <u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 81 of 555
15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u> The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering All surfaces shall have a minimum of four coats of paint made up as follows: (a) Primer coat	

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 82 of 555
The Contractor shall select the type and colour of primer & finish coat after approval by the Owner. For detail painting on building & structural steel elements, please refer Volume VI / A & B of this specification. 16.0 <u>COLOUR CO-ORDINATION & FINISH</u> 16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape. 16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification. 16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned. 16.4 Final colours and finishes shall be to the Approval of the Engineer. 17.0 <u>ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT</u> 17.1 <u>ENVIRONMENT PROTECTION</u> The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and Stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date. In case the Ministry of Environment & Forest stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 83 of 555
17.1.1 For Liquid Effluent (a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI: General Standards for discharge of Environmental pollutants Part-A: Effects of Environmental (Protection) Rules 1986, as amended till date. (b) Any specific requirement of State Pollution Authorities over and above the above stipulation 17.1.2 For Air Emission (a) Suspended Particulate Matter i.e. dust burden at Chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out). (b) NO_x : 365 ppm (maximum) or 750 mg/Nm³ (Equivalent NO₂). (c) SO₂ : As per prevailing Indian/ World Bank standards The Bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated. 17.2 <u>NOISE LEVEL REQUIREMENT</u> The plant shall be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations. 17.2.1 Maximum noise level shall not exceed 85 dB (A) when measured at 1.0 M away from the noise emission source. 17.2.2 Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise. 17.2.3 Any statutory changes in stipulations regarding noise limitation that may occur in future according to Maharashtra Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 84 of 555
during tenure of the contract, the Contractor shall comply with the requirement. An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves. 18.0 <u>INSPECTION AND TESTING</u> 18.1 <u>GENERAL:</u> 18.1.1 An indicative list of Inspection and testing requirements for each package has been given for equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments / systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid. 18.2 <u>INSPECTION AND TESTS DURING MANUFACTURE</u> 18.2.1 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract. 18.2.2 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this Specification. 18.2.3 Before any item of plant or equipment leaves its place of manufacture, the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards. 18.2.4 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 85 of 555
writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results. The Contractor shall forthwith forward to the engineer duly certified six (6) copies of the Test Certificates. Distribution of six (6) copies of Test Certificates for approval will be two (2) copies to Owner and four (4) copies to Consultant. These four (4) copies will be further distributed by Consultant after approval to Owner, site and bidder. One copy will be retained with the Consultant for record purpose. Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to Owner, Three (3) copies to site, Two (2) copies to Consultant, Two (2) copies to Owner's library / record. 18.2.5 Under no circumstances any repair or welding of castings shall be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer. 18.2.6 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works. Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture. 18.2.7 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Owner. The certificates shall include tests for mechanical properties and chemical analysis of representative material. 18.2.8 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 86 of 555
hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour. 18.2.9 All necessary non-destructive examinations shall be performed to meet the applicable code requirements. 18.2.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR, as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination, magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. 18.2.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR Maharashtra Jurisdiction) shall also be made by the Bidder. In such case, Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval. 18.3 <u>PERFORMANCE TESTS AT SITE</u> 18.3.1 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected system shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the system under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks etc. 18.3.2 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site. 18.3.3 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection,		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4	
REV: R0	MASTER SPECIFICATIONS	Page 87 of 555	
pre-commissioning to tests on completion and commissioning of the complete system/equipment.			
18.4	For details of specific tests required on individual equipment, refer to respective section of this specification.		
19.0	<u>TRAINING OF OWNER'S PERSONNEL</u>		
The Contractor shall extend all possible assistance and co-operation to the Owner regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.			
Number of man-days of training as mentioned below shall be included in Tender.			
19.1	<u>TRAINING AT CONTRACTOR'S PREMISES</u>		
The Contractor shall conduct training of Thirty (30) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contract.			
The total man-months for training of engineers shall be maximum Thirty (30), having following indicative break-up:			
	Discipline	Number of Engineers	Number of Man-month
(a)	Operation	10 heads	10
(b)	Maintenance (Boiler & Turbine)	10 heads	10
(c)	Electrical Maintenance	4 heads	4
(d)	Control & Instrumentation	4 heads	4
(e)	Maintenance Planning	2 heads	2
		30 heads	30

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 88 of 555

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

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

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

The Contractor shall be responsible for the development of the Training Module and Programme Schedule, which shall be submitted to the Owner for approval.

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

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

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

- (a) Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 89 of 555
(b) Plant operation and systems training for operators including simulator training as applicable. (c) Maintenance training programme covering electrical, mechanical and instrumentation and control. Said training programme shall be submitted to the Owner for approval. The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant. The Contractor shall provide qualified English speaking instructors and training coordinator (s) during the tenure of the training programme. 19.2 <u>OPERATION AND MAINTENANCE TRAINING AT SITE</u> The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the Unit. The following instructors shall be at the Site continuously during the training: (a) One (1) for Steam Generator and Auxiliaries ; (b) One (1) for Turbine Generator and Auxiliaries ; (c) One (1) for Electrical Works ; (d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ; (e) One (1) for Instrumentation and Control (Turbine and Auxiliaries). Instructors shall also be available for Coal handling Plant, Ash Handling Plant, Water Treatment Plant and other specific areas as per requirement.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 90 of 555
19.3 <u>ON-THE-JOB TRAINING</u> During the period of pre-commissioning, commissioning and trial operation, the Owner shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training. The Owner shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 91 of 555
<u>LIST OF STANDARDS FOR REFERENCE</u> <u>ANNEXURE – A</u> 1.0 International Standards Organisation (ISO) 2.0 International Electro-technical Commission (IEC) 3.0 American Society of Mechanical Engineers (ASME) 4.0 American National Standards Institute (ANSI) 5.0 American Society for Testing and Materials (ASTM) 6.0 American Institute of Steel Construction (AISC) 7.0 American Welding Society (AWS) 8.0 Architecture Institute of Japan (AIJ) 9.0 National Fire Protection Association (NFPA) 10.0 National Electrical Manufacturer's Association (NEMA) 11.0 Japanese Electro-technical Committee (JEC) 12.0 Institute of Electrical and Electronics Engineers (IEEE) 13.0 Federal Occupational Safety and Health Regulations (OSHA) 14.0 Instrument Society of America (ISA) 15.0 National Electric Code (NEC) 16.0 Heat Exchanger Institute (HEI) 17.0 Tubular Exchanger Manufacturer's Association (TEMA)		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 92 of 555
18.0	Hydraulic Institute (HIS)	
19.0	International Electro-Technical Commission (IEC) Publications	
20.0	Power Test Code for Steam Turbines (PTC)	
21.0	Applicable German Standards (DIN)	
22.0	Applicable British Standards (BS)	
23.0	Applicable Japanese Standards (JIS)	
24.0	Electric Power Research Institute (EPRI)	
25.0	Standards of Manufacturer's Standardization Society (MSS)	
26.0	Bureau of Indian Standards (BIS)	
27.0	Indian Electricity Rules	
28.0	Indian Boiler Regulations (IBR)	
29.0	Indian Explosives Act	
30.0	Indian Factories Act	
31.0	Tariff Advisory Committee (TAC) rules	
32.0	Emission regulation of Central Pollution Control Board (CPCB)	
33.0	Pollution Control regulations of Dept. of Environment, Govt. of India	
34.0	Central Board of Irrigation and Power (CBIP) Publications	
35.0	The Air Prevention and Control of Pollution Act	
36.0	The Environmental Protection Act	
37.0	The Public Liability Insurance Act	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 93 of 555
38.0 The Forest Conservation Act 39.0 The Wildlife protection Act 40.0 The EIA Notification, 1994 41.0 IS: 14665-Specification for Electric Traction Lift 42.0 Any other statutory Codes/Standards/Regulation		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 94 of 555

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 95 of 555
<u>CRITERIA FOR LAYOUT</u> <u>ANNEXURE – B</u>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	<u>SITE CONDITIONS TO BE CONSIDERED</u>	
1.1	Prevalent wind direction during summer (for deciding cooling tower orientation)	See wind-rose in plot plan.
1.2	Prevalent wind direction (s) during dry seasons (for deciding the location of coal stock pile and ash dump/unloading areas, minimising the pollution effect due to dust)	See wind-rose in plot plan.
1.3	Location of	
1.3.1	Raw Water intake point	As shown in Plot Plan
1.3.2	Plant drainage outfall point (s)	In Existing Drainage/Effluent treatment Plant
1.3.3	Railway entries & exits	As shown in Plot Plan
1.3.4	Road entries & exits	As shown in Plot Plan
1.3.5	Electrical power transmission grid system	As shown in Plot Plan
1.3.6	Preferred / selected ash dump area	Velhala nearly 10 Km from the site
1.3.7	Nearest residential area	Existing Colony

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 96 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
2.0	<u>LAYOUT REQUIREMENTS</u>		
2.1	<u>MAXIMUM PERMISSIBLE SLOPE IN</u>		
2.1.1	Rail track	1 in 400	
2.1.2	Road	1 in 30	
2.1.3	Sides of unpaved embankment	1 in 2	
2.2	<u>REQUIRED ROAD WIDTH</u>		
2.2.1	Main roads	14.00 Metres with 1.0 m wide shoulders on either side for outer roads on western and eastern side and 7 meters with 1.5 m wide shoulders for other two sides of power block.	
2.2.2	Auxiliary interconnections	Minimum 4 Metres without shoulders on either side and shall vary upto 7 m subject to availability of space. For carriage way, 5 Metre wide with 0.5 Metre shoulders and 7.0 Mtre wide with 1.5 Metre shoulders.	
2.2.3	Road to the power house unloading bay		
(a)	Only for entry to the unloading bay	Yes	
(b)	To pass through the unloading bay	No	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 97 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
2.3	Required minimum horizontal distance between the nearest points of		
2.3.1	Plant boundary and the boundary of residential area	(Local municipality/factory rule)	
2.3.2	Electrical transformer and any other	As per the Tariff Advisory Committee Rules	
2.3.3	Fire water supply installation and any building / facility subject to fire risk.	As per the Tariff Advisory Committee Rules	
2.3.4	Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code	
2.4	Required minimum vertical clearance		
2.4.1	Under pipes/cable racks at road crossings	8.0 Metres	
2.4.2	Soil coverage over underground pipes	1.0 Metre (minimum)	
2.4.3	Pipe/Cable trench	Not Acceptable	
2.5	Railway Wagon clearance	Rules of the Indian Railways	
2.6	Minimum Clearance between any road edge and building/ structure / any fixed installation	3 Metres	
2.7	Required level, above the local developed grade level, of		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 98 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
2.7.1	Top of all roads	150 mm	
2.7.2	All outdoor paved areas	150 mm	
2.8	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes	
2.9	Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.	

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 99 of 555
<u>BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS</u> <u>ANNEXURE – C</u>		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
1.0	Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1.1	<u>HORIZONTAL, IN ALL DIRECTIONS</u>	
1.1.1	Adjacent to any electrical equipment, electrical cables, running (rotating / reciprocating) equipment, safety valve or vent / drain pipe outlet, pipe / equipment of surface temperature exceeding 60°C.	1200 mm
1.1.2	Adjacent to any other plant facilities (including walls / structures)	1000 mm
1.2	<u>VERTICAL</u> (head-room clearance)	
1.2.1	Under any pipe / equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
1.2.2	Under any other plant facilities (including structures, pipes etc.)	2.0 Metre

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 100 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
1.3	For all areas where any equipment (including trucks, trolleys and other material handling equipment) move or manoeuvre.	Minimum 500 mm clear in all direction from the outer edges of the equipment	
1.4	Minimum clear hand space required for		
1.4.1	The application of thermal insulation	100 mm	
1.4.2	Welding work	150 mm	
1.4.3	Bolt tightening	150 mm	
2.0	<u>FLOORS, PLATFORMS, STAIRCASE, LADDERS, WALLS, DOORS & WINDOWS</u>		
2.1	Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.	
2.2	<u>OPERATION & MAINTENANCE REQUIREMENT</u>		
2.2.1	Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ Maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes	

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS	
Page 101 of 555		
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
2.2.2	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
2.3	Minimum access opening required (with rolling shutter) transportation,	3.5 M wide x 4 M high or wherever entry of truck, for material depending upon the envisaged equipment size to be handled.
2.4	Plinth level of all buildings, above the local developed for power house building.	300 mm
3.0	<u>OTHER MAINTENANCE REQUIREMENT</u>	
3.1	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking / lowering assembly, dismantling of building end walls / structures etc. shall be kept.	Yes

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 102 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>
3.2	Maintenance of the internals / impellers of all important equipment, like Boiler Feed Pumps, Feed Water Heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, Cooling Water Pumps, Coal Mills, Air Compressors, Blowers, Heat Exchangers, Fuel Oil Pumps, Filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3.3	Overhauling and handling of the casings for the above items	Shall be possible without disturbing / dismantling any piping / ducting not directly connected to them.
3.4	Crane Approach Wherever required, the unobstructed approach of the crane hook / other hoisting equipment hook to various plant & equipment shall be possible.	Yes
4.0	<u>CENTRAL CONTROL ROOM</u> All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 103 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
5.0	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.		
5.1	However, as a guide line, following features are given:		
5.1.1	False ceiling and false flooring shall be provided.		
5.1.2	Uniform height, colouring schemes for cabinets etc. shall be available.		
5.1.3	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.		
5.1.4	No opening shall be provided from Boiler side.		
5.1.5	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.		
5.1.6	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS		Page 104 of 555
<u>SR. NO.</u>	<u>ITEM</u>	<u>SPECIFICATION REQUIREMENT</u>	
5.1.7	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.		
5.1.8	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.		
5.1.9	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.		
6.0	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	MASTER SPECIFICATIONS	Page 105 of 555

SPECIFIC LAYOUT CONSIDERATIONS

ANNEXURE-D

While developing the layouts, the following major layout parameters shall be ensured, as a minimum:

<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
1.0	AB bay, BC & CD bay widths	36.0 M, 12.0 M & 12.0M
2.0	Arrangement of TG set	Longitudinal
3.0	Floor levels in AB bay	0.0 M, 9.0 M, 17.0 M
4.0	Floor levels in B-C bay	0.0 M, 9.0 M, 17.0 M 24.0M, 28.0 M 32.8 M, 38.0 M
5.0	Level of operating floor	17.0 M
6.0	Level of mezzanine floor	9.0 M
7.0	HT/LT Switchgear and MCC location	HT Switchgear at 3.5 M and LT Switchgear & MCC at 12.0 M in AB bay
8.0	Area of unloading bays	750 sq. M
9.0	Lay down Area (Minimum on operating floor) with EOT Crane approach	750 sq. M.
10.0	Minimum clear working space around the equipment	1200 mm
11.0	Location of Deaerator	In BC bay at EL. 38.0 M

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 4
REV: R0	MASTER SPECIFICATIONS	
<u>SR.NO.</u>	<u>PARAMETER</u>	<u>REQUIREMENTS</u>
12.0	Location of Heaters	HP Heaters/LP Heaters at Operating Floor/ Mezzanine Floor respectively in B-C Bay.
13.0	Location of BFP	TDBFP at Operating Floor and MDBFP at Ground Floor in AB Bay.
14.0	Location of Boiler MCC	At 28.0 M in BC bay
15.0	Clear Head room within Main plant Building for pipes, structures & cable trays, ducts etc.	2.5 M
16.0	Number of Fire Escape staircases in the main plant with fire doors at each landing	Minimum Four (4)
17.0	Minimum width of all staircases landings	1500 mm
18.0	Passenger Elevators	One (min)
19.0	Clear approach width in front and rear of ESP	10 M (Height = 8 M)
20.0	Head Room for pipe/cables trestles at rail, road crossing	8.0 M
21.0	Minimum straight length in Flue gas duct at ESP outlet for Opacity meters.	As required for accurate dust measurement within the battery limits.
22.0	Elevation of ID Ducts entering Chimney	12.75 M (Min.) (Bottom of steel)

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 64 of 158
VOLUME III-F SECTION-2 LOW PRESSURE PIPING, VALVES AND SPECIALITIES		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 65 of 158

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F																				
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2																				
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 66 of 158																				
<u>CONTENTS</u> <table><tr><th><u>CLAUSE NO.</u></th><th><u>DESCRIPTION</u></th></tr><tr><td>1.0</td><td>GENERAL INFORMATION</td></tr><tr><td>2.0</td><td>CODES AND STANDARDS</td></tr><tr><td>3.0</td><td>SCOPE OF WORK</td></tr><tr><td>4.0</td><td>GENERAL DESIGN AND CONSTRUCTION</td></tr><tr><td>5.0</td><td>BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF L.P. PIPING</td></tr><tr><td>6.0</td><td>DRAWINGS, DATA, INFORMATION & MANUALS</td></tr><tr><td>ANNEXURE – I</td><td>SPECIFICATION OF PIPES FOR DIFFERENT SERVICES</td></tr><tr><td>ANNEXURE – II</td><td>SERVICE OF VARIOUS CATEGORIES OF VALVES</td></tr><tr><td>ANNEXURE – III</td><td>SPECIFICATION OF VALVES</td></tr></table>			<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	1.0	GENERAL INFORMATION	2.0	CODES AND STANDARDS	3.0	SCOPE OF WORK	4.0	GENERAL DESIGN AND CONSTRUCTION	5.0	BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF L.P. PIPING	6.0	DRAWINGS, DATA, INFORMATION & MANUALS	ANNEXURE – I	SPECIFICATION OF PIPES FOR DIFFERENT SERVICES	ANNEXURE – II	SERVICE OF VARIOUS CATEGORIES OF VALVES	ANNEXURE – III	SPECIFICATION OF VALVES
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 67 of 158

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 68 of 158
1.0 <u>GENERAL INFORMATION</u> This section covers all the low-pressure piping up to 400 NB size, associated valves and specialties that include as a minimum: 1.1 The Raw Water Piping supplying raw water to raw water reservoir (from proposed raw water gravity line from Ozerkheda reservoir to existing 2 x 500 MW units.) 1.2 Raw water piping from discharge of raw water pumps up to Cascade Aerator in Pre treatment plant. 1.3 Service Air System 1.4 Instrument Air System 1.5 Demineralised Water Supply system 1.6 Plant Potable Water System - (filtered & Ozonised water) 1.7 Service Water System 1.8 Air heater washing system 1.9 Clear water supply line for Coal handling plant dust suppression/dust extraction from discharge of CHP DS/DE supply pumps located at Clear water pump house in ETP area. 1.10 Fuel oil system piping supply and Fuel Oil return from boiler and Steam tracing to HFO tank. 1.11 Any other low pressure piping as found necessary during detail engineering shall also be included. 2.0 <u>CODES AND STANDARDS</u> 2.1 In addition to the requirements spelt out in Volume II, the design, manufacture, inspection and testing of the piping, fittings, valves and		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION		Page 69 of 158
specialties covered under this specification shall conform, in general, to the standards and codes mentioned below:			
2.1.1	IS-1239 [Part-I & II]	: Mild steel tubes, tubular and other wrought steel fittings.	
2.1.2	IS-3589	: Electrically welded steel pipes for water, gas and sewage (200 to 2000 NB)	
2.1.3	IS-554	: Dimensions for pipe threads where pressure tight joints are required on the threads.	
2.1.4	IS-1363 [Part-I & II]	: Hexagonal head bolts, screws and nuts (size range M5 to M36)	
2.1.5	IS-1364	: Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)	
2.1.6	IS-3138	: Hexagon bolts & nuts (M42 to M150)	
2.1.7	IS-4736	: Hot dip zinc coating on mild steel tubes.	
2.1.8	IS 14846	: Sluice Valves for water works purposes.	
2.1.9	IS-2685	: Code of practice for selection, installation and maintenance of sluice valve.	
2.1.10	IS-5312	: Swing check type reflux (non-return) valves.	
2.1.11	IS-2379	: Colour code for the identification of pipelines.	
2.1.12	IS-2016	: Plain washers	
2.1.13	IS-2712	: Compressed asbestos fibre jointing	
2.1.14	ANSI B-16.5	: Steel pipe flanges and flanged fittings	
2.1.15	ANSI B-16.9	: Wrought steel Butt welding flanged	
2.1.16	ANSI B-16.11	: Forged steel fittings, Socket-welding and Threaded.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 70 of 158
2.1.17 ANSI B-36.10 : Steel pipes thickness 2.1.18 API-600 : Steel gate valves 2.1.19 BS-2633 : Class I Arc welding of ferrite steel pipe work for carrying fluids. 2.1.20 BS-534 : Specification for steel pipes and specials for water and sewage. 2.1.21 BS-5351 : Specification for Ball valves. 2.1.22 BS EN ISO : Specification for Ball valves. 17292 : 2004 2.1.23 AWWA-C-504 : Specification for Butterfly valves. 2.1.24 AWWA-C-208 : Dimension for fabricated steel water pipe fittings. 2.2 Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Owner. 3.0 <u>SCOPE OF WORK</u> 3.1 The equipment and materials to be supplied shall include as a minimum, the following : (a) Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc as required for the piping system. (b) Matching pipes, matching pieces like reducers/expanders etc, counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc. (c) Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 71 of 158
(d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc complete with the counter flanges and matching connecting pieces as required for entire low pressure piping system. (e) Anchors, hangers and supports etc as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc. (f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping shall be avoided to the extent possible. (g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches of the Power Station. (h) Pipe rack required between WTP, Oil storage area to TG Hall and boiler area is under bidders cost of design and construction including the civil foundation for pipe rack and any other piping support foundations wherever required. (i) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc as required for interconnecting piping, valves & fittings. (j) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop. 3.2 Following general requirements shall however be provided (a) Instrument connections including instruments, root valves, sensing lines etc. (b) Pipe stubs and blanking plates etc required for chemical cleaning and hydro testing.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2	
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION		Page 72 of 158	

For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.3 The Flow Diagrams forming a part of the specification are mainly intended to give general guidelines to the Bidder regarding extent of piping, valves, and specialties to be supplied under this section.

4.0 GENERAL DESIGN AND CONSTRUCTION

4.1 GENERAL CONSIDERATIONS

4.1.1 Line Sizing

Sizes of piping shall be selected such that the velocity of fluid in pipes does not exceed the following limits under conditions of maximum possible volumetric flow.

(a)	Water				
	(i)	Condenser CW	Below 1000 NB	1000-2000 NB	Above 2000 NB
		a. Pump suction	1.0	1.3	1.5
		b. Pump discharge / distribution	2.4	2.8	3.0
	(ii)	Water- General	Below 200 NB	200-400 NB	400-700 NB
		a. Pump suction	1.0		
		b. Pump discharge / distribution	1.8	2.2	2.5
(b)	Fuel oil				
		Heavy oil (Heated)			
		a. Pump suction	1.0		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F												
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2												
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION		Page 73 of 158												
<table><tr><td></td><td></td><td>b. Pump discharge / distribution</td><td>1.5-2.0</td></tr><tr><td>(c)</td><td colspan="3">Gases</td></tr><tr><td></td><td></td><td>a. Compressed air</td><td>15-25</td></tr></table>						b. Pump discharge / distribution	1.5-2.0	(c)	Gases					a. Compressed air	15-25
		b. Pump discharge / distribution	1.5-2.0												
(c)	Gases														
		a. Compressed air	15-25												
4.1.2	The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.														
4.1.3	The piping system shall be complete in every detail and in accordance with the highest standard of workmanship. Against any doubt, Owner shall be referred for clarification.														
4.1.4	All design and fabrication shall be in accordance with codes/standards specified.														
4.1.5	No pipe work shall run in trenches carrying electrical cables.														
4.1.6	Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.														
4.1.7	All piping shall be identified by means of colour strips, by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.														
4.1.8	Air release and drain branches shall be provided, wherever necessary, depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.														
4.1.9	Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/cm ² (g) at 80°C or as required by the design of the different piping system, if higher.														
4.1.10	Drain Pipe work														
	(a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.														

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 74 of 158

(b) Unless otherwise stated, all drain piping shall be of 25 NB minimum and all vent piping shall be of 15 NB minimum. For pipes up to 40 NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.

(c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.

4.1.11 Specification of pipes used in different services included in the L.P. piping section has been detailed in Annexure-I.

4.1.12 Following types of valves shall be used for the system/ service marked as y

	Types of Valves				
	Butterfly	Gate	Globe	Check	Ball
(a) Water	y	y	y	y	y
(b) Drains & Vent		y	y	y	
(c) Fuel oil		y	y	y	y
(d) Air		y	y	y	y

4.1.13 HFO oil line shall be traced by steam tracers.

4.2 MATERIAL SPECIFICATION

4.2.1 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Owner depending on the merits of alternative material.

4.2.2 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 75 of 158
4.3 <u>FABRICATION</u> For Detailed Fabrication requirement of LP piping, Refer clause no- 6.5 of Section –I of this specification. 4.4 <u>HANGERS, SUPPORTS, ANCHORS</u> Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item, shall be supported in such a way that the plant item does not take the weight of the piping. 4.4.1 Support spacing shall be as per good engineering practice. However, in no case it shall be less than support spacing stipulated in ANSI B31.1. 4.4.2 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection. 4.4.3 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required. 4.4.4 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by welding, by bolting or by beam clamps. Boltholes shall be drilled, not burned. Support components may be bolted to concrete using approved concrete anchors. 4.5 <u>VALVES AND ACCESSORIES</u> 4.5.1 Valves (a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure-II & III.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 76 of 158
(b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/ outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs shall be avoided as far as possible. (c) All valves shall, unless otherwise stated, have the internal diameter same as the internal diameter of the pipes to be joined. (d) All valves shall receive tests at manufacturer's or contractor's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Owner. (e) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate. (f) Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Owner's approval. (g) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items: (i) Hand wheel with embossed open and shut directions. (ii) Local position indicator. (iii) Motorised operation as specified by Engineer. (h) Gate valves, in addition shall be provided with following extra features (i) Bypass valve for larger valves (ii) Draining arrangement		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 77 of 158
(iii) Enclosed Gear operators for valves 300 NB and above for ease in operation. (iv) Motorised operation as specified by Engineer. (i) All gate and globe valves shall be rising stem type. (j) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also. (k) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties. (l) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position. (m) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided. (n) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction. (o) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 78 of 158
(p) Plastic or bakelite valve hand wheels will not be accepted. (q) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers. (r) Wherever practicable, heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500kg shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable. (s) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum. (t) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves. (u) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction. (v) All sampling and root valves shall be of integral body bonnet type. (w) Gate and globe valves used for fuel oil system shall be of such design as to permit re-packing while in service. For Design Requirements for different valves, refer Annexure-II & III. 4.5.2 Strainer for fuel oil system (a) There shall be Duplex strainers on the Fuel Oil Line.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 79 of 158
(b) The strainer shall have basket type straining elements permitting easy removal and replacement. (c) The open area ratio (i.e. straining area to the inlet area ratio) shall be at least 6:1. (d) The strainer shall have screen of stainless steel (AISI-316) construction with wire diameter of about 0.01 inch and open area of about 50%. (e) Strainer body shall be made of Mild steel. No Cast Iron component shall be used in F.O. system. (f) All strainers shall also be provided with oil drip plates beneath them for collection of oil. (g) Bolts and nuts shall be as per IS-1363. Gaskets shall be minimum 3 mm thick and made of compressed asbestos fibre as per IS-2712. 4.5.3 Steam Traps (a) The steam traps shall be inverted bucket or thermodynamic type complete with integral or separate strainers. (b) Traps shall have carbon steel body with stainless steel internals to AISI 316. (c) Y-type strainers whether integral with steam traps or otherwise shall have body of Cast Steel Class 150 material and perforated metal screen of type AISI-316 stainless steel with about 0.8 mm perforation. The strainer shall have screwed blow off connections fitted with removable plug. The free hole area shall be at least three (3) times the internal pipe area. (d) Numbers and location of steam traps shall be selected by the Bidder. 4.6 <u>SAFETY/RELIEF VALVES</u> 4.6.1 Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 80 of 158
4.6.2 All safety valves shall be provided with manual lifting lever. 4.6.3 Valves used for air and any other compressive fluid shall be of pop type. 4.6.4 Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure. 4.6.5 Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer. 4.6.6 The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting. 4.7 <u>HOSE PIPE AND ACCESSORIES</u> 4.7.1 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves. 4.7.2 Hose pipes with fittings for Service Water System: (a) The water hose shall be as per IS-444 (Type-3). (b) Length of each hose shall be 15 metres. (c) For each hose, one end shall be fitted with M.S. female coupling with swivelling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swivelling nut of a second hose whereby two hose lengths may be joined. 4.7.3 Hose pipes with fittings for Compressed air System (a) The compressed air hose shall be as per IS-911 (Type 2). (b) The length and type of each end shall be similar to as specified in above clause no. 4.7.2 (b) (c) above.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 81 of 158
5.0	<u>BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING</u>	
5.1	All fittings like "T" pieces, flanges, reducers etc shall be suitably matched with pipes for welding. The valves shall be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.	
5.2	Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered part of work and such work shall be carried out as per instructions, which shall include specified heat-treatment procedures etc also, wherever required.	
5.3	Certain adjustments in length may be necessary while erecting low pressure pipelines and the extra lengths shall be removed to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.	
5.4	Suspension for piping, pressure parts etc shall be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.	
5.5	All the valves, lifting equipments, actuators, power cylinders etc shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, shall be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.	
5.6	All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes.	
5.7	Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 82 of 158
after completion of erection, which shall be carried out by the Bidder without any extra cost to the Owner. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions. 5.8 No temporary supports shall be welded on the pressure parts. Welding of temporary supports, cleats etc on the building columns shall also be avoided. In case of absolute necessity, prior approval from Engineer shall be taken. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Engineer. 5.9 Wherever piping is connected to other piping or equipment, the joint at the connecting point shall be considered under this specification. (a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance. (b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance. (c) Piping shall be routed above ground unless otherwise specifically indicated/approved by the Engineer. In such special case, the piping may be arranged in trenches or buried and properly protected as per AWWA Standards. (d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 6 meters above roadways unless otherwise approved by the Engineer. Inside TG hall, headroom clearance for piping should be minimum 2 metres. (e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective drawings or not. The pipelines shall be sloped towards the drain points.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 83 of 158
(f) All drips and drains for piping and equipment whether shown in the drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. 5.10 Painting (a) All uninsulated piping systems, hangers and supports shall have two coats of red oxide Zinc Chromate primer (conforming to IS 2074) with minimum dry film thickness (DFT) of 25 microns per coat and two coats of finish paints using enamel paint to give a minimum total DFT of 100 microns (after two coats of primer and two coats of finish paint). Shades shall be as per IS 5 or as indicated by Owner/ Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations. (b) Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot, grease, rust etc. (c) All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint. 6.0 <u>DRAWINGS, DATA, INFORMATION & MANUALS</u> 6.1 For Drawing, Data and Information required along with BID refer, Volume VIII.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2
	REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 84 of 158

ANNEXURE – I

(SPECIFICATION OF PIPES FOR DIFFERENT SERVICES)

	A	B	C	D
1.0 Services	(a) Raw Water Piping (b) Clarified Water piping, (c) Filtered Water to DM Plant	Drinking (Potable) Water Supply piping (filtered water, ozonised)	Demineralised Water, Service and Instrument air piping less than and equal to 40 NB	Demineralised Water, Service and Instrument air piping for sizes equal to or greater than 50 NB
2.0 Material of Pipe	Carbon Steel IS-1239 Part I Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB with minimum pipe thickness of 6 mm.	Carbon Steel as per IS-1239 Part I Heavy Grade upto 150 NB and IS-3589 for sizes above 150 NB. The pipes shall be galvanized as per IS-4736.	Stainless Steel as per ASTM A-312 Gr 304. Thickness schedule 40S as per ANSI-B 36.19	Stainless steel as per ASTM A-312 Gr 304. Size up to 250 NB as per schedule 10S, ANSI B 36.19
3.0 Construction	ERW/Seamless	ERW/Seamless	Seamless	ERW/Seamless
4.0 End connections	Flange and butt weld for size 50 NB and above and Socket weld joint for size 40 NB and below.	Screwed flange for sizes 50 NB and above and screwed socket for size 40 NB and below.	Socket welded for DM water lines. Screwed end connection for airlines.	SORF and butt weld joint for DM application. Screwed end connection for air

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.				Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1				Section – 2
	PIPING, SPECIALTIES & THERMAL INSULATION				Page 85 of 158
REV: R0					
	A		B	C	D
					lines upto 80 NB. Beyond 80 NB, it shall be butt-welded.
5.0 Fittings	Pipe size ≥ 50 NB	Pipe Size ≤ 40 NB	Pipe size ≥ 50 NB	Pipe Size ≤ 40 NB	
5.1 Materials	A 234 Gr WPB/ IS 3589	A105 or compatible with IS-1239	A 234 Gr WPB /IS 3589	A105 or as compatible with IS-1239	A 351 CF8
5.2 Construction	Welded / Seamless	Forged	Welded / Seamless	Forged	Welded/Seamless
5.3 Standard	ANSI-B16.9 / fabricated fitting as per AWWA-C-208 is also acceptable	ANSI-B 16.11/ IS-1239 (Part-II) cold Bends from pipes having bend radius R=3D is also acceptable	ANSI B16.9	ANSI B16.11/IS-1239 (Part- II)	ANSI B16.9
5.4 End Details	Butt welded As per ANSI B16.25	Socket welded as per ANSI-B-16.11	Screwed/ Flanged	Screwed/ Socket as per ANSI B16.11/or IS-1239	Butt welded for pipe & fittings and flanged for

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.				Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1				Section – 2
	PIPING, SPECIALTIES & THERMAL INSULATION				Page 86 of 158
REV: R0					
	A		B		C
				(Part-II)	
			All fittings shall be galvanized		
6.0 Flanges	150 class as per ANSI B16.5 complete with nuts, bolts and gaskets. FF flanges for CI valves.		As per ANSI B16.5 pressure class 150 - galvanized- complete with nuts, bolts and gaskets. FF flanges for CI valves.		As per ANSI B16.5 pressure class 150 complete with nuts, bolts and gaskets. Use slip on flanges here.
					150 class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets. Use Lap Joint flanges here.
1.0	Services	Fuel Oil System			
2.0	Material of Pipe	API 5L Gr B or ASTM 106 Gr B			
3.0	Construction	Seamless			
4.0	End connections	≤ 40NB SW, ≥ 50NB – BW			
4.1	Fittings	ASTM A234 Gr WPB/ A 105			
5.0	Valve end	Flanged end is preferred			
6.0	connection				
NOTE:					
1. Refer Annexure –III for Valve material specification.					
2. Pipes which fall under IS: 1239 shall be hydrostatically tested according to the said code, for others refer Section-V, Volume II.					

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 87 of 158

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.		MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F
		BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2
REV: R0		PIPING, SPECIALTIES & THERMAL INSULATION		Page 88 of 158
<u>ANNEXURE – II</u> <u>SERVICES OF VARIOUS CATEGORIES OF VALVES</u>				
SR. NO.	VALVE CLASSIFICATION	SERVICE		
1.0	Cast iron body Gate/ Globe/Check Valve	(a) Service Water (Clarified)	For sizes 50 NB and above	
		(b) Filtered Water		
		(c) Drinking Water		
		(d) Inhibited Demineralised Water		
2.0	Stainless steel & Bronze body Gate / Globe / Check / Ball Valve	(a) For Demineralised water	For all sizes	
		(b) Drinking Water	For sizes less than and equal to 40 NB	
		(c) Service and Instrument Air	For all sizes. Ball valves to be used in air line.	
3.0	Steel Body valves	(a) Clarified Water	For sizes less than and equal to 40 NB	
		(b) Inhibited Demineralised Water for DMCW system		
		(c) Fuel oil system	For all sizes	
4.0	Cast Iron body butterfly valve & Check valve	(a) For Demineralised Water	For sizes 50 NB and above. Rubber lining shall be provided for DM water application.	
		(b) Raw water		
		(c) Clarified Water		
		(d) Filtered Water		
		(e) Inhibited Demineralised Water for DMCW system		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-F
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION	Page 89 of 158

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-F	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 2	
	REV: R0		Page 90 of 158	
<u>ANNEXURE-III</u>				
<u>SPECIFICATION OF VALVES</u>				
	(A)	(B)	(C)	
	Cast Iron Body Gate/ Globe/Check Valve	Stainless Steel Body Gate/ Globe /Check/Ball Valve	Steel Body Gate / Globe / Check Valves	
1.0 <u>BASIC DESIGN CODE</u>				
(a) Gate	(a)	(a)	(a)	
	(i) IS-780 for 50 – 300 NB	(i) API 600 for 50 NB and above /ANSI-B-16.34	(i) API 600 for 50 NB and above/ ANSI-B-16.34	
	(ii) IS-2906 for 350 NB & above or as per MSS- SP-70	(ii) API 602 for size below 50 NB /ANSI-B-16.34	(ii) API 602 for size below 50 NB/ANSI-B-16.34	
(b) Globe	(b) MSS-SP-85	(b) BS 1873/ANSI-B-16.34	(b) BS 1873/ANSI-B-16.34	
(c) Check	(c) IS-5312/MSS-SP-71	(c) BS 1868/ANSI-B-16.34	(c) BS 1868/ANSI-B-16.34	
(d) Ball		(d) BS 5351	(d) BS 5351	
2.0 <u>PRESSURE CLASS</u>	To be suitably chosen considering the pressure requirement.			
3.0 <u>CONSTRUCTION</u>	Cast body and bonnet/ cover	Forged body up to 50 NB and Cast body above that size	Same as Group B	
4.0 <u>MATERIAL</u>				

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.			Volume: III-F	
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1				Section – 2
	REV: R0	PIPING, SPECIALTIES & THERMAL INSULATION			Page 91 of 158
	(A)	(B)	(C)		
	Cast Iron Body Gate/ Globe/Check Valve	Stainless Steel Body Gate/ Globe /Check/Ball Valve	Steel Body Gate / Globe / Check Valves		
4.1 Body & Bonnet Cover	IS 210 Gr. FG 260	A 351 CF8 for cast Body and A 182 F304 for forged Body	A 216 Gr. WCB for Cast Body and A 105 for Forged body		
4.2 Trim/Disc	IS 210 Gr. FG 260	A 182 F304 for 13% Cr. Steel as per Gate, Globe, Check valves and A 351 CF8 for Ball Valves	A 182 Gr.F6 heat treated and hardened (min. 250 BHN) for cast body and A 105 Hard faced with Stellited (min. 350 HB) for forged body.		
4.3 Seating surface	13% Cr. Steel as per IS-1570	For Ball valves PTFE seats and seals	13% Cr. Steel as per A 182 Gr. F6.		
5.0 <u>END PREPARATION</u>	Socket welded for size equal to and below 40 NB and flanged with counter flanges for 50 NB and above.				
6.0 <u>TESTING</u>					
(a) Gate	(i) IS-780 for 50 – 300 NB	ANSI B-16.34 / API-598 / MSS-SP-61 / EN 12266-1	ANSI B-16.34 / API-598 / MSS-SP-61 / EN 12266-1		
	(ii) IS-2906 for sizes equal to and above 350 NB				
(b) Globe	MSS-SP-85				
(c) Check	IS 5312/MSS-SP-71				
(d) Ball					

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 147 of 555

VOLUME II
SECTION – 7
QUALITY ASSURANCE REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 148 of 555

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II																
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7																
REV: R0	MASTER SPECIFICATIONS	Page 149 of 555																
<u>CONTENT</u> <table><tr><td><u>CLAUSE NO</u></td><td><u>DESCRIPTION</u></td></tr><tr><td>1.0</td><td>QUALITY ASSURANCE PROGRAMME</td></tr><tr><td>2.0</td><td>GENERAL REQUIREMENTS-QUALITY ASSURANCE</td></tr><tr><td>3.0</td><td>QUALITY ASSURANCE DOCUMENTS</td></tr><tr><td>4.0</td><td>INSPECTION, TESTING & INSPECTION CERTIFICATES</td></tr><tr><td colspan="2"><u>ENCLOSURES</u></td></tr><tr><td>ANNEXURE–A</td><td>FORMAT OF QUALITY ASSURANCE PROGRAMME</td></tr><tr><td>ANNEXURE–B</td><td>FIELD WELDING SCHEDULE</td></tr></table>			<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	1.0	QUALITY ASSURANCE PROGRAMME	2.0	GENERAL REQUIREMENTS-QUALITY ASSURANCE	3.0	QUALITY ASSURANCE DOCUMENTS	4.0	INSPECTION, TESTING & INSPECTION CERTIFICATES	<u>ENCLOSURES</u>		ANNEXURE–A	FORMAT OF QUALITY ASSURANCE PROGRAMME	ANNEXURE–B	FIELD WELDING SCHEDULE
<u>CLAUSE NO</u>	<u>DESCRIPTION</u>																	
1.0	QUALITY ASSURANCE PROGRAMME																	
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 150 of 555

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 151 of 555
1.0 <u>QUALITY ASSURANCE PROGRAMME</u> 1.1 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following: 1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme. 1.1.2 Documentation control system. 1.1.3 Qualification data for Bidder's key personnel. 1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc. 1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls. 1.1.6 Control of non-conforming items and system for corrective actions. 1.1.7 Inspection and test procedure both for manufacture and all site related works. 1.1.8 Control of calibration and testing of measuring and testing equipments. 1.1.9 System for quality audit. 1.1.10 System for indication and appraisal of inspection status. 1.1.11 System for authorising of release of manufactured product to the Owner.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 152 of 555
1.1.12 System for handling storage and delivery. 1.1.13 System for maintenance of records. 1.1.14 Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component. 2.0 <u>GENERAL REQUIREMENTS - QUALITY ASSURANCE</u> 2.1 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 Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award. 2.2 Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing. 2.3 Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site. 2.4 The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc as referred		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 153 of 555
in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc shall be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify Customer Hold Points (CHP), test/ checks which shall be carried out in presence of the Owner's Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and disposal. 2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/Authorised representative and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC). 2.6 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it. 2.7 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record and mechanical property test results shall be furnished. 2.8 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner. All brazers, welders etc employed on any part of the contract at Contractor's / Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS- 4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 154 of 555
For welding of pressure parts and high pressure piping, the requirements of IBR shall also be complied with.		
2.9	All Non-Destructive Tests (NDT) shall be carried out in accordance with approved International Standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.	
2.10	List of all the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/ equipment shall be drawn up by the Contractor and finalised with the Owner. Such list shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.	
2.11	All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance. Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.	
2.12	Quality requirements for main equipment shall equally apply for spares and replacement items.	
2.13	Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 155 of 555
2.14	For quality assurance of all civil works refer to the specifications for civil works.	
3.0	<u>QUALITY ASSURANCE DOCUMENTS</u>	
3.1	The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :	
3.1.1	Material mill test reports on components as specified by the specification.	
3.1.2	The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.	
3.1.3	Non-destructive examination results/reports including radiography interpretation reports.	
3.1.4	Factory tests results for testing required as per applicable codes and standards referred in the specification.	
3.1.5	Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.	
3.1.6	Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.	
3.1.7	Stress relief time temperature charts.	
3.1.8	Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :	
	(a) When some important repair work is involved to make the job acceptable.	
	(b) The repair work remains part of the accepted product quality.	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 156 of 555
3.2	Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.	
4.0	<u>INSPECTION, TESTING AND INSPECTION CERTIFICATES</u>	
4.1	The Engineer, his duly authorised 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 Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.	
4.2	The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified Six (6) copies of test reports.	
4.3	The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.	
4.4	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a	

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 157 of 555
certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract. 4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing. 4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.		

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD. BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1 REV: R0 MASTER SPECIFICATIONS	Volume: II
		Section – 7
		Page 158 of 555

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 7
REV: R0	MASTER SPECIFICATIONS	Page 159 of 555

FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

Sl. No.	Name of Company/ Contractor	NAME OF CONTRACT PACKAGE	QUALITY PLAN FOR						Format of Record	Agency	Remark
			Package No. : _____	QP No. : _____	Date _____	Type of Check	Quantum of Check	Reference Document	Acceptance Norm		
		Contractor : _____		Rev. No.: _____	Date _____						

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 7
	MASTER SPECIFICATIONS		Page 160 of 555

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 7
	REV: R0		Page 161 of 555

FIELD WELDING SCHEDULE

ANNEXURE – B

PROJECT	:	FWS NO	:
CONTRACTOR	:	REV NO.	:
PACKAGE	:	FIELD WELDING CODE	:
SYSTEM	:	PAGE NO.	:

SI No	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Preheat Temperature	Heat Treatment [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 7
	MASTER SPECIFICATIONS		Page 162 of 555
The Field Welding schedule shall be submitted for: (a) Pressure Parts (b) Tanks/Vessels (c) Piping (d) Heavy /Important Structural Steel (e) Heat Exchangers (f) Bus Ducts			

CONSULTANT : PROCON ENGINEERS



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I SECTION – IA

REVISION 01

DATE: 21.11..2019

SAMPLE QUALITY ASSURANCE PLAN

QAP OF LEVEL INDICATOR

Manufacturer's Name:			QUALITY ASSURANCE PLAN				PROJECT: PACKAGE: Misc. Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1			
			QAP OF LEVEL INDICATOR									
Sl. No.	Components and Operation	Characteristic/ Item	Class	Type of Check	Extent of Check	Reference Document	Acceptance Norm	Format of Record (D*)	Agency			Remarks
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
1	Level Indicator	Check for Type, Model No., Tag No.	MA	Visual	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
2		Float Leakage Test	CR	Mechanical	100%	Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
3		Review of TC for Material	CR	Visual	For Lot	MTC	MTC	Mfgr. TC	P	V	V	
		C: BHEL B : Vendor M. : Manufacturer				P - Perform W - Witness V - Verification						
Manufacturer / Contractor / Sub contractor		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics		FOR BHEL				FOR CUSTOMER	APRD. BY			
Signature												

Manufacturer's Name:			MANUFACTURING QUALITY PLAN FOR VALVES				PROJECT: PACKAGE: Misc. Tanks (Site Fabricated)			BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1			
							LOI No. :						
							Customer : BHEL						
Sl. No.	Components and Operation	Characteristic/ Item	Class	Type of Check	Quantum	Reference Document	Acceptance Norm	Format of Record (D*)	D	Agency			Remarks
										M	B	C	
1.0	Material :												
1.1	Body,Bonnet,forgings/casting	1.Chemical compositon	CR	Chem.test	One lheat	Approved Data Sheet/DRG	Relevant standard.	TC	√	P	V	V	
		2.Mech properties	CR	Tensile test	One lheat HT Batch	Approved Data Sheet/DRG	Relevant standard.	TC	√	P	V	V	
1.2	Disc & spindle	1. Mech Properties	MR	Tensile test	1 Test bar /Heat	Approved Datasheet	Relevant standard.	TC	√	P	V	V	
		Chemical properties	MR	Chemical analysis									
2.0	In Process Inspection :-												
2.1	Body,Bonnet,Disc,spindle after Machining	Visual	MR	Visual	100%		No visual surface defect	IR	√	P			
		Dimension	MR	Measurements	100%	Component drg	Component drg	compliance report					
2.2	Body,Seat ring ,Disc,spindle after Machining	Surface defects	MR	DPT	100%	ASTM A 165	No significant defects	mfrg.TC	√	P	-		
3.0	TESTING & FINAL INSPECTION												
3.1	Complete valve	hydrotesting(pressure & duration as per approved datasheet/std.)	MR	Body/seat	100%	Approved datsheet	No leakage through Body/seat	TC	√	P	W	W	
3.2		Functional test	MR	Full open & full close	100%	Approved Drg/datasheet	Smooth operation	IR	√	P	W	W	
		LEGEND : * RECORDS INDENTIFIED WITH "TICK" SHALL BE INCLUDED											
		C: BHEL B. : VENDOR M:Manufacturer DPT=Dye penetrant test MR-MAJOR.CR-Critical ,CHP-customer Hod, R=review,NDT-non Destructive test,TC-test certificate, IR-inspection Report ,D-Data folder DPT=Dye penetrant Test				P - Perform W - Witness V - Verification							
Manufacturer / Contractor / Sub contractor		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics			FOR BHEL		FOR CUSTOMER				APRD. BY		
Signature													

QAP OF PIPE FITTINGS ,FLANGES & ACCESSORIES

Manufacturer's Name:		QUALITY ASSURANCE PLAN		PROJECT: PACKAGE: Misc.Tanks (Site Fabricated) LOI No. : Customer : BHEL		BHEL Doc. No.: Rev. No. : 0 Date: SHEET 1 OF 1			
		INSPECTION CHECK LIST FOR PIPE FITTINGS ,FLANGES & ACCESSORIES							
Sl. No.	Components and Operation	Class	Type of Check	Reference Document/Acceptance Norm	Agency			Remarks	
					M	B	C		
1	2	3	4	5	6			7	
1	Pipes Fittings,Flanges & Accessories	MI	Visual	As per Approved Data Sheet/Tech spec.	P	V	V		
2		MI	Dimensional	As per Approved Data Sheet/Tech spec.	P	V	V		
3		MI	Review of TC	As per MTC	P	V	V		
		MA	Hydro Test	As per MTC	P	V	V		
		LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE INCLUDED C : CUSTOMER /BHEL B. : VENDOR M. : Manufacturer					DOC. NO. :		
Manufacturer / Contractor / Sub contractor Signature		CR-Critical Characteristics MA - Major Characteristics MI- Minor Characteristics IR-Inspection Report ,MTC- Material/Manufacturer's Test. Certificate				FOR BHEL FOR CUSTOMER		APRD. BY	APPROVAL SEAL



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
SUB-VENDOR LIST
ANNEXURE-I**

SPECIFICATION NO. PE-TS-XXX-167-A001

VOLUME II-B

SECTION 'E'

REVISION 01

DATE: 07/07/2015

PAGE 1 of 5

**ANNEXURE-I
LIST OF MAKES OF SUB-VENDOR ITEMS
MISCELLANEOUS TANKS**


07/07/15

VIPIN NAUNI
PEM - NOIDA



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
SUB-VENDOR LIST
ANNEXURE-I**

SPECIFICATION NO. PE-TS-XXX-167-A001

VOLUME II-B

SECTION 'E'

REVISION 01

DATE: 07/07/2015

PAGE 2 of 5

SUB-VENDORS - MISCELLANEOUS TANKS

S.NO	ITEM	SUB-VENDORS	PLACE	TECHNICAL LIMIT
1	CS PIPES ERW	TISCO	JAMSHEDPUR	UP TO 350 NB
		SAIL	ROURKELA	
		SURYA ROSHNI	BAHADURGARH	UP TO 400 NB
		JINDAL	GHAZIABAD	UP TO 350 NB
		RATNAMANI	KUTCH	UP TO 400 NB
		MAHARASHTRA SEAMLESS	RAIGARH	UP TO 500 NB
		WELSPUN	ANJAR	UP TO 400 NB (IS 3589)
2	CS PIPES SEAMLESS	MAHARASHTRA SEAMLESS	RAIGARH	UP TO 350 NB
		ISMT	AHMEDNAGAR	UP TO 150 NB
		JINDAL SAW	NASHIK	
		REMI METAL GUJRAT LTD	BHARUCH	UP TO 150 NB HOT FINISH & UPTO 100NB COLD FINISH
		ISMT	BARAMATI	UP TO 200 NB
3	SS PIPES	REMI	TARAPUR	
		RATNAMANI	KUTCH	
		APEX TUBES	BEHROR (ALWAR)	
		PRAKASH STEELAGE LTD	MUMBAI	SS SEAMLESS PIPE UPTO 50MM
		SUMITAMO	JAPAN	
4	STRUCTURAL STEEL / MS PLATE	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		M/S UTTAM VALUE STEEL (LLOYDS)		
		ISPAT		
		JSW		
		INDIAN IRON & STEEL CO. LTD		
5	GATE, GLOBE AND CHECK (STAINLESS STEEL VALVES)	A.V. VALVES LTD	AGRA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900, GV/300/400, GV/600/300, GV/GLV/NRV/900/250, GLV/300/300, GLV/150/350/, SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
SUB-VENDOR LIST
ANNEXURE-I**

SPECIFICATION NO. PE-TS-XXX-167-A001

VOLUME II-B

SECTION 'E'

REVISION 01

DATE: 07/07/2015

PAGE 3 of 5

		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO		
		OSWAL INDUSTRIES		
		A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500, GLV-BBT-UPTO300NB CL UPTO600, SCNRV-BBT-UPTO600NB CL UPTO150, SCNRV-BBT-UPTO300NB CL 300, SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900, GV/300/400, GV/600/300, GV/GLV/NRV/900/250, GLV/300/300, GLV/150/350/, SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO -L&T	CHENNAI / COIMBATORE	
		OSWAL INDUSTRIES		
		HITECH	AHMEDABAD	
		KSB WATER PUMPS / VALVES	COIMBATORE	
		KBL	KONDHAPURI	
		HAWA ENGINEERS	AHMEDABAD	
		BHEL	GOINDWAL	
		FOURESS ENGG	MUMBAI	UPTO 600 NB, CL-300 & 300NB CL-600
		FOURESS ENGG	AURANGABAD	
6	GATE, GLOBE AND CHECK (CS STEEL VALVES)	FLOW STAR	FARIDABAD	
		SCIENTIFIC DEVICES	MUMBAI	
		GAUGES BOURDEN	PANVEL	
		PUNE TECHTROL	PUNE	
		SBEM	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
7	LEVEL INDIATOR FLOAT AND BOARD TYPE			



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
SUB-VENDOR LIST
ANNEXURE-I**

SPECIFICATION NO. PE-TS-XXX-167-A001

VOLUME II-B

SECTION 'E'

REVISION 01

DATE: 07/07/2015

PAGE 4 of 5

		CHEMTROL		
		DK INSTRUMENT	KOLKATA	
		V AUTOMAT	DELHI	
8	PAINT	ASIAN PAINT		
		BERGER		
		KANSAI NEROLAC		
		JOTUN		
		SHALIMAR		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		AKZONOBEL COATINGS		
9	FITTINGS (MS/SS)	PIPE FIT ENGINEERS	VADODARA	
		GUJRAT INFRA PIPES	VADODARA	
		MS FITTINGS	KOLKATA	
		TUBE PRODUCT	VADODARA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
		NL HAZRA	KOLKATA	
		EXCEL METAL		
		INTERTECH		
		FITTECH		
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
10	SEAL POT / NAOH BREATHER	SELF MANUFACTURED ITEM		
	INSPECTION CATEGORIZATION			
	1. CAT I :INSPECTION BY OWNER, BHEL/BHEL NOMINATED TPIA & VENDOR .MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.			
	2. CAT II:INSPECTION BY BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.			
	3. CAT III: MDCC WILL BE ISSUED BASED COC & MTC ISSUED BY VENDOR AND VERIFICATION BY BHEL/OWNER IN LINE WITH APPROVED QAP/CHECK LIST			

The make of Sub-vendor items shall be generally as indicated above which is subject to customer / BHEL approval during detail engineering.

Make of any unlisted items shall be subject to customer / BHEL approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for Customer / BHEL's review and approval. Bidder shall furnish following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
SUB-VENDOR LIST
ANNEXURE-I**

SPECIFICATION NO. PE-TS-XXX-167-A001

VOLUME II-B

SECTION 'E'

REVISION 01

DATE: 07/07/2015

PAGE 5 of 5

- a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.
- b) Documentation in the form of certificate that the equipment/system has been operating satisfactorily for two years as on the scheduled date of bid opening.

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily be submitted within one month of placement of LOI to ensure timely placement of order for BOIs

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6
ANNEXURE-II**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION-1 A

REVISION 01

DATE: 21.11.2019

PAGE 1 of 4

DRAWINGS DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

S. NO	DOCUMENT NO.	DOCUMENT TITLE	SCH. DATE OF SUB. FROM LOI (IN WEEKS)	PURPOSE
1	PE-V0-415-167-A003	GAD OF MISCELLANEOUS TANKS INCLUDING ROOF STRUCTURE AND NOZZLE ORIENTATION - VERTICAL CYLINDRICAL	3	APPROVAL
2	PE-V0-415-167-A008	SUB-VENDOR LIST WITH INSPECTION CATEGORISATION PLAN FOR MISCELLANEOUS TANK	3	APPROVAL
3	PE-V0-415-167-A001	FABRICATION DRAWING OF MISCELLANEOUS TANKS	5	APPROVAL
4	PE-V0-415-167-A007	QAP OF COMPONENTS OF MISCELLANEOUS TANKS	8	APPROVAL
5	PE-V0-415-167-A002	DESIGN CALCULATION OF MISCELLANEOUS TANKS - VERTICAL CYLINDRICAL	3	APPROVAL
6	PE-V0-415-167-A005	DS & GAD OF COMPONENTS OF MISCELLANEOUS TANKS	6	APPROVAL
7	PE-V0-415-167-A010	GAD OF HORIZONTAL MISCELLANEOUS TANKS ALONG WITH DESIGN CALCULATION	3	APPROVAL

NOTE:

1. Drawing / Document shall be uploaded by the successful bidder on WRENCH /DMS. Procedure for the same will be informed after award of contract.
2. Resubmission of drawing/ documents shall be done within 7 days upon receipt of customer/BHEL comments by Bidder.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY _____

DATE: _____

COMPANY SEAL

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6 ANNEXURE-II	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION-1 A	
		REVISION 01	DATE: 21.11.2019
		PAGE 2 of 4	

Other points to be considered while preparing drawings:

- a) Data sheets of various items shall be prepared by the bidder for storage tanks and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.
- b) Drawing, nozzle schedule, design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.
- c) Drawing covering all details shown in data sheets like design data, dimensions, material of construction, list of appurtenances, lists of specifications, details of paints, standards & codes, general notes including details of test to be conducted on tank in accordance with specification and brand-name of welding electrodes to be used etc.
- d) Field quality plan / quality assurance plan / check list shall be prepared by the bidder for storage tanks / each instrument / item and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.
- e) Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test procedure, list of sub-vendors, 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.
- f) 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.
- g) 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.
- h) Any other drawings and documents in addition to the list of drawings and documents indicated in the NIT specification as required by BHEL for the execution of the project shall be furnished by them during detailed engineering stage and no commercial implication shall be entertained by BHEL for the same.
- i) Bidder to note that all the drawings shall be prepared in Auto Cad - 2010 version or later and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 1X660 MW BHUSAWAL TPP UNIT # 6 ANNEXURE-II	SPECIFICATION NO. PE-TS-415-167-A001	
		SECTION-1 A	
		REVISION 01	DATE: 21.11.2019
		PAGE 3 of 4	

Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained.

- j) Bidder to provide AutoCAD copy of drawing / document for review and interfacing with our facilities.
- k) Civil works will be done by BHEL based on civil inputs furnished by the bidder during detail engineering. In case of any changes in the civil input drawing after civil work is completed. Necessary prices on account of modification of the civil work shall be deducted from bidder's account or rectification in civil work to be done by bidder.
- l) Bidder to furnish the civil foundation drawing of the tanks / seal pots / NaOH or KOH breather along with the loading data for approval during detailed engineering stage showing / indicating the followings:-
 - Scope of work by BHEL and bidder shall be indicated with different legend or in the form of note.
 - Recommended locations of earthing pads.
 - Civil loads shall be furnished and the detailed calculation showing weights of roof, bottom, and shell plates, all accessories and nozzles etc.
- m) All drawings and documents 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.: -
 - All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.
 - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view etc. All major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
- n) All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6
ANNEXURE-II**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION-1 A

REVISION 01

DATE: 21.11.2019

PAGE 4 of 4

DRAWING AND DOCUMENTS FOR SUBMISSION

S.N.	Drawings and documents	Soft and Hard Prints
1.0	<i>DRAWING FOR APPROVAL</i>	
1.1	For approval	Soft+2 Hard Print
1.2	For customer approval	Soft+2 Hard Print
1.3	For final distribution	Soft+2 CD +5 Hard Print
2.0	DRAWING FOR REFERENCE	
2.1	For reference	Soft+2 Hard Print
2.2	For final distribution	Soft+2 CD+5 Hard Print
3.0	CERTIFICATE, REPORTS ETC.	Soft+2 Hard Print
4.0	AS BUILT DRAWINGS (IF REQUIRED)	Soft+2 CD+8 Hard Print
5.0	O&M MANUAL	
5.1	Draft for approval	Soft +3 CD+ 5 Hard Print
5.2	For final distribution	Soft +3 CD + 8 Hard Print
6.0	QUALITY PLAN / Field quality plan / PG test	Soft + 2 Hard Print



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

**SUB-SECTION – IB
DATASHEET AND DRAWING OF TANKS**



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11.2019

1) Datasheet of DM Water Storage Tank

S. No	CHARACTERISTICS	DETAILS
1.	No. of tanks & capacity	DM Tank: Two (2) Nos. 1000 cum each
2.	Type of construction	Vertical cylindrical storage tank
2.1	Type of roof	Fixed roof with central column.
3.	Tank Dimensions	DM Tank: 12.0 m dia x 11.0 m ht
4.	Design & construction code	IS803 / API650
5.	Corrosion allowance (CA)	1.5 mm
6.	Min. Plate thickness including CA (in mm)	Bottom – 8, Shell - 8 , Roof- 6
7.	Joint efficiency	0.85
7.1	Radiography	Radiography of tanks shall be done as per clause 8.1.2 to 8.1.8 of API 650
8.	Material of construction for Plates	IS2062 Gr. B
9.	Material of construction for Structures (Angle, Channel, Beam, Bar and Flat)	IS2062 Gr. A / B
10	Handrail	
10.1	Size of pipe	32 NB
10.2	Material	ERW pipe as per IS:1239 (Medium Gr.),Part-I, Galvanized
10.3	Dimension standard	ANSI 36.10, plain ends
11.	Material for Valves, Pipes & fittings	As per DS of valves, Pipes and fittings given below.
12.	Other accessories to be provided with tank	a) Conservation vent valve /NAOH breather (to be placed on ground). (b)Overflow of 150 Nb & drain piping of 100 Nb with drain valve. (c) Seal pot with drain valve etc for overflow (d) Level gauge float & board type to cover entire rang (e)2 nos of nozzle connection of 50 Nb for level transmitters. (f) spare connection of 150 Nb (1 nos.), 100 Nb (1 no.) spare valves shall be provided for spare connections.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11.2019

		(g) Sampling connection with 25 nb valve on tank. (h) 3 nos. instrument connections on tank roof for LI
13.	Width of Plate	Width of the plate can be considered out of these 1250/1500/1800/2000. As per IS803, minimum course width is 1500mm unless agreed otherwise mutually. Due to non-availability of plates at the time of detail engineering, option of course width of 1250mm has been also kept.
14.	Internal Ladder for Tanks:	Spiral staircase along the shell of tanks and two nos. Manhole i.e. one on the tank roof & other one on tank shell shall be provided.

NOTE:

1. ALL OTHER STANDARD TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS APPLICABLE SHALL BE CONSIDERED.

2. ALL THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

1) Datasheet of CST Tank

S. No	CHARACTERISTICS	DETAILS
1.	No. of tanks & capacity	CST: One (1) No. 850 cum.
2.	Type of construction	Vertical cylindrical storage tank
2.1	Type of roof	Fixed roof with central column.
3.	Tank Dimensions	CST : 11.0 m dia x 10.5m ht
4.	Design & construction code	IS803 / API650
5.	Corrosion allowance (CA)	1.5 mm
6.	Min. Plate thickness including CA (in mm)	Bottom – 8, Shell - 8 , Roof- 6
7.	Joint efficiency	0.85
7.1	Radiography	Radiography of tanks shall be done as per clause 8.1.2 to 8.1.8 of API 650
8.	Material of construction for Plates	IS2062 Gr. B
9.	Material of construction for Structures (Angle, Channel, Beam, Bar and Flat)	IS2062 Gr. A / B
10	Handrail	
10.1	Size of pipe	32 NB
10.2	Material	ERW pipe as per IS:1239 (Medium Gr.),Part-I, Galvanized
10.3	Dimension standard	ANSI 36.10, plain ends
11.	Material for Valves, Pipes & fittings	As per DS of valves, Pipes and fittings given below.
12.	Other accessories to be provided with tank	a) Conservation vent valve /NAOH breather (to be placed on ground). (b)Overflow of 150 Nb & drain piping of 100 Nb with drain valve. (c) Seal pot with drain valve etc for overflow (d) Level gauge float & board type to cover entire rang (e)2 nos of nozzle connection of 50 Nb for level transmitters. (f) spare connection of 150 Nb (1 nos.), 200 Nb (01 no.), 100 Nb (1 no.) spare valves shall be provided for spare connections. (g) Sampling connection with 25 nb valve on tank. (h) 3 nos. instrument connections on tank roof for



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

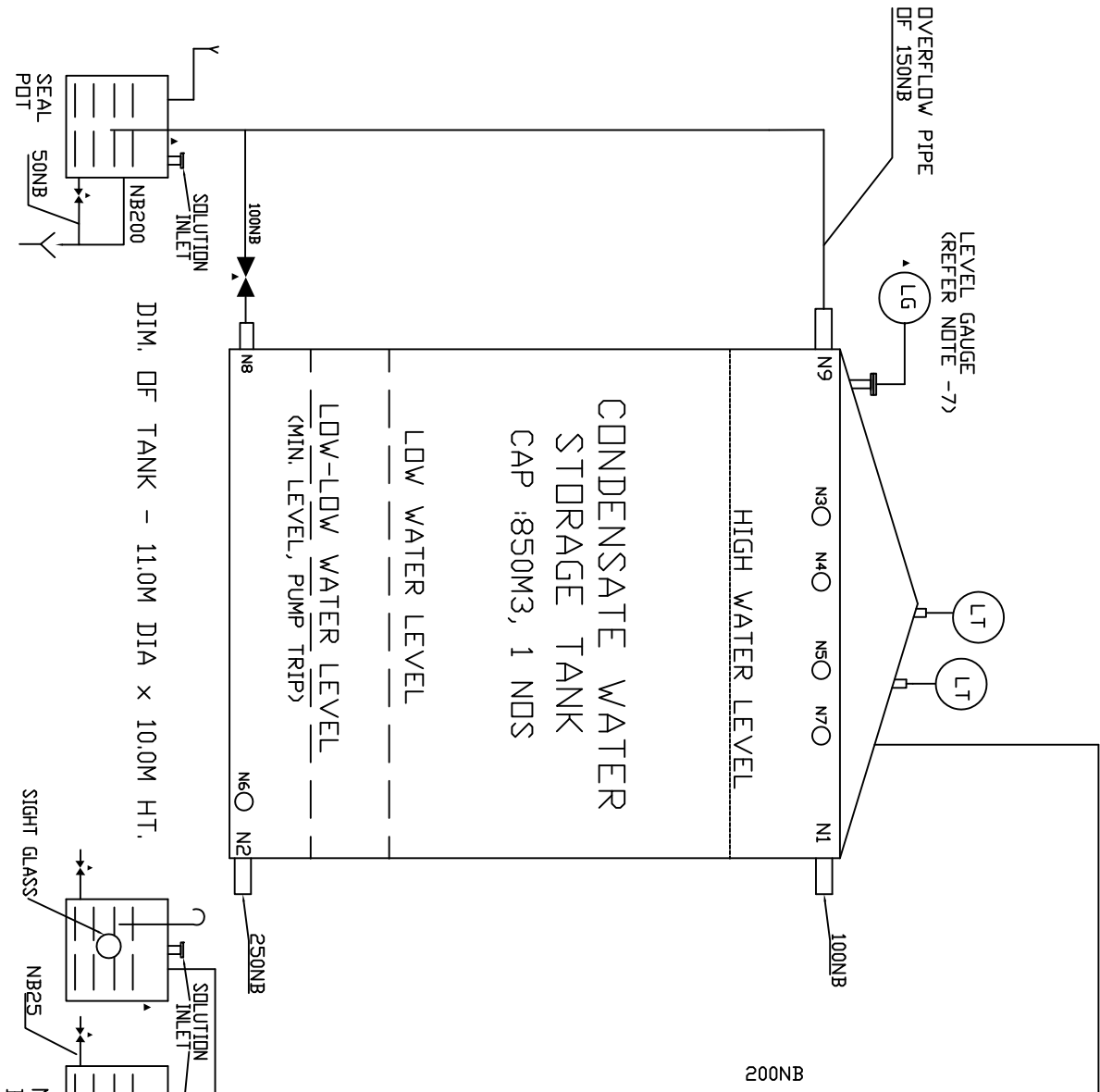
		LI
13.	Width of Plate	Width of the plate can be considered out of these 1250/1500/1800/2000. As per IS803, minimum course width is 1500mm unless agreed otherwise mutually. Due to non-availability of plates at the time of detail engineering, option of course width of 1250mm has been also kept.
14.	Internal Ladder for Tanks:	Spiral staircase along the shell of tanks and two nos. Manhole i.e. one on the tank roof & other one on tank shell shall be provided.

NOTE:

1. ALL OTHER STANDARD TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS APPLICABLE SHALL BE CONSIDERED.

2. ALL THE REQUIREMENTS SHOWN UNDER GA DRAWING ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.

SKETCH FOR CST



NOTES:

- 1.0 - HIGH WATER LEVEL SHALL BE MIN.100MM BELOW BOTTOM OF OVERFLOW NOZZLE.
- 2.0 - ALL NOZZLES (ALONG WITH FLANGES & COUNTER FLANGES), OVERFLOW PIPE, NOZZLE FOR MOUNTING LEVEL INDICATOR, SPARE VALVES SHALL BE SUPPLIED BY TANK VENDOR.
- 3.0 - TRANSMITTER SHOWN ARE EXCLUDED FROM TANK VENDOR SCOPE. THESE SHALL BE SUPPLIED SEPARATELY UNDER INSTRUMENTATION PACKAGE. 80NB NOZZLE ON TOP OF THE TANK SHALL BE PROVIDED BY TANK VENDOR FOR MOUNTING OF LTS.
- 4.0 - ▲-ITEMS THUS MARKED ARE TO BE SUPPLIED ALONG WITH TANK.
- 5.0 - LOCATION OF THE TANK IS OUTDOOR.
- 6.0 - THE NET CAPACITY OF TANK IE 850 CUM IS CAPACITY BETWEEN LOW AND HIGH LEVEL SHOWN IN THIS SKETCH.
- 7.0 - FLUAT & BOARD TYPE LEVEL GAUGE SHALL BE PROVIDED.
- 8.0 - INLET SPARE CONNECTIONS SHALL BE PROVIDED WITH BLIND FLANGE. SPARE VALVES SHALL BE PROVIDED AT SPARE OUTLET CONNECTIONS.
- 9.0 - A CIRCUMFERENTIAL DRAIN SHALL BE PROVIDED AROUND THE DM WATER TANK FOR TERMINATING THE TANK, SEAL POT & NaOH BREATHER DRAINS. THE CIRCUMFERENTIAL DRAIN SHALL THEN BE CONNECTED TO NEARBY PLANT DRAIN BY CIVIL AGENCY.
- 10.0 - SIZE OF TWO(2) NDS MANHOLES, ONE ON SHELL & OTHER ON RDDF ARE 600MM DIA.

NOZZLE NO.	DESCRIPTION	SIZE (NB)
N1	DM WATER INLET	100
N2	COND. OUTLET	250
N3	RECIRCULATION	60
N4	RECIRCULATION	80
N5	EXCESS DUMP	200
N6	SPARE	200
N7	SPARE	150
N8	DRAIN	100
N9	OVERFLOW	150



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11.2019

1) Datasheet of Service water storage Tank

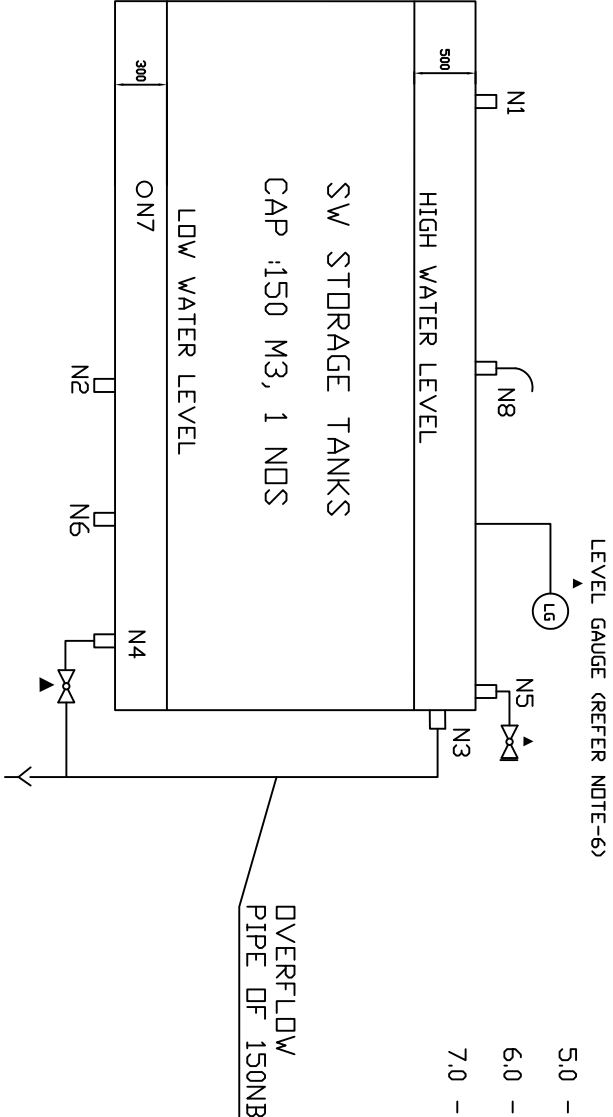
S. No	CHARACTERISTICS	DETAILS
1.	No. of tank & capacity	One (1) No. 150 cum.
2.	Type of construction	Horizontal cylindrical storage tank with flat ends
2.1	Type of support	Saddle support.
3.	Tank Dimensions	4.0 m dia x 14.0 m long
4.	Design & construction code	IS 2825 / BS 2594
5.	Corrosion allowance (CA)	1.5 mm
6.	Min. Plate thickness including CA (in mm)	Shell - 12 , End- 40
7.	Joint efficiency	0.85 (Spot Radiography)
8.	Material of construction for Plates	IS2062 Gr. B
9.	Material of construction for Structures (Angle, Channel, Beam, Bar and Flat)	IS2062 Gr. A / B
10	Handrail	
10.1	Size of pipe	32 NB
10.2	Material	ERW pipe as per IS:1239 (Medium Gr.),Part-I, Galvanized
10.3	Dimension standard	ANSI 36.10, plain ends
11.	Width of Plate	Width of the plate can be considered out of these 1250/1500/1800/2000.
12.	Manhole for Tanks:	One (1) no on at top of shell shall be provided.

NOTE:

1. ALL OTHER STANDARD TECHNICAL REQUIREMENTS / ACCESSORIES & SPARES AS APPLICABLE SHALL BE CONSIDERED.

2.ALL THE REQUIREMENTS SHOWN UNDER SKETCH ARE BARE MINIMUM, ANY OTHER ITEM FOUND APPLICABLE DURING DETAILED ENGINEERING AS PER TECHNICAL SPECIFICATION/ FUNCTIONAL REQUIREMENT SHALL BE SUPPLIED BY BIDDER WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.

SKETCH FOR SERVICE WATER TANK



- NOTES:
- 1.0 - HIGH WATER LEVEL SHALL BE MIN.150MM BELOW BOTTOM OF OVERFLOW NOZZLE.
 - 2.0 - ALL NOZZLES (ALONG WITH FLANGES & COUNTER FLANGES), OVERFLOW PIPE, NOZZLE FOR MOUNTING
 - LEVEL INDICATOR, STANDPIPE AND PIPING FOR SPARE VALVES SHALL BE SUPPLIED BY TANK VENDOR.
 - 3.0 - VOID
 - 4.0 - -ITEMS THUS MARKED ARE TO BE SUPPLIED ALONG WITH TANK.
 - 5.0 - LOCATION OF THE TANK IS AT EL(+>38.0M FLOOR
 - 6.0 - LEVEL OF BC BAY OF POWER HOUSE BUILDING. FLOOD AND ARROW TYPE MECHANICAL LEVEL INDICATOR SHALL BE PROVIDED.
 - 7.0 - ALL THE VALVES SHALL BE PROVIDED WITH PROPER ACCESS FOR OPERATION.

DIM. OF TANK - 4.0M DIA × 14.0M LENGTH (FLAT ENDS)

NOZZLE NO.	DESCRIPTION	SIZE (NB)
N1	SW INLET	100
N2	SW OUTLET	100
N3	OVERFLOW	150
N4	DRAIN	80
N5	SPARE INLET (WITH VALVE)	100
N6	SPARE OUTLET (WITH VALVE)	100
N7	SAMPLING CONNEC. WITH VALVE	50
N8	VENT WITH MESH	80



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

1) Datasheet of Float and Board type Level Indicator

S.NO.	COMPONENT	DESCRIPTION
1	Type	Float and Arrow
2	Float Material	SS 316
3	Float Cable	SS-316
4	Indicator Assembly	Epoxy Painted Aluminum
5	Guide wire Spring assembly	SS-316 (2 nos.)
16	Guide wire Anchor	SS-316 Anodized Aluminum with engraved marking (Minimum graduation 10mm)
7	Scale Board	Mounting brackets and suitable hardware required as per tank height
8	Elbow Assembly	Anodized Aluminum
9	Flanges	RF, ANSI 150, SS (3 nos.)
10	Accuracy	± 10 mm or better
11	Accessories	All the mounting accessories including counter flange, nuts & bolts, suitable gasket as applicable.
12	Quantity	One (1) No. per tank

2) Datasheet of Pipes, Fittings, Flanges & Accessories

S.No.	Description	Material Standard	Dimensional Standard
1.0	SS Pipes		
1.1	40 NB and below	Stainless steel pipe as per ASTM A-312, Gr. 304 , Seamless, Sch. 40S	As per ANSI B-36.19, socket welded
1.2	50 NB and above	Stainless steel pipe as per ASTM A-312, Gr. TP-304, Seamless /ERW, Sch.10S	As per ANSI B-36.19, BW ends as per ANSI B16.25
2.0	SS Fittings(Elbow, Tees & Reducers)		
2.1	40 NB and below	Forged Stainless steel as per ASTM A-182, F-304	ANSI B 16.11, S/W ends
2.2	50 NB and above	Stainless Steel as per ASTM A-351, CF8	ANSI B 16.9, B/W ends
3.0	SS Flanges		
3.1	For SS Pipes up to 40 NB	ASTM A182 F304	ANSI B16.5, RF slip-on.
3.2	For SS Pipes above 40 NB	ASTM A403 Gr. 304	ANSI B16.5, FF lap joint.
4.0	Gasket for SS fittings		
4.1	Up to 50NB	SS jacketed CAF with superior oil / resistance	ANSI B 16.21
4.2	Above 50NB	PTFE (TEFLON)	ANSI B 16.21
5.0	Bolts & Nuts		
5.1	Wherever applicable in all the tanks.	ASTM A-193, Gr. B7 for Bolts ASTM A-194, Gr. 2H for Nuts	ASTM A-193 / A-194



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

3) Datasheet of Valves

S.NO.	COMPONENT	DESCRIPTION
1.	Body & Bonnet	ASTM A182 Gr.F304 (40NB & below) ASTM A351 Gr.CF8M (50NB & above)
2.	Wedge & Seat ring	ASTM A182 Gr.F304 (40NB & below) ASTM A351 Gr.CF8M (50NB & above)
3.	Trim	ASTM A182 Gr F304
4.	Rating	Class 800 (40NB & below) Class 150 (50NB & above)
5.	Ends	SW to B16.11 (40NB &below) Flanged to B16.5 (50NB & above)
6.	Design Standards	B16.34 / API600 for Gate valve B16.34 / BS1873 for Globe valve
7.	Testing standards	API 598 for all valve (All sizes)
8.	Bolts & Nuts	A193 Grb7 & A194 Gr.2H



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION I, SUB-SECTION – IB

REVISION 01

DATE: 21.11..2019

1) PAINTING SPECIFICATION

PAINTING SPECIFICATION FOR MISCELLANEOUS TANKS

Coat Description	Tank Internal	Tank External, Structural steel works, stairways & other accessories	Tank Underneath
Surface Preparation (As per SSPC, Vis 1 or DIN 55928, Section-4 or SIS 055900)	SA 2.5	Wire Brushing/ hand tool cleaning to ST-2.	Wire Brushing/ hand tool cleaning to ST-2.
Primer	One (1) coat of epoxy primer containing high level of Zinc Phosphate Anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.	One (1) coat (minimum DFT of 100 microns) of Synthetic red lead primer.	Three (3) coats of high build coal tar epoxy suitably pigmented (2 pack), DFT: 80 – 100 microns each coat.
Intermediate coat	N. A.	N.A.	N. A.
Finish	Three (3) coats coal tar Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.	One (1) coat (minimum DFT of 75 microns) of synthetic enamel paint of approved shade and color with glossy finish.	N. A.
Total DFT	500 microns	300 microns	240-300 microns
However, same shall be finalized during detailed Engineering with minor modification or Vice versa.			



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION II

REVISION 01

DATE: 21.11..2019

SECTION – II

STANDARD TECHNICAL SPECIFICATION

SUB-SECTION IIA – Standard Technical Requirement (Mechanical)

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 1 of 9	

1.0 **SCOPE**

This specification covers design, engineering, supply of material, fabrication, assembly, inspection and testing at shop as well as at site, erection and commissioning, painting and functional demonstration testing at site.

2.0 **CODES & STANDARDS**

The design, fabrication & assembly, erection & performance of steel tanks shall comply with all latest statutory regulations and safety codes applicable in the locality where the tanks are to be installed. Tanks shall conform to the latest applicable Indian / British / USA standards. The vendor shall not be construed to be relieved of his responsibility by virtue of this specification. The tank in general shall conform to the latest editions, as applicable, out of the following standards.

1. IS-800 Code of practice for use of steel in general building construction
2. IS-803 Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.
3. IS-804 Specification for rectangular pressed steel tanks
4. IS-805 Code of practice for use of steel in gravity water tank.
5. IS-816 Code of practice for metal arc welding for general construction in MS.
6. IS-817 Code of practice for training and testing for metal arc welder
7. IS-2825 Code of practice for unfired pressure vessel
8. BS-2594 Specification for carbon steel welded horizontal cylindrical storage tank
9. BS-2654 Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry
12. Indian Factories Act
13. American code for oil tanks API 650
14. Material Specification as per relevant IS / or approved equal
15. American water works association standards (AWWA D100)

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 2 of 9	

3.0	<u>DESIGN REQUIREMENT</u>
3.1	<u>General Requirement</u>
3.1.1	All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid which these tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain. The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.
3.1.2	Tank thickness shall be calculated as per IS803 latest edition. Intermediary wind girder design, Wind Design, Seismic design, anchor bolt design / selection etc. shall be done as per API 650 latest edition, latest addendum available at the time of detail engineering.
3.1.3	All tanks will be designed for the capacities, dimensions and working conditions as specified in DATA SHEET for DM & Condensate Storage Tank . These tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. A 2.0 mm corrosion allowance for shells, bottom and roofs above and beyond the required thickness / calculated thickness / nominal thickness as specified in the design code shall be provided.
3.1.4	Vessel seams shall be so positioned that they do not pass through nozzle connections on vessel. For vessels consisting of more than two sections, longitudinal seams shall be offset.
3.1.5	The inside seam should be ground smooth, suitable for application of corrosion resistant primer. If the stiffening of shell, bottom and / or roof is necessary, tanks will be stiffened from outside.
3.1.6	Flange faces of all nozzles shall be machined and squared with the vessel center line.
3.1.7	All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m ² of projected area.
3.1.8	The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.
3.1.9	When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface. The plate shall not be gouged or torn in process of removing lugs.
3.1.10	In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.
3.1.11	Material of construction of all tanks shall be mild steel conforms to IS – 2062 grade – B unless otherwise specified in the DATA SHEET for DM & Condensate Storage Tank .

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 3 of 9	

3.1.10

Alignment

3.1.10.1

Plates to be joined by butt-welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whichever is larger.

3.1.10.2

In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate thickness exceeding 8 mm except that for plate thickness 8 mm and under, the maximum shall be 1.5 mm.

3.1.10.3

Each tank shall be properly constructed ensuring perfect vertical alignment with 5 mm or as specified in the relevant code / standard and tank circularity within 5 mm on diameter or as specified in the relevant code / standard. Local bulging and / or depressions at any location of tank particularly shell shall not be permitted.

3.1.11

WELDING

3.1.11.1

Tanks and other attachments shall be welded as per IS-816.

3.1.11.2

Welding sequence shall be so adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be submitted for approval of BHEL giving details of material, welding position, sequence, type of electrode used, pre-heat & post weld requirement etc as per the code of construction. Brand name of electrodes to be used with proper classification (e.g. E 6013) shall be as per BHEL’s approval.

3.1.11.3

Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.

3.1.11.4

Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets, bolts, nuts etc shall be conforming to relevant standards of repute and approved by the purchaser prior to use.

3.1.12

Each tank shall be complete with access staircase, ladder and safety cage and fittings like drain connection, overflow connection, tank inlet and outlet covers, level gauge glass, fittings with isolation cocks and protection covers, tank vent connection etc all complete with needed accessories for the completeness of the tanks and as specified in **DATA SHEET for DM & Condensate Storage Tank**.

3.1.13

All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.

3.1.14

STAIRCASE / ACCESS LADDER AND HAND RAILING

3.1.14.1

All cylindrical vertical tanks shall be provided with spiral staircase and shall conform to the requirements specified in design codes / standards unless specified otherwise. All stair treads shall be 32 mm steel fabricated gratings or 8mm thk. chequered plate which will be decided during detail engineering stage. Each tread, if needed, shall be housed in individual

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 4 of 9	

steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall have minimum 800 mm clear width.

3.1.14.2 Access ladder, one (1) for each horizontal cylindrical / rectangular tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm diameter rods spaced at not more than 30 mm center to center. All ladders shall have steel fabricated safety cage to the approved construction. Safety cage shall be provided about 2.5 m clear height of the ladder. Access ladder's stringers shall be widely spaced at top for free access to the tank roof.

3.1.14.3 All staircase and roofs of vertical cylindrical tanks shall be provided with pipe hand railings of effective height as indicated in the relevant code / standard throughout. Handrails shall be constructed out of 32 mm medium class galvanized steel pipe conforming to IS- 1239: 1968. Handrail posts shall be arranged at spacing not greater than 1850 mm. Two (2) sets of pipes horizontal runners all along the length shall be provided. All welds joints in the handrails shall be ground flush to protect any person getting injured. Steel toe plates of 100 mm flats shall be used. Hand railing shall be fabricated and installed in an approved manner as directed by purchaser in accordance with approved drawings.

3.1.15 Unless otherwise specified, for all flanged connections, vendor shall furnish suitable counter flanges and necessary nuts, bolts and gaskets materials.

3.1.16 Unless otherwise specified, bolts and nuts shall be hexagonal head conforming to bolts and nuts shall be SA 193 & 194 respectively.

3.1.17 Gaskets shall be 3 mm thick full-face rubber or CAF. On completion of hydraulic test / water fill test, contractor shall replace the gaskets used during testing at his own cost.

3.1.18 Float level indicators other than float and arrow type level indicator, gauge glass shall be provided.

3.1.19 During erection of tank, shell plates shall be suitably supported both for outside and inside to avoid buckling / collapsing of tank due to high-speed wind, gust or severe storm, if any, occurring during erection.

3.2 **VERTICAL CYLINDRICAL STORAGE TANKS**

3.2.1 The vertical cylindrical storage (non- pressure) tanks shall be of mild steel welded construction and shall be designed in accordance with codes and standards as specified in the **DATA SHEET for Condensate Storage Tank**. The vertical cylindrical storage tanks shall have slightly sloping bottom towards an adequately sized sump inside the tank to enable complete draining of the tank. The tank shall be designed for a wind pressure and seismic coefficient as specified.

3.2.2 Conical roof shall be either self-supported or supporting. The roof shall have a slope as specified in the relevant design code to ensure drainage of rainwater. Needed roof rafters and purlins adequately designed shall be provided.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 5 of 9	
3.2.3	All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.		
3.2.4	All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.		
3.2.5	All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non-injurious methods.		
3.2.6	Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all vertical joints be staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 8 mm.		
3.2.7	The tank height shall be completed by the provision of top curb/ angle which shall be butt-welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.		
3.2.8	Tank roof shall be either self-supported or supported over rafters / steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding bolted connections at one end and preferably on the tank periphery side. The roof-supporting frame shall have needed tie rods or bracing sets.		
3.2.9	Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.		
3.2.10	Openings needed for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall be bolted and hinged covers unless otherwise specified.		
3.2.11	All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.		
3.3.0	<u>RECTANGULAR TANKS</u>		
3.3.1	Rectangular tanks shall be fabricated in steel material and shall be designed to withstand internal hydrostatic pressure. In addition these shall be checked for a wind pressure and seismic coefficient as specified wherever applicable. While worst of these two shall be considered, the permissible stress shall be increased as per good engineering practice when their effect considered with tank load.		

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 6 of 9	
3.3.2	Tank bottom and / or side plates shall be of minimum 8 mm thick plate. Corrosion margin of at least 2 mm shall be provided over the design thickness of bottom and / or side plates.		
3.3.3	To support tank plates and to maintain required unsupported plate length, adequately sized and spaced steel structural closed frame shall be provided inside the tank. Longitudinal and / or vertical structural members to connect and adequately support these frames shall be provided at corners. Horizontal diagonal members / sway bracings at corner shall also be provided.		
3.3.4	Tank plates cut to size shall be welded on these frames. Plate butt weld joints at other locations shall be eliminated to avoid warping of the plates at free joints. Adequate openings in the structural frames, particularly at the bottom shall be provided to ensure complete unrestricted drainage of tank at one point. Suitable sized drain valve of size minimum 25 NB unless otherwise specified in the DATA SHEET for DM & Condensate Storage Tank shall be provided below the tank bottom for proper draining of the tank.		
3.3.5	Complete assembled tank shall have at its bottom longitudinal steel fabricated bearer beams welded to it. The tank with bearer will rest over number of concrete blocks to be provided by purchaser. The tank shall be adequately bolted / welded to the concrete blocks. Needed inserts / anchor bolts shall be furnished by the bidders. Grouting of tank over concrete blocks in approved manner shall be included in bidder's scope of work, if erection is also awarded to the bidder.		
3.3.6	Where rectangular tanks are flushed in dual compartments the inside partition plate shall be well reinforced to withstand hydrostatic test pressure completely on one side throughout the full height.		
3.3.7	The rectangular tank shall be designed as per good engineering practice and reference shall be taken from the book named "Theory of plates and shells" by Timoshenko. Design calculation shall be done in accordance with the above mentioned book.		
3.3.8	Suitable steel structural e.g. channels shall be provided below the bottom plate so that tank can rest on the foundation / slabs through the structural supports.		
3.4	<u>HORIZONTAL CYLINDRICAL TANK</u>		
3.4.1	The horizontal cylindrical tank with dished ends shall be of mild steel welded construction and shall be designed in accordance with BS – 2594 / IS – 2825 / ASME as specified in the DATA SHEET for DM & Condensate Storage Tank . The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be considered, the permissible stress shall be increased as per relevant code / standard.		
3.4.2	The shell and dished end plate thickness shall be chosen as per design requirement but in no case the dished end and shell plate thickness shall be less than 8 mm.		
3.4.3	All seams, longitudinal as well as circumferential, shall be butt-welded. Longitudinal seams should not be situated in the lower third of a tank or on the top center line.		

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 7 of 9	

- 3.4.4 All tank shall be supplied with integral saddle support and shall be designed in accordance with BS- 2594 / IS – 2825 / ASME as specified in the **DATA SHEET for DM & Condensate Storage Tank.**

4.0 **TESTING AND INSPECTION AT MANUFACTURER'S WORKS**

4.1 **General**

- 4.1.1 The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.

- 4.1.2 All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out the necessary tests required by codes at his own cost.

- 4.1.3 Alloy cast iron and cast steel components shall be tested for both physical and chemical properties in absence of purchaser's representatives. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.

- 4.1.4 All materials including valves, instruments, pipings, flanges, counter flanges etc. shall be procured from BHEL approved manufacturer's only. Dealers are not acceptable.

4.2 **TESTING AND INSPECTION FOR TANKS**

- 4.2.1 The scope of testing and inspection for pressure vessel covered in this specification shall generally comprise of the following:

- i) Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.
- ii) Examination of materials of construction and identification with material test certificates.
- iii) All the plates of thickness 50 mm or more shall be ultrasonically tested to ensure freedom from laminations.
- iv) Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.
- v) Inspection of dished end flanges and alloy steel bolting where required.
- vi) Inspection during fabrication at appropriate stages including fit ups.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 8 of 9	

vii)

For all butt welds, the root run and final run shall be subjected to dye-penetrant or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye-penetrant / magnetic particle examination.

viii)

Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatment procedure as required by codes and specifications.

ix)

Examination of internal cleanliness before final closure.

x)

Dimensional examination of completed vessel including axis marking, proof marking, match marking etc.

xi)

Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification. In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.

xii)

Witnessing cleanliness, preservation, packing and marking.

xiii)

Stamping of vessel and issue of certificates.

xiv)

All tanks under this specification shall be tested as per the relevant design and testing code / standard. Supplier shall submit the detailed testing procedure for the tanks during detail engineering stage for BHEL / customer / consultant's approval and approved document shall be adhered by them and testing shall be done accordingly without any commercial implication.

4.2.2

NON - PRESSURE TANKS

The scope of testing and inspection for non-pressure tanks covered in this specification will comprise of the following:

i)

Identification of materials to manufacturer's test certificates.

ii)

Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling.

iii)

Checking of dimension and match marking.

iv)

Bottom testing

a.

After the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

b.

Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of purchaser.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. PE-TS-417-167-A001	
			SECTION IIA
		REVISION 00	DATE: 29.03.2018
		PAGE 9 of 9	

c.

Alternatively, the bottom seams may be tested by vacuum box method subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS- 803, 1976 (figure-24)

v)

Shell testing

The shell of fixed roof non - pressure tanks shall be tested after completion of roof. Testing shall be done by filling the tank with water to the level of the top leg of the top curb angle and noting any leaks.

vi)

Roof testing

The roof of the tank shall be tested by pumping air under the roof plates while the tank is still full of water. In the non - pressure tank, the roof shall be tested to a pressure of 75 mm of water gauge and in case of pressure roof tanks, to a pressure of one and a quarter times the pressure at which the pressure sides of the pressure / vacuum relief valve is designed to open. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

vii)

All field-testing shall be performed prior to any painting or coating application.

4.3

REPAIR OF LEAKS

4.3.1

All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

4.3.2

In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity, the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

4.3.3

In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only welding and if necessary, after first cutting out the defective part.

4.3.4

When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

4.3.5

No welding shall be done on any tank unless all lines connecting thereto have been completely blanked off. No repairs shall attempted on tanks while filled with oil, nor any tanks which have contained oil until the tanks have been emptied, cleaned and freed from gas in a safe manner. No repair shall be attempted by the on a tank which has contained oil except in a manner approved in writing by the purchaser, and in absence of the purchaser’s inspector.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION II

REVISION 01

DATE: 21.11.2019

SECTION – II

SUB-SECTION IIB

SITE STORAGE AND PRESERVATION GUIDELINES

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



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

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

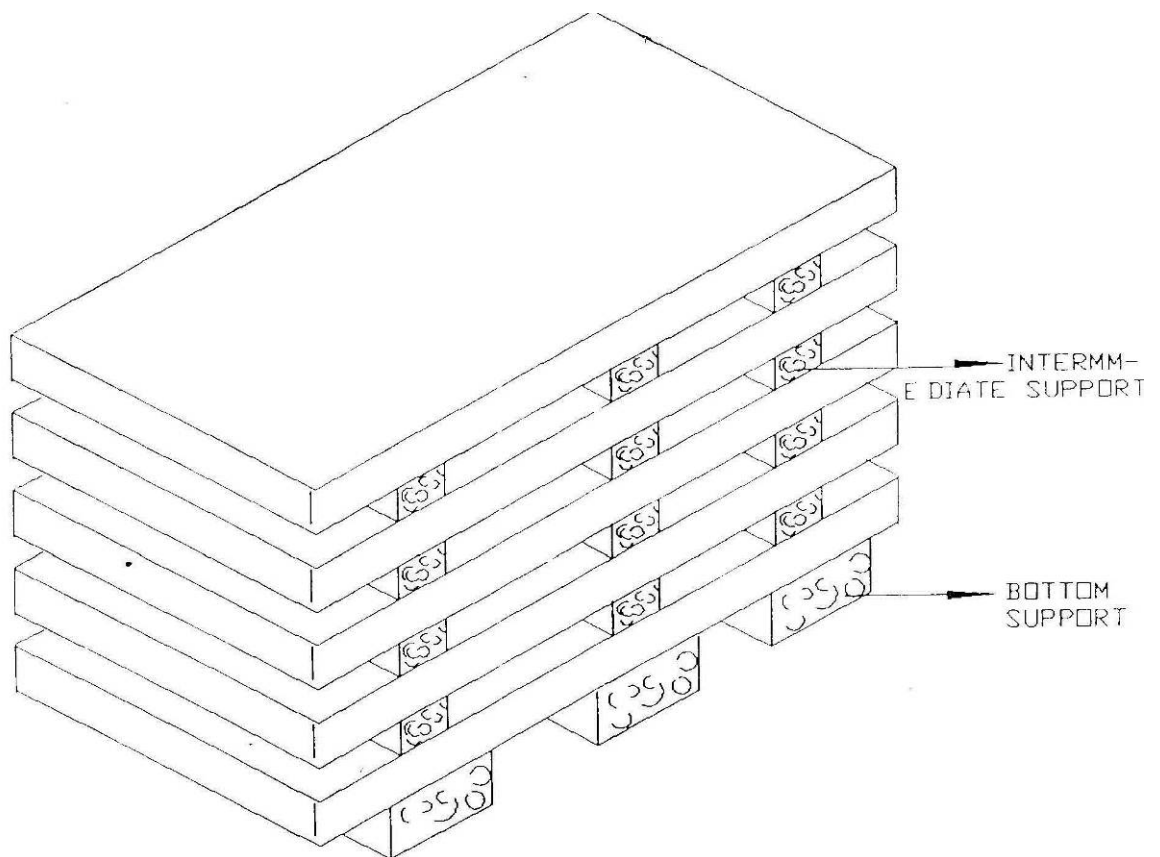


Figure – 1 – PLATE STACKING ARRANGEMENT

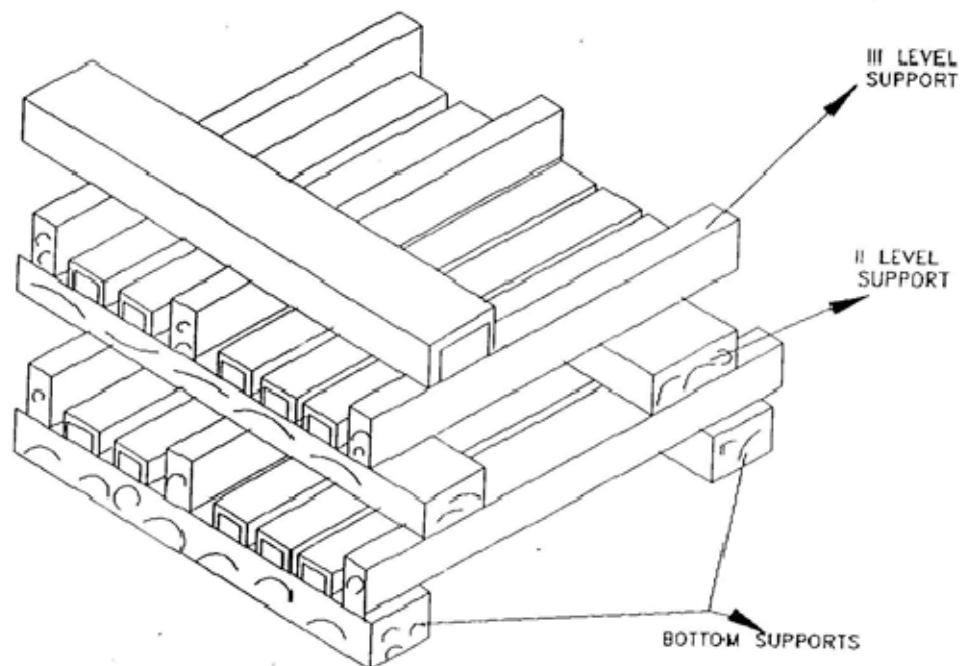


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION II

REVISION 01

DATE: 21.11..2019

SECTION – II

SUB-SECTION IIC

FORMAT FOR OPERATION AND MANITENANCE

Format for Operation & Maintenance Manual

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION III

REVISION 01

DATE: 21.11..2019

SECTION-III

LIST OF DOCUMENTS TO BE SUBMITTED BY BIDDER



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION III; SUB-SECTION III A

REVISION 01

DATE: 21.11.2019

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID:

Bidder shall submit signed and stamped copy of the following drawings / documents along with their Bid:

a) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation.

Or

No deviation certificate.

b) Copy of pre-bid clarifications (if any).

c) Compliance cum Confirmation Certificate.

d) Un priced copy of price format indicating **quoted/ not quoted** against each row/column along with cost of withdrawal / price implication format for deviations.

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT/S OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.



**TECHNICAL SPECIFICATION FOR
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1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION III, SUB-SECTION: IIIB

REVISION 01

DATE: 21.11.2019

SECTION – III

SUB-SECTION IIIB

COMPLIANCE CUM CONFIRMATION CERTIFICATE



TITLE:
TECHNICAL SPECIFICATION – MISC TANKS
1X660 MW BHUSAWAL TPP UNIT 6
COMPLIANCE CUM CONFIRMATION
CERTIFICATE

SPEC. NO.: PE-TS-415-167-A001

SECTION: III, SUB-SECTION IIIB

REV. NO. 01 DATE: 21.11.2019

SHEET 1 OF 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment as applicable, shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



TITLE:
TECHNICAL SPECIFICATION – MISC TANKS
1X660 MW BHUSAWAL TPP UNIT 6
COMPLIANCE CUM CONFIRMATION
CERTIFICATE

SPEC. NO.: PE-TS-415-167-A001

SECTION: III, SUB-SECTION IIIB

REV. NO. 01 DATE: 21.11.2019

SHEET 2 OF 2

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION III, SUB-SECTION: IIIC

REVISION 01

DATE: 21.11.2019

SECTION – III

SUB-SECTION IIIC

PRE-BID CLARIFICATION SCHEDULE



TITLE

TECHNICAL SPECIFICATION FOR MISC TANKS**1X660 MW BHUSAWAL TPP UNIT 6**

SPECIFICATION NO. PE-TS-415 -167-A001

SECTION III, SUB-SECTION IIIC

REV 01

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL



**TECHNICAL SPECIFICATION FOR
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1X660 MW BHUSAWAL TPP UNIT # 6**

SPECIFICATION NO. PE-TS-415-167-A001

SECTION III, SUB-SECTION: IIID

REVISION 01

DATE: 21.11..2019

**SECTION – III
SUB-SECTION IIID
SCHEDULE OF TECHNICAL DEVIATION**

DEVIATION SHEET (COST OF WITHDRAWAL)**PROJECT:- 1X660 MW BHUSAWAL TPP UNIT 6****PACKAGE:- MISC TANKS****TENDER ENQUIRY REFERENCE:-****NAME OF VENDOR:-**

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.