

2X660 MW MOUDA STPP-II

VOLUME: II B & III

**TECHNICAL SPECIFICATIONS
FOR
CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-387-155A-A001



BHARAT HEAVY ELECTRICALS LIMITED

**POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**



**TITLE: TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT
2X660 MW MOUDA STPP STAGE II**

SPEC. NO. PE-TS-387-155A-A001

VOLUME

SECTION

REV. NO. 0

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SECTION – A

SCOPE OF ENQUIRY

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1.0 SCOPE OF ENQUIRY

- 1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at manufacturer's works, delivery at site including start up and commissioning spares properly packed for transportation, unloading / handling and storage at site, assembly, erection and commissioning, preparation and submission of "As Built" drawings, carrying out performance guarantee tests at site and handover of Condensate Polishing Units and external regeneration system for the 2 X 660 MW MAUDA STTP STAGE II.
- 1.2 The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.
- 1.3 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.
- 1.4 It is not the intent to specify all the details of the design & manufacture. However, the equipment shall conform in all respect to high standard of design, engineering & workmanship and shall be capable of performing the required duties in a manner acceptable to BHEL / NTPC, who will interpret the meaning of drawing & the specification & shall be entitled to reject any work or material, which is not in full accordance herewith.
- 1.5 In case of any Deviation, the Bidder shall indicate the same clause by clause in the deviation schedule. In the absence of the same it will be construed that the bid conform strictly to the specification.
- 1.6 General terms & conditions, instructions to the bidder and other attachments referred to elsewhere, shall be made part of tender specification. The bidder shall be responsible for all governed by requirements stipulated hereinafter.
- 1.7 In case of any data/requirement stipulated in the drawings but not in the specification and vice-versa, such data /requirement shall be deemed to be contained in the both.
- 1.8 In the event of any conflict between the various sections of the specification, bidder shall bring the same to the attention of the BHEL during bid clarification stage before award of contract. Else BHEL / NTPC interpretation shall be followed without any commercial & delivery implication to BHEL / customer after award of contract.
- 1.9 In case the bidder fails to fulfill the requirements specified in clause numbers 1.6 and 1.7, the final verdict on such cases shall rest with the BHEL/NTPC and same shall be binding on the bidder without any technical/commercial/delivery implications to the BHEL/NTPC.
- 1.10 Bidder to note that the terms "Owner", "Customer" or "End-user" used anywhere in this technical specification essentially means the end-user of the project or his assigned consultant.
- 1.11 The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/NTPC.
- 1.12 BHEL's / Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him
- 1.13 The omission of specific reference to any component/accessory necessary for the proper performance of Condensate Polishing Units shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.

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SECTION – B

PROJECT INFORMATION

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1.0 BACKGROUND

Mauda STTP Stage-I comprising of two units of 500 MW each is presently under implementation. Now in view the huge power generation capacity requirement and future capacity addition plans, it is proposed to enhanced capacity of Mauda STTP. The Present proposal is to install additional two units of 660 MW in Stage-II this making the ultimate capacity of the project to 2320 MW.

2.0 LOCATION AND APPROACH

The plant site is located in Mauda Tehsil, district Nagpur of Maharashtra Stage, having latitude and longitude of 20°10'50" N and 79°23'52" E respectively. The site is bounded by villages Kumbhari on North, Lapka & Mauda on south, Koradi on East & Rahli on West and is at a distance of about 4 kms. From Mauda town and approachable form NH-6. Nearest railway station is Chacker 8 Kms away from site on Nagpur – Kolkata Broad Gauge (BG) section of south Eastern Railway (main line). The nearest commercial airport is at Nagpur Located at a distance of approximately 42 Kms form the project site.

Vicinity Plan is enclosed.

3.0 LAND

For Stage –I of Mauda project, about 1580 acres of land required for the project is acquired/under acquisition.

About 125 acres of additional land for plant and 50 acres for Township required. The same has been identified contiguous to existing plant and township areas. The township is to be located in North West of the plant area and on Mauda – Ramtek road, 6 Kms away from Mauda town. No major problem anticipated in acquisition as per site visit and discussions with State Govt. officials.

About 550 acres of land is required for ash disposal. Alternatives suggested by Mauda site visited on 09.07.09 and the land near Kirnapur & Kpra villages have been finalized. In principle land availability for Mauda Stage-II has been obtained from Office of the Collector, Nagpur vide letter ref. no. Desk-17/Resettlement/T-1/w.s. 323/09 dated 27.08.09

Bidder may visit the site and acquaint themselves with the facilities available.


4.0 WATER

Make up water requirement for Stage-II of this project would be about 4800 m³/hr. Water requirement for the project will be met form pondage created on river wain Ganga/ Kanhan by construction of dam near Goshikhurd by Govt. of Maharashtra. Make-up water shall be drawn from above mentioned source and shall be pumped to the raw water reservoir located about 24 Kms from intakes well.

Maharashtra Government has approved the reservation of 100 MCM water including the evaporation losses for NTPC in Goshikhurd Project for the ultimate stage of the project (Stage-1 2x500 MW) + Stage-II (2x660 MW). Ministry of Industries, /energy and a Labour Department, Government of Maharashtra vide letter dated 10.12.2002 has given in principle consent for making available the required water for Mauda project.

5.0 RAILWAY SIDING

Customer intends to construct the railway siding to project site from the nearest existing railway line. However the same may not be available to BHEL for his use to transport equipment and material.

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6.0 COAL AVAILABILITY AND TRANSPORTATION

7.0 COAL AVAILABILITY

Raw coal is proposed as fuel. The annual coal requirement would be about of 7.5 MTPA for 2x660MW of Mauda STTP Stage-II.

Likely coal source for the expansion project is similar to Mauda TPP Stage-I. The matter has been taken up with Ministry of Coal, Govt. of India for Long Term Coal Linkage.

8.0 COAL TRANSPORTATION

Coal is proposed to be transported through Indian Railway network.

9.0 CAPACITY

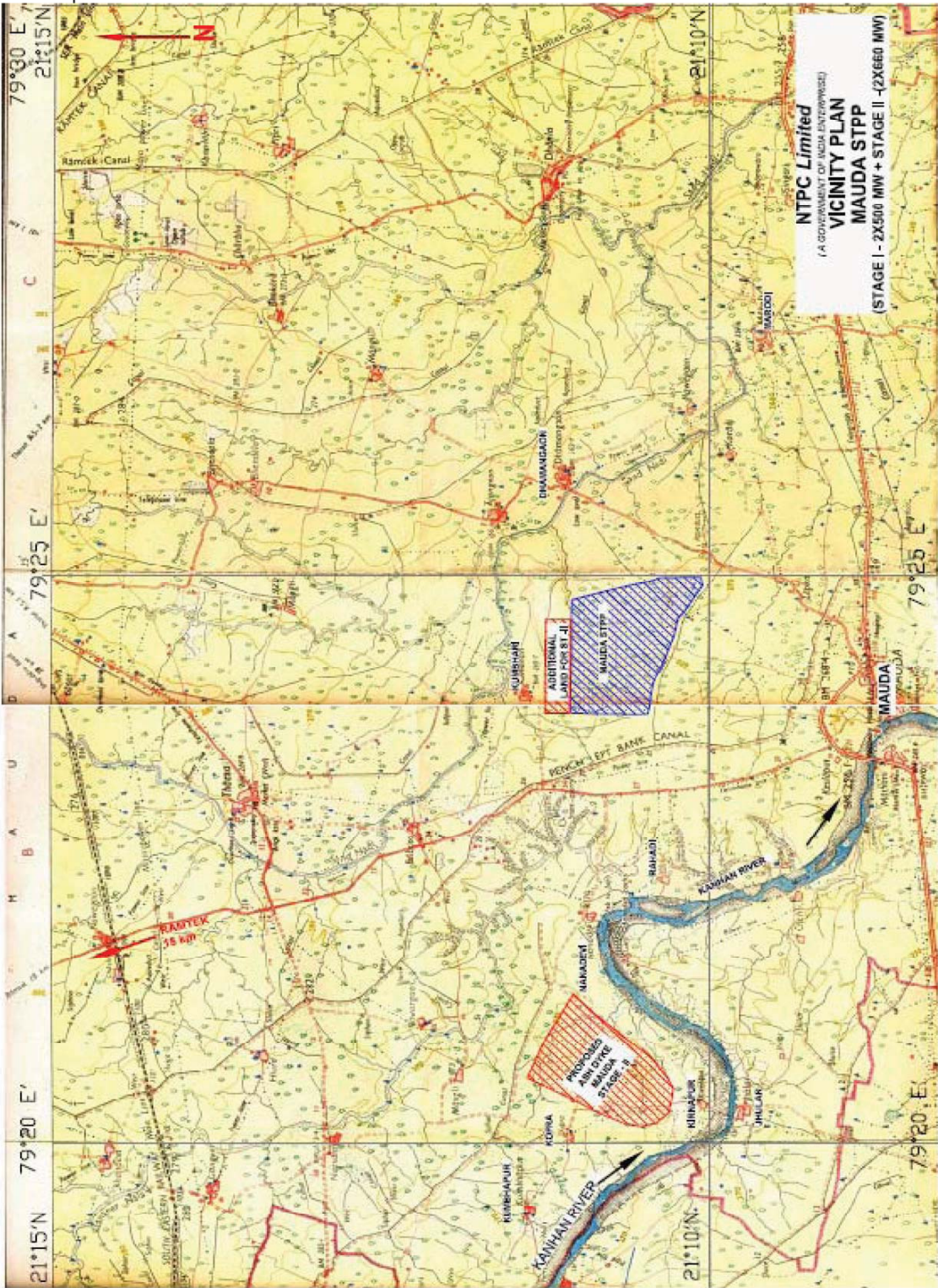
Stage-I	:	2x500MW	Under construction/Implementation
Stage-II	:	2x660MW	Present Proposal

10.0 CONSTRUCTION POWER

The requirements of the construction power supply for the project would be met from the existing 11 KV. Miscellaneous Switchgear located near 132 KV switchyard. Necessary 11KV ring main/LT sub-stations shall be provided for the required power plant area.


11.0 METROLOGICAL DATA

The metrological data from nearest observatory is placed in section B.


CLAUSE NO.	PROJECT INFORMATION	<div>एनटीपीसी NTPC</div>	
			
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO. : CS-9575/9571/0360/0370/9586-102-2	PART-A SUB SECTION-II	PAGE 5 OF 17

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CLAUSE NO.	PROJECT SYNOPSIS				
	COOLING WATER ANALYSIS				
	Sl. No.	Constituent	as	mg per litre	
	1.	Calcium	CaCO ₃	407	
	2.	Magnesium	CaCO ₃	250	
	3.	Sodium & Potassium	CaCO ₃	175	
	4.	Cations	CaCO ₃	832	
	5.	Bicarbonates	CaCO ₃	516	
	6.	Chloride	CaCO ₃	162	
	7.	Sulphate	CaCO ₃	154	
	8.	Anions	CaCO ₃	832	
	9.	Silica	SiO ₂	50	
	10.	Iron	Fe	<0.8	
	11.	pH Value	-	8.4	
	12.	TSS	mg/l	<25	
Note : The C.W system is expected to operate at about 3.0 Cycles of Concentration.					
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-A		PROJECT SYNOPSIS	
				PAGE 5 OF 9	

CLAUSE NO.	PROJECT SYNOPSIS			<div>एनटीपीसी NTPC</div>																		
	<div>ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER</div> <table><tr><th>SI.No.</th><th>Characteristics</th><th>Value</th></tr><tr><td>1.</td><td>Silica (Max.)</td><td>0.02 ppm as Sio2</td></tr><tr><td>2.</td><td>Iron as Fe</td><td>Nil</td></tr><tr><td>3.</td><td>Total hardness</td><td>Nil</td></tr><tr><td>4.</td><td>pH value</td><td>6.8 to 7.2</td></tr><tr><td>5.</td><td>Conductivity</td><td>Not more than 0.1 μs/cm excluding the effects of free CO₂</td></tr></table>				SI.No.	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as Sio2	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 to 7.2	5.	Conductivity	Not more than 0.1 μs/cm excluding the effects of free CO ₂
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MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-A	PROJECT SYNOPSIS	PAGE 6 OF 9																		

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SECTION – C

SPECIFIC TECHNICAL REQUIREMENT

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SECTION – C1

SPECIFIC TECHNICAL REQUIREMENT - MECHANICAL

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1.0 GENERAL

The Condensate Polishing Units with a common external regeneration system and associated accessories shall conform to the technical specification for **2X660 MW, MAUDA STPP STAGE II**.

2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING PLANT

There shall be three service vessels (3X33.33%) for each 660 MW unit each polishing 33.33 % of the condensate flow corresponding to VWO (valve wide open) condition at 3%make up.

3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate plant shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing plant and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polisher service vessels shall be located in the TG hall of corresponding units. The resins shall be transferred to and from the common regeneration facility by sluicing through a pipeline hydraulically only.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

4.0 SCOPE OF SUPPLY (MECHANICAL)

Following are in bidder's scope of supply.

Broad scope of supply (mechanical) for this package is detailed below and as indicated in relevant portion of this specification.

A. SERVICE VESSEL FACILITY

- 1) There shall be three service vessels (3X33.33%) for each 660 MW unit each polishing 33.33 % of the condensate flow corresponding to VWO (valve wide open) condition at 3%make up.
- 2) Each Condensate polisher vessels shall be complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, bed support-cum-under drain system, inlet water distributors, air distribution arrangement for resin mixing, all fittings and appurtenances etc. as specified and as required.
- 3) One no External resin traps at the outlet of each of the polisher vessel, designed for in-place manual back washing.
- 4) Condensate inlet and outlet headers with pipe connections to the condensate polisher vessels.
- 5) Resin transfer header connecting the common external regeneration facilities to the condensate polisher vessels of each installation.
- 6) Rinse water outlet headers from condensate polisher vessels of each installation up to the condenser hot well.
- 7) All necessary valves and fittings for the installations with actuators necessary for their remote operation. These shall include suitable fool proof arrangement to prevent accidental over pressurization of the resin transfer pipeline and regeneration facilities connected to it which are designed for pressure much lower than that of the polisher service vessels.
- 8) A common drain header for the condensate polisher service vessels of each unit up to the condenser

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hot well.

- 9) All necessary drains, vents and sampling points, with valves as specified and as required.
- 10) Gland sealing water piping for the valves in the rinse water line.
- 11) Two nos. (1W + 1S) oil free type air blowers with electric motor drives for each unit for supplying air required for mixing the resins in the service vessels. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc all mounted on a single base.
- 12) Complete Instrumentation and Control for automatic operation.
- 13) Emergency bypass between the condensate influent and effluent headers with a modulating butterfly type control valve, along with wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) on the upstream and downstream side of the control valve. The control valve can be of 2x50% or 1x100% configuration to achieve proper control under all operating conditions. Isolation valve shall be provided with geared operators for manual operation.
- 14) Nine (9) complete charges of resins. One charge will be defined as cation, anion & inert resin (if applicable) requirement for one service vessel. Further one Year's topping requirements or 10 % of first fill quantity, whichever is more shall be supplied by bidder.
- 15) One no Conductivity Analyzer at condensate inlet header, condensate outlet header, outlet of each condensate polishing vessel.
- 16) One number multichannel silica analyzer at outlet of the three service vessels. Total numbers of multichannel silica analyzers for both the units shall be two.
- 17) One no multichannel sodium analyzer at outlet of the three service vessels. Total no of multichannel sodium analyzers for both the units shall be two.
- 18) Complete instrumentation and controls for this system, including the differential pressure transmitters, actuator for the control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system.
- 19) All the piping, valves, fitting, accessories etc used in service vessel area shall be 300# class minimum.

B. REGENERATION SYSTEM

- I. One common facility for regeneration of the resins from the condensate polishers of all the TG units shall be provided by the bidder and consisting of following:
 - 1) One no Resin Separation & Cation Regeneration Vessel.
 - 2) One no Anion resin regeneration vessel.
 - 3) One no Mixed resin storage vessel
 - 4) Interface isolation vessel (if resin separation process calls for). However one additional mixed resin storage vessel along with resin charge, interconnected valves, piping for transfer of resin has to be provided by bidder as mandatory requirement for storage of regenerated resin which will be transferred to the service vessel area during regeneration.
 - 5) All internals, fittings and appurtenances for these vessels.
 - 6) Common waste effluent header with one resin trap designed for in place manual backwashing.
 - 7) The type of vessels indicated above (s.no 1, 2 and 3) shall be as per supplier process requirement.
 - 8) Resin injection hopper complete with water ejector system for resin make up. Resin injection hopper

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shall be sized to handle up to minimum 150 liters of as received new resins per single injection.

- 9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc all mounted on a single base.
- 10) Two (2) numbers of DM water Storage tanks dedicated for CPU regeneration cum resin transfer purpose complete with CO2 absorbers, overflow seal, drain, integral pipe works, valves, instrumentation and all other accessories required.
- 11) Two (2X100%) nos. DM water pumps for regeneration with electric motor drives for water supply for chemical preparation, dilution & regeneration etc.
- 12) Two (2X100%) nos. DM water pumps for resin transfer operations with electric motor drives for water supply for resin transfer process.
- 13) The DM water used for resin transfer operations from the Regeneration building to the Condensate Polisher vessels and from the Condensate Polisher vessels to the Regeneration building shall be collected in a tank (MSRL construction) of adequate capacity in Condensate Polishing Plant regeneration building and the same shall be pumped to Customer's CW channel near CW Pump House for recycle/re-use.
- 14) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc for these vessels.

II. BULK ACID AND ALKALI UNLOADING AND DOSING FACILITY

- 1) One no hose station for transfer of hydrochloric acid (30-33% HCl) consisting of two (2) sets of hoses each of size 80 mm NB @ 10 m, provided along with coupling & diaphragm type isolation valves.
- 2) One no hose station for transfer of Alkali (48% NaOH) consisting of two (2) sets of hoses each of size 80 mm NB @ 10 m, provided along with coupling & diaphragm type isolation valves.
- 3) Two nos. Bulk Acid storage tank complete with integral pipe works, valves, level transmitter, level gauges and all other accessories required.
- 4) Two nos. Bulk Alkali storage tank complete with integral pipe works, valves, level transmitters, level gauges and all other accessories required.
- 5) Two nos. (2X100%) Acid unloading pumps each complete with electrical drive motor and all other accessories as required.
- 6) Two nos. (2X100%) Alkali unloading pumps each complete with electrical drive motor and all other accessories as required.

III. ALKALI PREPARATION FACILITY

In order to facilitate erection at site chemical dosing preparation equipment shall be mounted on structural steel skids and assembled (including piping) at the manufacturer's shop, to the maximum extent possible, prior to shipping. The number of mechanical connections shall be minimised by the use of pipe headers wherever possible. The bidder may also supply and install these equipment's independently instead of assembling the skids. Complete facility for preparing alkali solution from alkali lyse & flakes shall be included in Bidder's scope. This will consist of the following:

- 1) One number alkali solution preparation tank. The tank shall consist of slow speed agitator driven by motor, carbon dioxide absorber, overflow seal, dissolving basket, integral pipe works, valves and all other required accessories.
- 2) A hot water tank with 2x50% electrical heating coil for heating of alkali diluent water, in a tank of mild steel rubber lined construction complete with integral pipe works, valves, instrumentation and all other

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accessories required shall be provided.

- 3) Two (2) nos. (1W+1S) alkali transfer cum recirculation pumps. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories as required.
- 4) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves and all other accessories as required.
- 5) One carbon trap at the outlet of ACF
- 6) All interconnecting piping, valves and fittings & instrumentation as required to complete the system.

IV. Acid and Alkali Dosing System

The Acid and Alkali dosing systems shall be skid mounted and shall consist of at least following equipment's:

- 1) Two (02) numbers acid measuring tanks complete with fume absorbers, overflow seal, integral pipe works, valves, instrumentation and all other accessories required.
- 2) One (1) no Alkali measuring (day) tank including slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal, integral pipe works, valves, instrumentation and all other accessories required.
- 3) Two (02) numbers (1W+1S) Positive displacement type metering pumps for acid dosing with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories.
- 4) Two (02) numbers (1W+1S) Positive displacement type metering pumps for alkali dosing with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories.
- 5) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator, and a mixing tee where the chemicals get injected into the water stream.
- 6) All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, upto the mixing tee with the diluent water.
- 7) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance

C. NPIT AND NPIT DISPOSAL SYSTEM

- 1) Neutralizing pit of RCC construction (civil work not in bidder's scope) in two compartments with acid and alkali resistant tiles shall be provided by the customer. However isolation gates along with pumps, piping shall be in bidder's scope. Each section shall hold 150% of waste water generated in one regeneration of one service vessel.
- 2) One no. Lime tank of SS-316 for the neutralization of acid in regeneration area near N- pit along with slow speed agitator driven by motor complete with integral pipe works, valves all other accessories shall be supplied by bidder.
- 3) Three (3) numbers (1W+2S) waste recirculation/ disposal pumps of horizontal centrifugal type (rubber lined) single stage with priming arrangement (two priming tanks for N-pit waste recirculation) and final disposal to ash slurry pump house. Each pump shall be designed to pump the total volume of one

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section of the pit in eight hours, however minimum capacity of the pump shall be 50 m³/hr. Proven agitation system like air agitation, venturi mixing etc shall be provided in addition to recirculation from pumps.

- 4) One no pH Analyser at effluent discharge header, shall be in the scope of bidder.

D. PIPING

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges Hangers and supports, embedment plates with lugs etc required for the below given piping shall also be provided by the bidder.

- 1) Service vessel inlet header shall be SA 106 Gr-C (OD 406.4 X 12.7 mm thick)
- 2) Service vessel outlet header shall be SA 106 Gr C (OD 406.4 X 12.7 mm thick)
- 3) Rinse water outlet piping shall be SA 106 Gr-B (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser hot well shall be considered as 70 meter.
- 4) Resin transfer piping shall be minimum 80 NB and of SS 304 Sch 40S (minimum). One way distance for resin transfer piping between farthest service vessel and regeneration area shall be 500m and the same is in bidder's scope.
- 5) Piping handling DM water shall be minimum 150 NB of SS 316 Schedule 40 S (minimum). 500m of DM water piping should be considered and the same is in bidder's scope.
- 6) N.Pit effluents piping from N.Pit to Ash Slurry Pump house shall be minimum 150 NB MSRL. The distance between N.Pit and Ash Slurry Pump House shall be 700m and the same is in bidder's scope.
- 7) The DM water used for resin transfer operations from the regeneration area to the condensate polisher vessels and from the condensate polisher vessels to the regeneration area shall be collected in a tank (MSRL construction) of adequate capacity in Condensate Polishing Plant regeneration area and the same shall be pumped to Customer's CW channel near CW Pump House for recycle/re-use. 750 m of minimum 80 NB MSRL piping is to be considered and the same is in bidder's scope. Out of 750 m of piping, 50 m of piping shall be buried under the ground. This 50 m of piping shall be provided with suitable buried protection and the same shall be in bidder's scope.
- 8) Piping handling alkali and alkali solution shall be SS 316 Sch 40S minimum.
- 9) Piping handling acid service shall be Carbon Steel (Heavy Grade) PP Lined.
- 10) Piping for air service shall be hot dip galvanized (heavy grade) steel.
- 11) All piping within each of the above skids/equipment shall be in bidder's scope.
- 12) Similarly DM water piping from each DM water storage tanks to CPU DM water regeneration pumps (including re circulation lines connected to DM water storage tanks) & resin transfer pumps(including re circulation lines connected to DM water storage tanks) shall be in bidder's scope.
- 13) Further DM water piping from each CPU DM water resin transfer pumps to service vessel area and regeneration area & DM water piping from CPU DM water regeneration pumps to the regeneration area shall be in bidder's scope.
- 14) Service water piping (used for cooling of condensate sample), instrument air piping and service air piping, potable water piping etc. shall be in bidder's scope.
- 15) Similarly, all piping between the external regeneration facility and the skids for chemical dosing and acid/alkali preparation shall also be designed, supplied, erected and tested by the bidder. These shall include demineralized water piping to the chemical dosing, acid /alkali piping from external bulk storage tanks to respective preparation skids, the alkali preparation skids from the external regeneration facility,

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alkali solution from its preparation facility to the alkali dosing skid, dilute chemical solution piping for acid and alkali from the dosing skids to the external regeneration facility, piping to the preparation/dosing facilities, instrument air piping and power supply for immersion heaters of the diluent water tank from the regeneration facility, and all instrumentation and control wiring between these skids, etc.

NOTE: System shall be designed to take care of any increase or decrease in length of piping.

- 16) A static head of minimum 13m is to be considered for calculating the head of the following pumps:
- DM Water Pumps for Resin Transfer.
 - Effluent re-circulation cum disposal pumps.
 - Waste water pumps.
 - DM Water Pumps for Regeneration System.

E. ADDITIONAL REQUIREMENT

- Operating platforms, ladders, supports and other structural works for each vessel to facilitate accessibility for operation and maintenance for all the condensate polisher mixed beds, regeneration vessels, storage tanks, alkali and acid measuring tanks & preparation tanks and other equipment's etc. is also in bidder's scope.
- Initial charge of all lubricants & grease.
- All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box. Finish paints for touch-up painting of equipment after erection at site in sealed container.
- Start-up and commissioning spares as required.

5.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Section C2 (Specific Technical Requirement Electrical) and D2 (General Technical Requirement Electrical)

6.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Section C3 (Specific Technical Requirement C&I) and D3 (General Technical Requirement C&I)

7.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however Civil Input drawing shall be provided by bidder.

8.0 SCOPE OF SERVICES

The bidder's scope also includes following services for scope under this specification:

- Erection and Commissioning.
- Arrangement of all instruments, reagents and chemicals for carrying out trial run /commissioning and PG test.
- Monitoring gadgets, instruments and equipments required for maintenance.

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- (iv) During FAT of DCS, bidder will depute his concerned representative for technical support as and when required by customer.
- (v) All personnel required during maintenance and PG test.
- (vi) Trial run for requisite period.
- (vii) Performance testing.
- (viii) All the Piping, Valves and Equipment's of this system shall be protected against external corrosion by providing suitable painting. The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The condensate pipelines and valves near the condensate polisher vessels shall be painted as per Annexure V of this Technical Specification. All the condensate polisher vessels and other equipment's, piping, valves and equipment's in the regeneration area shall be painted as follows:
 - a. For all the steel surfaces inside the building (indoor installation), a coat of chlorinated rubber based zinc phosphate primer of minimum DFT of 50 microns followed up with undercoat of chlorinated rubber paint of minimum DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with minimum DFT of 50 microns and topcoat consisting of two coats of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 100 microns shall be provided. Total DFT of paint system shall not be less than 200 microns.
 - b. For all the steel surfaces exposed to atmosphere (outdoor installation), one primer coat of epoxy resin based zinc phosphate primer of having a minimum DFT of 100 microns followed up with undercoat of epoxy resin based paint pigmented with Titanium Oxide with minimum DFT of 100 microns shall be applied. Thereafter topcoat shall be applied consisting of one coat of epoxy paint suitably pigmented of approved shade with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided over the topcoat. The paint may be applied in one coat, incase high built paint is used; otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.
 - c. Specification for the application of Epoxy coating for internal protection of DM tank shall be as follows:
Primer hardener : One coat of unmodified epoxy resin along with polyamide. Paint hardener: Two (2) coats unmodified epoxy resin along with Aromatic adduct. Total thickness of primer and paint should not be less than 400 microns.
- (ix) Painting shall be as specified ANNEXURE- V of this technical specification. However any variation in the painting schedule as finally approved by BHEL / Customer shall be taken care by the bidder without any commercial and delivery implication to BHEL / Customer. Colour coding scheme shall be intimated to vendor during detail engineering.
- (x) Final touch up paint at site.

9.0 TERMINAL POINTS

9.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA

- (i) Service vessel inlet – (OD 406.4 X 12.7 mm thick, SA 106 Gr-B) - Single piping connection near service vessel area in BC bay.

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- (ii) Service vessel outlet – (OD 406.4 X 12.7 mm thick, SA 106 Gr-B) - Single piping connection near service vessel area in BC bay.
- (iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, SA 106 Gr-B) till condenser hot well for each unit is in the scope of bidder.
- (iv) The DM water used for resin transfer operations from the Regeneration building to the Condensate Polisher vessels and from the Condensate Polisher vessels to the Regeneration building shall be collected in a tank (MSRL construction) in regeneration building and the same shall be pumped to Cusotmer's CW channel near CW Pump House for recycle/re-use. 850 m of piping to be considered for the same.
- (v) 25 NB connection of Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from service vessel area.
- (vi) 25 NB connection of Service air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from service vessel area. If service air required is more than provided by BHEL, bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.
- (vii) Gland sealing water supply & analyser rack cooling water supply piping - Service water connection (40 NB) at 5 meter distance from service vessel area. Piping inside service vessel area for mentioned services will be in bidder's scope.

9.2 EXTERNAL REGENERATION AREA

- (i) DM Water Supply –The DM water inlet connections shall be provided by customer at 10 m from the foundation of DM Tanks at ground Level. Piping from the terminal point to inlet nozzle of the DM Water storage tanks & from outlet nozzle of the DM water storage tanks to the pump suctions (DM water regeneration pumps & DM water resin transfer pumps) shall be in the scope of bidder.
- (ii) DM Pumps Recirculation Lines – Piping from DM Pumps (DM water regeneration pumps & DM water resin transfer pumps) outlet lines to DM water storage tanks recirculation nozzle/inlet nozzle shall also be in the scope of bidder.
- (iii) 25 NB Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from the regeneration building.
- (iv) 25 NB Service air supply at 5 to 7 kg/cm² (g) - At 5 meter distance from regeneration area. If service air required is more than provided by BHEL, bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.
- (v) Drinking water (25 NB) and service water (50 NB)- At 5 meter distance from the regeneration area. However distribution and piping inside regeneration area will be in bidder's scope.
- (vi) NPit effluent piping (150 NB) from NPit up to ash slurry pump house shall be in bidder's scope. The piping distance to be considered shall be 900 m

10.0 EXCLUSIONS

- 10.1 All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. But civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails, structural supports and hangers for pipes / cables / ducts, crane rails, all embedments and inserts with lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in vendor's scope.
- 10.2 Main pipe trestles interconnecting CPU regeneration building and Service vessel Pipe trestle. However, auxiliary structure, hanger/support components for all the piping (CPU regeneration area, in acid/alkali handling area, interconnecting acid/alkali storage area ,CPU service vessels, DM water piping, resin

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transfer piping, instrument air piping, service air piping and effluent disposal piping etc.) are in bidder's scope.

10.3 Instrument air & service air up to terminal points.

10.4 All chemicals (Acid, alkali and Lime) required for pre-commissioning, commissioning, trial run and PG Test are excluded from bidder's scope. However all reagents, monitoring gadgets, etc. required for pre-commissioning, commissioning, trial run and PG Test shall be in bidder's scope.

10.5 Air conditioning, ventilation & fire fighting facilities.

10.6 Other exclusions are mentioned in the electrical & C&I parts of this specification.

10.7 Drinking water and service water & DM water up to terminal points.

11.0 QP AND SUB VENDOR APPROVAL

11.1 QP requirements are specified as ANNEXURE -I. BHEL & customer reserves the right for inspection of imported items by BHEL/customer officials (if felt necessary).The same shall be decided during detail engineering during approval of QP's.

11.2 However any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.

11.3 Approved sub vendor list is enclosed as ANNEXURE-II. However any additional sub vendor shall be subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

12.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

Functional Guarantees and liquidated damages shall be as per enclosed ANNEXURE-III.

13.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Section C & D the following shall also be complied under scope of this specification.

The P&I diagram is enclosed herein in this section for bidders compliance.

The material of construction specified in data sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

14.0 DRAWING/DOCUMENTS REQUIREMENT

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The number of drawing/documents to be submitted by the bidder shall be as per enclosed ANNEXURE-IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. The bidder has to submit the revised document along with the compliance sheet indicating enumerate reply to all BHEL comments. Without compliance sheet the submission of the documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL/CUSTOMER without price & delivery implication

(a) List of documents to be submitted after award of contract:-

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S.N O.	BHEL DRAWING NUMBER	DRAWING TITLE
1	PE-V2-385-155-A001	P& I DIAGRAM OF CONDENSATE POLISHING UNIT
2	PE-V2-385-155-A002	PROCESS DESIGN AND SIZING CALCULATIONS , VESSEL THICKNESS AND PUMP PRESSURE DROP CALCULATIONS FOR CPU
3	PE-V2-385-155-A003	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)
4	PE-V2-385-155-A004	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)
5	PE-V2-385-155-A005	OPERATION & CONTROL PHILOSOPHY FOR CPU
6	PE-V2-385-155-A006	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)
7	PE-V2-385-155-A007	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT REGENERATION AREA)
8	PE-V2-385-155-A008	PIPING LAYOUT (SERVICE VESSEL AREA)
9	PE-V2-385-155-A009	PIPING LAYOUT (REGENERATION AREA)
10	PE-V2-385-155-A010	YARD PIPING LAYOUT
11	PE-V2-385-155-A011	GA DRAWING OF SERVICE VESSELS FOR CPU
12	PE-V2-385-155-A012	GA DRAWING OF PRESSURE VESSELS EXCEPT SERVICE VESSELS FOR CPU
13	PE-V2-385-155-A013	GA DRAWING OF ATMOSPHERIC TANKS FOR CPU
14	PE-V2-385-155-A014	TECHNICAL DATA SHEET OF PUMPS WITH MOTORS
15	PE-V2-385-155-A015	TECHNICAL DATA SHEET OF BLOWERS WITH MOTORS
16	PE-V2-385-155-A016	TECHNICAL DATA SHEET OF AGITATORS WITH MOTORS
17	PE-V2-385-155-A017	TECHNICAL DATA SHEET FOR HEATER, ACTIVATED CARBON AND RESIN OF CPU
18	PE-V2-385-155-A018	DATA SHEET OF RESIN TRAP AND CARBON TRAP
19	PE-V2-385-155-A019	TECHNICAL DATA SHEET FOR HIGH PRESSURE VALVES FOR CPU*
20	PE-V2-385-155-A020	TECHNICAL DATA SHEET FOR LOW PRESSURE VALVES FOR CPU
21	PE-V2-385-155-A021	VALVE SCHEDULE OF CPU
22	PE-V2-385-155-A022	VALVE SEQUENCE CHART OF CPU
23	PE-V2-385-155-A023	ELECTRICAL LOAD DATA OF CPU
24	PE-V2-385-155-A024	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CONDENSATE POLISHING UNIT (REGENERATION AREA)
25	PE-V2-385-155-A042	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)
26	PE-V2-385-155-A026	CABLE SCHEDULE FOR CONDENSATE POLISHING UNIT
27	PE-V2-385-155-A027	DATA SHEET OF SOLENOID VALVES
28	PE-V2-385-155-A028	DATA SHEET OF AIR FILTER REGULATOR
29	PE-V2-385-155-A029	TECHNICAL DATA SHEET FOR INSTRUMENTS OF CPU
30	PE-V2-385-155-A030	INSTRUMENT SCHEDULE OF CPU

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31	PE-V2-385-155-A031	DATA SHEET AND GA OF ANALYZER ALONG WITH RACK AND PANEL ARRANGEMENT DRAWING
32	PE-V2-385-155-A032	DRIVE LIST FOR CPU ALONG WITH JUNCTION BOX GROUPING
33	PE-V2-385-155-A033	ALARM AND ANNUNCIATION LIST
34	PE-V2-385-155-A034	CONTROL LOGIC AND STANDARD MMI GRAPHICS
35	PE-V2-385-155-A035	TYPE TEST REPORTS
36	PE-V2-385-155-A036	INTERCONNECTION CABLE SCHEDULE AND DRAWING
37	PE-V2-385-155-A037	HMI-LOGS, TRENDS AND BAR CHARTS
38	PE-V2-385-155-A038	DRIVE LIST AND ANALOG/BINARY INPUT/OUTPUT LIST
39	PE-V2-385-155-A039	RECOMMENDED CONTROL WRITE-UP AND CONTROL SCHEME (AND/OR LOGIC)
40	PE-V2-385-155-A040	LIE/LIR GROUPING DOCUMENT
41	PE-V2-385-155-A041	POWER DISTRIBUTION DIAGRAM SERVICE VESSEL AREA AND REGENERATION AREA
42	PE-V2-385-155-A042	TERMINAL INTERCONNECTION DRAWING
43	PE-V2-385-155-A043	QAP / ICL FOR CONDENSATE POLISHING UNIT
44	PE-V2-385-155-A044	SUB VENDOR LIST FOR CONDENSATE POLISHING PLANT
45	PE-V2-385-155-A045	PG TEST PROCEDURE FOR CONDENSATE POLISHING PLANT
46	PE-V2-385-155-A046	O&M MANUAL FOR CONDENSATE POLISHING UNIT

Note: Any additional drawings-documents required during detailed engineering stage shall be provided by bidder without any commercial, technical and delivery implication to BHEL and Customer.

*High pressure valves are those valves which are subjected to the service vessel pressure. Rests of the valves are treated as low pressure valves.

- (b) Bidder to note that drg /doc submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link
(<http://124.124.36.198/wrenchwebaccess/login.aspx>)

- (c) Bidder to note that drawings submission schedule as follows :

a. Drawing/documents submission schedule: First submission of basic drawings/ documents – (Process Design & Sizing Calculation, Operation & Control Philosophy, P&ID and Service Vessel & Regeneration Area Layout) shall be within 4 weeks from the date of LOI.

b. The rest of the drawings/documents shall be submitted within three months from the date of approval of P&ID and Process Design & Sizing Calculation in CAT-II.

c. Every revised submission incorporating comments – within 10 days.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

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15.0 SPARES

Erection & Commissioning Spares are in bidder' scope of supply.

16.0 MINIMUM IMPORTED ITEMS

- i) High pressure ball valves.
- ii) Resins.

17.0 BIDDER TO FURNISH THE SIGNED AND STAMPED COPIES OF THE FOLLOWING DOCUMENTS/INFORMATION ALONG WITH THE BID (FOR ELECTRICAL AND C&I PLEASE REER THE RESPECTIVE SECTION OF THE SPECIFICATION).

- Detailed process write up of the system offered. Bidder to note that the detailed process write up is for information only. Hence any hidden deviation detailed in the detailed process write up will not be acceptable. Tender technical specification requirement to be met.
- Deviation / Clarification if any in the enclosed deviation / clarification schedule only with mention of specification clause for which deviation / clarification is being asked.
- Equipment layout of service and regeneration area. Bidder to note that the equipment layout is for information only. Hence any hidden deviation detailed in the equipment layout will not be acceptable. Tender technical specification requirement to be met.
- Electrical Load List in BHEL format
- Price Schedule duly filled in.
- List of Erection & Commissioning Spares.
- List of Erection & Maintenance Tools & Tackles.
- Following guaranteed chemical consumption required for regeneration (in kg) to be furnished.
 - i) Acid (30% HCL) consumption per vessel per regeneration
 - ii) Alkali (48 % NaOH) consumption per vessel per regeneration.


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ANNEXURE -I

QUALITY PLAN


CLAUSE NO.		QUALITY ASSURANCE														<div>एनटीपीसी</div> <div>NTPC</div>	
CONENSATE POLISHING PLANT																	
Tests/Check Items / Components		Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Pneumatic Test	Functional/operational Test	Bleeding resistance tests	Adhesion/ Spark Test	Performance Test	Other Test	All Test as per relevant Std/ Appd Data Sheets	Dynamic Balancing	Remarks
CPU Service Vessel		Y ^a	Y	Y	Y	Y	Y ₃	Y						Y ¹			
Acid Alkali/Chemical Storage Tanks/ Vessels (LP)		Y ^a	Y	Y	Y	Y	Y ₄	Y									
Resins/Activated Carbon & Internals of CPU		Y ^a				Y									Y		
Rubber Lining of Vessels/ Tanks/ Pipes etc		Y ^a				Y					Y ²	Y			Y		
Dosing Pumps/Metering Pumps		Y ^a						Y					Y ⁵		Y		
Diaphragm Valves		Y ^a				Y		Y ₆	Y ⁶						Y ⁷		
Butterfly Valves (Low Pressure)						Y		Y ₆		Y				Y ⁸			
1. Body (Cast)		Y ^a		Y ^b													
2. Disc (Cast)		Y ^a		Y ^b													
3. Shaft		Y ^a		Y										Y ^c			
High Pressure Ball Valves & Butterfly Valves		Y ^a						Y							Y		
Horizontal Centrifugal Pumps					Y	Y							Y ⁵		Y		
1. Casing		Y ^a		Y ^b				Y									
2. Impeller		Y ^a		Y ^b												Y	
3. Shaft		Y ^a		Y										Y ^c		Y	
Rotary Blowers					Y	Y							Y		Y		
1. Casing		Y ^a		Y ^b				Y									
2. Rotor		Y ^a		Y										Y		Y	
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE					TECHNICAL SPECIFICATION SECTION-VI PART-B					E-8 : CPU				PAGE 1 OF 2			

CLAUSE NO.	QUALITY ASSURANCE		<div>एनटीपीसी NTPC</div>	
<div>Notes:</div> <div><div><div>1. Heat Treatment shall be done as per ASME code.</div><div>2. Bleeding Resistance tests shall be done by keeping the sample in 33% HCl, 48% NaOH and DM Water for 72 Hrs.</div><div>3. Hydro Test shall be conducted, before Rubber lining.</div><div>4. As per code requirements.</div><div>5. As per HIS, USA.</div><div>6. Hydro test of body before Rubber lining. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator.</div><div>7. Tests on Rubber parts such as Diaphragms shall be done per batch of Rubber mix, such as Tensile, Hardness, Adhesion, Spark Test, Bleed Resistance test and Flex test. Life Cycle test for Diaphragms for 50000 cycles etc shall also be done.</div><div>8. Hydro Test of Body, Seat & Disc Strength shall be carried out in accordance with latest edition of AWWA C-504 Standard. Proof of Design Test in accordance with latest edition of AWWA C-504 Standard shall also be carried out, if not carried out earlier. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator. Seat leakage test shall be carried out in both directions.<div><div>a) One per Heat/Heat Treatment batch/Lot</div><div>b) On machined surfaces only.</div><div>c) UT shall be done for shafts with Dia 50 mm or above.</div></div></div><div>9. For all other Misc. items, refer Table on LP piping.</div><div>10. Bidder will perform hydro test at 1.5 times of design pressure of entire Condensate Polishing Plant at site after commissioning of all the equipments in pressence of Customer/BHEL. Format of record will be through protocol, subject to BHEL/Customer acceptance.</div><div>11. Hydro test will be conducted before rubber lining.</div><div>12. Proof of Design (P.O.D.) for butter fly valves.</div><div>12.1 P.O.D. test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in absence of which actual POD test shall be conducted by the bidder in the presence of Customer's representative.</div><div>12.2 All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504.</div></div></div>				
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-B	E-8 : CPU	PAGE 2 OF 2


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ANNEXURE-II


SUB-VENDOR LIST

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW, MAUDA STPP STAGE II	BHEL DOCUMENTS NO.: PE-TS-387-155A-A001	
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SNo	ITEM	SUPPLIERS	PLACE	SUB-VENDOR STATUS	QP / INSPN CAT	REMARKS
1	SERVICE VESSELS	R&C	MUMBAI	A		
		ISGEC	YAMUNANAGAR	A		
		ANUP ENGG.	AHMEDABAD	A		WITH LLOYDS APPD HEAT TREATMENT AGENCY
2	ACTIVATED CARBON	INDUSTRIAL CARBON	ANKLESHWAR	A		
		VVD & SONS	TUTICORIN	A		
3	AIR BLOWERS	SWAN PNEUMATIC	NOIDA	A		
		EVEREST TRANSMISSION	NEW DELHI	A		
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	A		
		EVEREST BLOWER	BAHADURGARH	A		UPTO 15 BHP
4	METERING PUMPS (DIAPHRAGM TYPE)	VK PUMPS	NASIK	A		
		MILTON ROY INDIA	CHENNAI	A		
		SWELLORE	AHMEDABAD	A		
5	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	A		
		FIBRE & FIBRE	MUMBAI / SILVASA	A		
6	HORIZONTAL CENTRIFUGAL PUMPS	KBL	WADI	A		
		MATHER & PLATT	PUNE	A		
		KSB	PUNE	A		
		SAM TURBO IND LTD	COIMBATORE	A		
		KISHOR PUMPS	PUNE	A		
		SULZER PUMP INDIA	PUNE	A		
		WPIL	GHAZIABAD	A		
7	HORIZONTAL CENTRIFUGAL PUMPS (RUBBER LINED)	KISHOR PUMPS	PUNE	A		
		SU MOTORS	MUMBAI	A		
8	MISC. PUMP VERTICAL TURBINE	KBL	PUNE	A		
		M&P	PUNE	A		
		WPIL	GHAZIABAD	A		
		JYOTI PUMPS	VADODRA	A		
		VOLTAS	PUNE	A		
9	RESIN TRAP ELEMENT	JHONSONS SCREEN	AUSTRALIA	A		

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	FOR SERVICE AREA					
	UNDER BED NOZZLE FOR CPU VESSEL	JONSONS SCREEN	AUSTRALIA	A		
10	RESIN	ROHM & HASS	FRANCE.	A		
		BAYERS	GERMANY.	A		
11	HEATER	ESCORTS	FARIDABAD	A		
		RACOLDS	FARIDABAD	A		
12	CCS VALVES	LEADER ENGG WORKS	JALANDHAR	A		
		FOURESS ENGINEERING	AURANGABAD	A		
		KSB	COIMBATORE	A		
		BDK	HUBLI	A		
		AUDCO	CHENNAI	A		
		KBL	PUNE	A		
		KBL	KONDHAPU	A		
13	BALL VALVE (NON FIRE SAFE TYPE)	PEC	NASIK	A		
		FLOWCHEM	AHEMDABAD	A		
		BDK	HUBLI	A		
		AUDCO	CHENNAI / KANCHIPURAM	A		
		MICROFINISH VALVES	HUBLI	A		
		AK INDUSTRIES	HUBLI	A		
		LEADER	JALANDHAR	A		
14	ANGLE VALVE	VELAN INC	CANADA	DR		
		IL	PALGHAT	A		
		REINEKE	GERMANY	A		
		SAMPELL AG	GERMANY	A		
15	HIGH PRESSURE BUTTERFLY VALVE / CONTROL VALVE	DeZURICK (Upto 400 NB)	USA	A		
		TYCO (UPTO 450 NB)	USA	A		
16	BALL VALVE (HIGH PRESSURE)	VELAN	CANADA	A		
17	SS BALL VALVE 150 LBS	BDK	HUBLI	A		
		AUDCO	CHENNAI	A		UPTO 200 NB
		MICRO FINUISH	HUBLI	A		UPTO 40 NB
		BRAY	CHINA	A		
18	BUTTER-FLY VALVE (MANUAL / PNEUMATIC) UPTO 200 CLASS 150	AUDCO	CHENNAI	A		
		DAMBALA VALVES	THANE	A		
		BDK VALVES,	HUBLI	A		
		CRANE FLOW PROCESS	SATARA	A		

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19	DUAL PLATE TYPE NON-RETURN VALVE (SS & CI UPTO 100 NB, CLASS 150)	ADVANCE VALVES	NOIDA	A		
		BDK VALVES,	HUBLI	DR		
		R& MULTIPLES	VALSAD	A		
20	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) UPTO 80 NB	BDK	HUBLI	A		
		CRANE FLOW PROCESS	SATARA	A		
21	GATE / GLOBEVALVES UP TO 300 NB PN 10	LEADER	JALANDHAR	A		
		H SARKAR	HOWRAH	A		
		BANKIM & COMPANY	HOWRAH	A		
	CHECK VALVE / NRV (LINED / UNLINED), FLAP TYPE SIZE UPTO 50 NB	MAJESTIC WORKS	MUMBAI	A		
		BDK	HUBLI	A		
		H SARKAR	HOWRAH	A		
		LEADER (FOR CHECK VALVE ONLY)	JALANDHAR	A		
22	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN	MUMBAI	A		
		GRAND PRIX	NEW DELHI	A		
		JAYPEE	NEW DELHI	A		
		GREAVES COTTON	MUMBAI	A		
		MULTITEX	NEW DELHI / NOIDA	A		
23	MS PIPES (IS: 1239 & 3589)	SAIL	ROURKELA.	A		
		JINDAL TUBES	GAZIABAD	A		UPTO 350 NB
		SURYA ROSHINI	BHADURGARH	A		UPTO 300 NB
		TISCO	JAMSHEDPUR	A		UPTO 150 NB
		WELSPUN	ANJAR	A		UPTO 400 NB
		MSL (FOR IS 3589)	RAIGAD	A		200 NB TO 500 NB
24	SS PIPES (ERW / SEAMLESS) UPTO 100 NB	RATNAMANI	CHATTRAL	A		
		REMI	TARAPUR	A		
		APEX TUBES PVT LTD (Approved for SS welded pipes up to 150 NB & 4.78 mm thick as per ASTM A 312 & seamless pipe up to 50 NB as per ASTM A 312)	BEHROR (ALWAR)	A		
25	CS PIPE (ASTM A 106 GR. B) UPTO 400 NB	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	A		UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	A		UPTO 350 NB
26	VERTICAL TURBINE PUMPS	KBL	KILOSARWADI	A		
		WPIL LTD	KOLKOTA	A		
		SAM INDUSTRIAL PUMPS	COIMBATORE	A		



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		FAIR BANK MORSE/FLOW MORE	SAHIBABAD	A		
		KISHORE PUMPS	PUNE	A		
27	PLC	ABB	BANGLORE	A		
		GE FANUC	BANGLORE	A		
		L & T LTD	MUMBAI	A		
		ROCKWELL	GHAZIABAD	A		
		SIEMENS	NASIK	A		
		SCHNEIDER ELECTRIC	NEW DELHI	A		
28	CONTROL VALVE	CONTROL COMPONENT INC	USA	A		
		DRESSER	COIMBATORE	DR		
		FISHER XOMOS	CHENNAI	A		
		FISHER CONTROLS	UK/ USA	A		
		DRESSER MESONILAN	FRANCE	A		
		WEIR VALVES	UK	DR		
		IL	PALGHAT	A		
		MIL CONTROLS	ALWAYE	A		
		NIPPON FISHER	JAPAN	A		
		COPE VALCUN	UK	A		
		EMERSON	FRANCE	A		
29	LEVEL GAUGE	LEVCON	KOLKATA	A		
		SBEM	PUNE	A		
		SIGMA	MUMBAI	A		
		V. AUTOMAT	NEW DELHI	A		
		PUNE CONTROL	PUNE	A		
		CHEMTROLS	GOA	A		
		DK INSTRUMENTS	KOLKATA	A		
		SCIENTIFIC DEVICES	MUMBAI	A		
30	LEVEL SWITCH (FLOAT / DISPLACER TYPE)	DK INSTRUMENTS	KOLKATA	A		
		LEVCON	KOLKATA	A		
		TRAC	HYDERABAD	A		
		SIGMA	MUMBAI	A		
		SBEM	PUNE	A		
		V. AUTOMAT	NEW DELHI	A		
		PUNE CONTROL	PUNE	A		
31	LEVEL SWITCH (RF TYPE)	EIP BULK CONTROLS	NOIDA	A		For RF type

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	/ CAP TYPE)	LEVCON	KOLKATA	A		For Capacitance type only
		EIP ENVIRO CONTROL	HYDERABAD	A		For RF type
		NIVO CONTROL	INDORE	A		For Capacitance type only
		SBEM	PUNE	A		For Capacitance type only
		MAGNETRO	BELGIUM	A		
		PUNE CONTROL	PUNE	A		For Capacitance type only
32	LEVEL TRANSMITTER (CAPACITANCE TYPE)	E&H	GERMANY	A		
		LEVCON	KOLKATA	A		
		PUNE TECHTROL	PUNE	A		
		MAGNETROL	BELGIUM	A		
		NIVO CONTROL	INDORE	A		
		SBEM	PUNE	A		
		WIKA	PUNE	A		
33	LEVEL TRANSMITTER (GUIDED WAVE RADAR)	K TECH	USA	A		
		E&H	GERMANY	A		
		EMERSON (SAB ROSEMOUNT)	SWEDEN	A		
		MAGNETROL	BELGIUM	A		
		EMERSON	DAMAN	A		
		CHEMTROL	GOA	DR		
34	LEVEL TRANSMITTER (ULTRASONIC TYPE)	KAB INSTRUMENTS	SOUTH AFRICA	A		
		SIEMENS MILLTRONICS	CANADA	A		
		K TECH	USA	DR		
		E&H	GERMANY	A		
		KRISTLER MORSE	USA	DR		
		EMERSON	USA / DAMAN	A		
35	PRESSURE / DP / TEMP SWITCH	GAUGES BOURDON (I)	MUMBAI	A		FOR PRESSURE SWITCH ONLY
		INDFOS	GHAZIABAD	A		UPTO 40KG/CM2, NOT FOR VACUUM APPLICATIONS
		SWITZER	CHENNAI	A		UPTO 40KG/CM2, (EXCEPT 900 SERIES PRESSURE SWITCH & AND NOT FOR VACUUM APPLICATIONS)



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2X660 MW, MAUDA STPP STAGE II

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		TREFAG	RANIPET	DR		
36	SILICA ANALYSER	POLYTRON / HACH ULTRA	FRANCE	A		
		ABB	UK	A		
		HACH	USA	A		
37	SODIUM ANALYSER	POLYTRON / HACH ULTRA	FRANCE	A		
		ABB	UK	A		
		ORION	USA	A		
		SWAN	USA / EUROPE	DR		
38	ANALYTICAL INSTRUMENTS	HACH (POLYMETRON)	FRANCE	A		
		ABB	UK / USA / FARIDABAD	A		
		EMERSON	USA / DAMAN	A		
39	PRESSURE GUAGE	A.N.INST	NARENDRAPUR	A		
		GENERAL INST CONSORTIUM	MUMBAI / GOA	A		
		GLUCK	MUMBAI	A		
		GOA THERMOSTATIC	GOA	A		WITH IMPORTED BOURDON TUBE FOR PRESSURE GAUGE
		MANOMETER	MUMBAI	A		
		WIKI	PUNE	DR		
40	PRESSURE / DP TRANSMITTER	EMERSON PROCESS MANAGEMENT	USA / DAMAN	A		
		FUJI ELECTRIC	JAPAN	A		
		HONEYWELL	USA	A		
		YOKOGAWA	JAPAN	A		
		ABB	ITALY / FARIDABAD	A		
41	TEMPERATURE GUAGE	A.N.INST	KOLKATTA	A		
		WIKI	PUNE	DR		
		H.GURU (SI) PVT LTD	BANGLORE	A		
		GIC	GOA / MUMBAI	A		
		GOA THERMOSTATIC INST	GOA	A		
42	FLOW ELEMENT	BRISTOL BABCOCK	UK	A		
		BALIGA LIGHTING EQUIP	CHENNAI	A		
		ENGINEERING SPECIALITIES	KOLKATA	DR		
		IL	PALGHAT	A		

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		MICRO	FARIDABAD	A		
		STAR-MECH	PUNE	DR		
43	TEMPETAURE ELEMENT	GENERAL INST CONSORTIUM	NEW DELHI	A		
		DETRIVE INST & ELECTRONICS	MUMBAI	A		
		PYRO ELECTRIC	GOA	A		
		TOSHNIWAL BROS	NEW DELHI	A		
		WAAREE INST	MUMBAI	A		
44	TEMPERATURE SWITCH	INDFOSS	GHAZIABAD	A		
		DRESSER	USA	A		
		SWITZER	CHENNAI	A		
		SOR INC	USA	A		
		TOSHNIWAL BRO	NEW DELHI	A		
		VASU TECH	NEW DELHI	A		
45	SIGHT FLOW INDICATORS	BLISS ANAND	GURGAON	A		
		CHEMTROLS	MUMBAI	A		
		INSTRUMENTATION ENGINEERS	HYDERABAD	A		
		SIGMA	MUMBAI	A		
		TELACE E QUIP	CHENNAI	A		
46	INST PIPE FITTINGS	AURA INCORPORATED	NEW DELHI	A		
		HYD-AIR ENGG	MUMBAI	A		
		METPRESS ENGG	KOLKATA	A		
		PRECISION ENGG	MUMBAI	A		
		SWITZER INST	CHENNAI	A		
		VIKAS INDUSTRIAL	NOIDA	A		
47	DP SWITCH	KAUSTUBA UDYOG	PUNE	A		
		SWITZER	CHENNAI	A		
		SOR INC	USA	A		
		VASU TECH	REWARI	A		
48	ANUBAR	ENDRESS+HAUSER GmbH +Co.KG	SWITZERLAND	A		
		SWITZER	CHENNAI	A		
		STAR-MECH	PUNE	A		
49	CONTROL PANEL	PROCON INST	CHENNAI	A		
		CONTROL & SWGR CO	NOIDA	A		



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		INDUSTRIAL CONTROLS & APPS	MUMBAI	A		
		PYROTECH	UDAIPUR	A		
		ELECMECH	AHEMDABAD	A		
		POSITRONICS	BARODA	A		
50	JUNCTION BOXES	BALIGA LIGHTING EQUIP	CHENNAI	A		
		CREATIVE INST	BANGLORE	A		
		DEVI POLY	CHENNAI	A		
		INFO CONTROL	BANGLORE	A		
		K.S.INTRUMENTS	BANGLORE	A		
		MANISHA ENTERPRISE	PUNE	A		
		SUCHITRA INDUSTRIES	BANGLORE	A		
51	INST TUBE FITTINGS	AURA INCORPORATED	NEW DELHI	A		
		HYD-AIR ENGG	MUMBAI	A		
		METPRESS ENGG	KOLKATA	A		
		PRECISION ENGG	MUMBAI	A		
		SWITZER INST	CHENNAI	A		
		VIKAS INDUSTRIAL	NOIDA	A		
52	ROTAMETERS / ORIFICE ASSEMBLY (BYPASS / DOL)	TRAC	HYDERABAD	A		
		EUREKA IND	PUNE	A		
		IEPL	HYDERABAD	A		
		PLACKA	CHENNAI	A		
		SCIENTFIC DEVICES	MUMBAI	A		
		FLOWSTAR	FARIDABAD	DR		
53	INSTRUMENT CABLE	DELTON CABLES	FARIDABAD	A		
		PARAMOUNT CABLES	KHUSKHERA	A		
		RELIANCE	BANGLORE	A		
		POLYCAB	DAMAN	A		
		UNIVERSAL CABLES	SATNA	A		
		NICCO	KOLKATTA	A		
		CORDS	BHIWADI	A		
		INCAB	PUNE	A		
54	SCREENED INSTRUMENT CABLE – PVC / FRLS	PARAMOUNT CABLES	KHUSKHERA	A		
		POLYCAB	DAMAN	A		
		RELIANCE	BANGLORE	A		
		DELTON CABLES	FARIDABAD	A		
		CORDS	BHIWADI	A		
		UNIVERSAL CABLES	SATNA	A		
		INCAB	PUNE	A		

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		NICCO CORPORATION LIMITED	KOLKATTA	A		
55	BATTERY	HBL NIFE POWER SYSTEM LTD	HYDERABAD	A		
		HOPPECKE	GERMANY	DR		
		AMCO SAFT	BANGLORE	A		
		EXCIDE INDUSTRIES	KOLKATA	A		
56	BATTERY CHARGER	BHARTIA CUTLLER	-----	DR		
		CALDYNE	KOLKATA	A		
		AMAR RAJA POWER SYSTEM PVT	TIRUPATI	A		
		DUBAS	BANGLORE	A		
		HBL NIFE	HYDERABAD	A		
		CHHABI ELECTRICALS PVT LTD	JALGAON	A		
57	CABLE LUGS	CHETNA	MUMBAI	A		
		DOWELL	MUMBAI	A		
		ELECTRO BILLETS (3D)	VALSAD	A		
58	SOLENOID VALVE	ROTEX AUTOMATION	BARODA	A		
		AVCON	MUMBAI	A		
		ASCO	CHENNAI	A		
59	EIP CONVERTER OR I/P CONVERTOR	NORGREN(WATSON SMITH)	UK	A		
		EMERSON	PAWANE	A		
		ABB	FARIDABAD	A		
60	SAFETY SHOWER	UNICARE	MUMBAI	A		

NOTE:

1. ANY OTHER SUB-VENDOR NOT LISTED IN ABOVE LIST SHALL BE SUBJECT TO BHEL / CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL.
2. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL./ CUSTOMER.



TITLE:
2X600 MW, MAUDA STPP STAGE II

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ANNEXURE-III

FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES



TITLE:
2X600 MW, MAUDA STPP STAGE II

**TECHNICAL SPECIFICATION FOR
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FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND GUARANTEE TESTS

The terms "Performance Guarantees" wherever appears in this ANNEXURE-III shall have the same meaning and shall be synonymous to "Functional Guarantees". Similarly the term "Performance Tests" wherever appears in this ANNEXURE-III shall have the same meaning and shall be synonymous to "Guarantee Test(s)". The term "TMCR"(Turbine Maximum Continuous Rating) appearing in the technical specification shall mean 660 MW electrical power output at generator terminals(power at generator terminals as per clause indicated in the sub- section) under 0% cycle make-up and 77 mm Hg(abs) condenser pressure unless used in conjunction with a different cycle make-up and/or a different condenser pressure.

1.00 PERFORMANCE GUARANTEES

General Requirements

- 1.01 The Bidder shall guarantee that the equipment offered shall meet the rating and performance requirements stipulated for various equipment covered in these specifications.
- 1.02 The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
- 1.03 The bidder shall demonstrate all the guarantees covered herein during performance guarantee/acceptance test. The various tests which are to be carried out during performance guarantee/acceptance tests are listed in the specification. The guarantee tests shall be conducted by the contractor at site in presence of BHEL / CUSTOMER on each unit individually
- 1.04 All costs associated with the tests shall be included in the bid price.
- 1.05 In case during performance guarantee tests, it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the BHEL / CUSTOMER and re-conduct the performance guarantee test(s) with BHEL / CUSTOMER's consent. However if the specified performance guarantee(s) are still not met but are achieved within the Acceptable shortfall limit specified in the specification, BHEL / CUSTOMER will accept the equipment/system/plant after levying liquidated damages as mention in the specification. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the BHEL / CUSTOMER, after the tests have been completed, the BHEL / CUSTOMER will have the right to either of the following:

a) For Category-I Guarantees

Reject the equipment/system/plant and recover the payments already made.

OR

Accept the equipment/system/plant after levying liquidated damages as specified hereunder. The liquidated damages, for shortfall in performance shall be levied separately for each unit. The rates indicated are on per unit basis. The liquidated damages shall be prorata for the fractional parts of the deficiencies. The performance guarantees coming under this category shall be called 'Category-I' Guarantees.

b) For Category-II Guarantees

Reject the equipment/system/plant and recover the payments already made. The performance guarantees under this category shall be called 'Category-II' Guarantees. Conformance to the performance requirements under category-II is mandatory.

c) For Category-III Guarantees

Reject the equipment/system/plant and recover from the contractor the payments already made.

OR

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the



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BHEL/CUSTOMER. Such damages shall, however be limited to the cost of replacement of the equipments/systems replacement of which shall remove the deficiency so as to achieve the guarantee performance. These parameters / capacities shall be termed as Category-III, guarantees.

2.00 GUARANTEES UNDER CATEGORY I

The performance guarantees which attract liquidated damages are as follows:

Condensate Polishing Unit (CPU)

- a) Chemical consumption (acid and alkali) required for regeneration of each CPU service vessel.
- b) Total throughput (in Cu. M) through each CPU service vessel i.e. Design flow multiplied with 720 hours of operation.

AMOUNT OF LIQUIDATED DAMAGES APPLICABLE FOR CATEGORY-I GUARANTEES

If the performance guarantee(s) specified above are not met by the contractor even after the modifications and/or replacements mentioned but are achieved within the stipulated Acceptable Shortfall Limit as indicated in this clause, BHEL / CUSTOMER will accept the equipment/system/plant after levying liquidated damages as indicated here under, however, if the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, the BHEL / CUSTOMER may at his discretion reject the equipment/system and recover the payment already made or accept the equipment/system only after levying liquidated damages against the contractor, at the rates listed herein, and such liquidated damages shall be deducted from the contract price.

Condensate Polishing Plant

- a) In case each vessel of Condensate Polishing Plant (CPP) (using guaranteed chemicals for regeneration) has delivered less total throughput than guaranteed value between two successive regenerations, L.D, for shortfall in output shall be calculated as follows:

$$LD \text{ per vessel (Rs)} = 14.31 \times R \left[\frac{(12.167 \times Q_{mg}) - (12 \times Q_{ma})}{Q_{ma}} \right]$$

Where

Q_{ma} = Actual throughput per vessel between two successive regenerations (Cu.m)

Q_{mg} = Guaranteed throughput per vessel between two successive regenerations (Cu.m) which is calculated as design flow (cum/hr) per CPU service vessel multiplied by 720 (hours)

$R = R_1 + R_2$

R_1 = Guaranteed acid consumption per CPU service vessel per regeneration x US\$ 93/- per ton of 30% HCL

R_2 = Guaranteed alkali consumption per CPU service vessel per regeneration x US\$ 267/- per ton of 48% NaOH

Acceptable shortfall limit with LD for the above guarantee shall be (-) minus 10% of the guaranteed throughput per vessel. Liquidated damages shall be calculated considering two working vessels for each unit and for all condensate polishing plants.

NOTE:

- i. Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.
- ii. If the contract currency is other than US dollars, then the liquidated damages shall be equivalent amount of contract currency based on bill selling exchange rate of State Bank of India prevailing on the date of award of contract.
- iii. All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/Special Condition of Contract (SCC).



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- iv. Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the contract price.

GUARANTEE UNDER CATEGORY –II

NIL


GUARANTEE UNDER CATEGORY –III

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

CONDENSATE POLISHING PLANT

Apart from guarantees covered Under Category-I, guarantee test shall be conducted to demonstrate the following guarantee parameters for each vessel:

- i. Effluent quality at outlet of each CPU service vessel at its rated design flow and design service length between two regenerations under various design conditions (as specified in technical specifications) for which CPP is designed. No shortfall in maintaining the guaranteed effluent quality will be accepted by BHEL / CUSTOMER.
- ii. Pressure drop across the CPU service vessel (as defined in specification) in clean and dirty condition of resin at rated design flow.
- iii. Vibration, parallel operation and noise level of all the pumps and blowers at the rated duty point shall be demonstrated at site.

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ANNEXURE IV

DRAWING DOCUMENTS SUBMISSION SCHEDULE

Documents:	PEM-Engineering
Documents for approval	8 numbers
Documents for information	8 numbers
Schedules, diagrams, lists, tables, calculation, specifications and other documents	8 numbers
Final as-built drawings	
CD-ROMs of final as-built drawings	10 numbers
Final as-built drawings (hard copy)	14 numbers
Final O&M manuals	18 numbers
CD-ROMs of Final O&M Manuals	10 numbers
Detailed project time schedules	5 numbers

Note:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - P&IDs.
 - Equipment lay out of the service vessel area and regeneration area.
 - Equipment Cable tray layout for service vessel area and regeneration area
 - Equipment earthing layout service vessel area and regeneration area
 - Civil scope drawings.
 - Piping lay out drawing for Service vessel area, regenerative area and yard piping layout.
 - Valve schedule
 - Instrument schedule
 - Cable Schedule


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ANNEXURE -V

PAINTING SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS		<div>एनटीपीसी NTPC</div>	
14.04.02	Number of cycles			
	For the life cycle test, the number of test cycles shall be minimum 10,000 cycles.			
14.04.03	Other tests for metallic expansion joints shall be carried out as per the approved QP / QA Section. Further, other terms and conditions for type test shall be as specified elsewhere in the specification.			
15.00.00	SPECIFICATION FOR SURFACE PREPARATION & PAINTING			
15.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
15.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labeled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
15.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
15.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering..			
15.05.00	SURFACE PREPARATION			
15.05.01	All surfaces to be painted shall be thoroughly cleaned of oil, grease and other foreign matter. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
15.05.02	The following surface schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.			
	SP1	Solvent cleaning		
	SP2	Application of rust converter (Ruskil or equivalent grade)		
	SP3	Power tool cleaning		
	SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns</p> <p>SP5 Phosphating</p> <p>SP6 Emery sheet cleaning/Manual wire brush cleaning.</p>			
15.06.00	APPLICATION OF PRIMER/PAINT			
15.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
15.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
15.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.			
15.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.			
15.06.05	<p>Following are the Primer/painting schemes envisaged herein:</p> <p>PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.</p> <p>PS3* - Zinc Chrome primer (Alkyd base) by dip coat.</p> <p>PS4 - Synthetic Enamel (long oil alkyd) to IS2932.</p> <p>PS5 - Red oxide zinc phosphate to IS-12744.</p> <p>PS9 - Aluminum paint to IS 2339.</p> <p>PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 °C - 600 °C) , IS-13183 Gr.-II (for temperature 200 °C - 400 °C) and IS-13183 Gr.-III (for temperature upto 200 °C)</p> <p>PS13 - Rust preventive fluid by spray, dip or brush.</p> <p>PS14 - Weldable primer-Deoxaluminat or equivalent.</p> <p>PS16 - High Build Epoxy CDC mastic `15' .</p>			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
15.06.06 15.06.07	<p>PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)</p> <p>PS18 - Epoxy based TiO2 pigmented coat</p> <p>PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=35.0(min.).</p> <p>PS20 - Epoxy based finish paint.</p> <p>All weld edge preparation for site welding shall be applied with one coat of weldable primer.</p> <p>For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.</p>			
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TECHNICAL REQUIREMENTS

15.07.00

Primer/Painting Schedule

Sl. No	Description	Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
			System	Coat	Min. DFT / coat (Microns)	System	Coat	Min. DFT / Coat (Microns)	System	Coat	Min. DFT / Coat (Microns)		
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	Design temperature <60 °C	PS 5	2	25	-	-	-	PS 4	3	35	155	
		Design temperature 60 °C-200 °C	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200 °C	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH), Variable Load Hanger (VLH) and other supports	SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4.	Valves												
	Cast /Forged	SP1/SP2/SP3	PS9	1	20	-	-	-	PS9	1	20	40	
	Design temperature <95 °C												

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TECHNICAL REQUIREMENTS

	Design temperature 95 °C-200 °C	SP1/SP2/SP3	PS 9*	1	20	-	-	-	PS9*	1	20	40
	Design temperature > 200 °C	SP1/SP2/SP3	PS9*	1	20				PS9*	1	20	40
5.	All Structural Steel components	SP4* Outside TG building and in SG envelope	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a) Epoxy coat b) Final coat of paint PS17	2 1	35 30	250
6.	Weld Edges	SP4* Within TG building	-do-	1	35	PS18	1	35	a) Epoxy coat b) Final coat of paint PS17	2 1	25 30	150
6.		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	-
\$ The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3 rd finish coat (min.DFT 35 Microns) shall be applied at site.												


16.00.00 Testing Requirements:

The detailed testing requirements for power cycle piping and its components are given in the subsection for Quality Assurance(QA) .The requirements pertaining to testing given in this subsection if in variance with that given in QA subsection, then the more stringent of the two shall be followed.


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DATA SHEET-A

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1.0	Description of turbo generator unit (TG) for which condensate polishing is to be provided :		
i)	No. of units	Two	
ii)	Capacity of each unit	660 MW	
iii)	Total flow in all the service vessels (per unit)	1600 tph.	
iv)	Assumed Condensate flow per vessel	535 tph.	
v)	Operating pressure of condensate pumps	30 kg./sq.cm (g)	
vi)	Shut off pressure of condensate pumps	46 kg./sq.cm (g)	
2.0	CONDENSATE POLISHER SERVICE VESSELS PER UNIT :		
i)	No. of polisher Vessels	Three	
ii)	Type of service vessel	Cylindrical / Spherical	
iii)	Capacity of each polisher vessel	33.33% of condensate flow	
iv)	Flow through each	535 tph.	
v)	Inlet pressure to the polisher	30 kg/sq.cm (g)	
vi)	Design pressure of the Polisher	49 kg./sq.cm (g)	
	Design Temp.	60 °C	
2.1	Air-blowers for Resin Mixing (Service Vessels Area) PER UNIT		
i)	Number	Two (2x100%)	
ii)	Type	Centrifugal / Twin lobe type	
iii)	Duty	Intermittent	
iv)	Capacity & Head	As required	
v)	Pressure gauge	One per blower	
vi)	Location	Indoor	
vii)	Material of Construction	Casing – Cast Iron GR FG 260 to IS 210 Lobe – Cast Iron GR FG 260 to IS 210 Shaft – Carbon Steel to EN 8	
3.0	EXTERNAL REGENERATION FACILITIES		
3.1	BULK ACID AND ALKALI STORAGE TANK		
i)	Chemical Tanks	Acid Storage Tank	Alkali Storage Tank

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ii)	Number required	Two (2)	Two (2)
iii)	Dimensions (diameter, length & thickness)	As per BS : 2594	
iv)	Location	Outdoor	
v)	Useful capacity	Each tank to store one month's requirement of all the units or 25 cum whichever is higher	Each tank to store one month's requirement of all the units or 20 cum whichever is higher
vi)	Type and Pressure class	Horizontal with dished end (torispherical) ends, atmospheric	
vii)	Material of construction	Mild Steel	
viii)	Internal painting / lining	Rubber lining (4.5 mm thick)	
ix)	Concentration	30 -33 % HCl	5-50% NaOH
x)	Accessories	Vent, overflow, Drain, sample connections, Fume absorbers, CO2 absorbers, manholes, operating platforms etc	

3.2 ACID AND ALKALI UNLOADING PUMPS


i)	Pumps	Acid Unloading Pump	Alkali Unloading Pump and Alkali transfer cum recirculation pumps
ii)	Number required	Two (1W+1S)	Two (1W+1S) unloading pumps & Two (1W+1S) alkali transfer pumps
iii)	Type	Horizontal Centrifugal	
iv)	Pump speed	Maximum 1500 rpm	
vi)	Capacity and head of each pump	10 cum / hr and 10 mWC minimum	
vii)	Liquid to be handled	30 -33 % HCL	5-50% NaOH
viii)	Type of shaft sealing	Mechanical Seal	
ix)	Material of construction	Polypropylene or equivalent suitable for HCl	Stainless Steel -316
x)	Reinforced rubber hosed	Minimum two nos of size 80 NB of minimum 10 meters length with isolation valve	Minimum two nos of size 80 NB of minimum 10 meters length with isolation valve
xi)	Accessories	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, y- type strainers.	

3.3 CHEMICAL HANDLING, PREPARATION & DOSING SYSTEM

a)	Chemical Tanks	Alkali Preparation	Alkali Day	Acid Measuring Tank
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		Tank	Tank	
i)	Number required	One (1)	One (1)	Two (2)
ii)	Type	-- Vertical Cylindrical with dish end at bottom and cover at top; Atmospheric --		
iii)	Useful capacity	Minimum 10 Cu.m	Each tank shall be adequate to hold chemical for 125% of one regeneration	
iv)	Material	- M.S. with 4.5 mm thick rubber lining inside-----		
vi)	Accessories Required	Vent, Overflow, drain connection, motor driven stirrer (only for alkali preparation tanks), dissolving basket in SS-316 construction (only for alkali preparation & day tanks), fume absorber/ CO2 absorber etc		
ix)	Dissolving basket	AISI-316	AISI-316	Not reqd.
x)	Stirrer	Slow speed stirrer driven by motor drive and reduction gear		Not reqd.
b)	Dosing Pumps	Acid	Alkali	
i)	Number	Two (2) (1W+1S)		Two (1W+1S)
ii)	Type	----- Simplex positive displacement hydraulically operated diaphragm type -----		
iii)	Whether suction strainer required	----- Yes -----		
iv)	Accessories			
1)	Pressure Dampener	-----Two (2)-----		
2)	External safety relief valve (in addition to inbuilt safety valve)	Two (Hastelloy-B)	Two (SS:316)	
3)	Maximum pump stroke speed per minute	----- 100 per minute-----		
v)	Material of construction			
1)	Liquid End (Pump Head, Valves, Valve housing, valve spring etc.).	PVC	AISI:316	
2)	Diaphragm	PT.F.E.	P.T.F.E.	
3)	Packing	P.T.F.E.	P.T.F.E.	
4)	Shaft	----- Hardened steel EN 8 (BS:970)-----		

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5)	Worm & worm wheel(if applicable) Manganese Bronze
6)	Connecting rod Manganese Bronze
7)	Cross head guide Bronze
vi)	Capacity & Head	————— As per system requirement —————

3.4 DM WATER STORAGE TANK

i)	Number	Two
ii)	Type	Vertical Cylindrical type
iii)	Capacity (Effective)	1.5 times the DM water required for one regeneration of one TG unit (including resin transfer operation from condensate polishing plant to regeneration plant and vice versa and also for preparation of chemicals for regeneration of one unit.) or 450 cum each (whichever is maximum)
iv)	Material	MS with internally epoxy painted
v)	Design code	IS : 803
vi)	Minimum Thickness of shell plate, bottom plate and roof plate	8 mm, 10 mm and 6 mm respectively

3.5 Activated Carbon Filter for Alkali

i)	Number	One (1)
ii)	Size	10 M3/hr (not less than the design capacity of alkali transfer cum recirculation pump)
iii)	Min bed depth	1M
iv)	Flow velocity	12 m/hr (max).
v)	Pressure gauge	As per P&ID.
a)	Number and Location	Two No. (One each at inlet and outlet of filter)
b)	Seal	Teflon diaphragm
vi)	Material of construction	
a)	Shell	Carbon Steel as per IS 2062 Gr. B
b)	Dish ends	Carbon Steel as per IS 2002 Gr. 2A
vii)	Influent Distributor Material	SS 316
viii)	Manhole	Two (2) nos. minimum each of Davit type and 500 mm dia.

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ix)	Sight Windows	One (1) no. in backwash space
x)	Hand hole	One (1) no. of 150 mm dia for removal of activated carbon

3.6 Alkali diluent water heating tank (Hot water tank)


i)	Number	One (1)
ii)	Type/Capacity	Electric heater / 120% of water required for regeneration.
iii)	Temperature of alkali to be be heated	To obtain temp. of 50°C at alkali mixing feed out let.
iv)	Temperature gauge	Three (3) nos.
v)	Temp. Transmitter	To be provided
vi)	Burn out protection	To be provided
vii)	Material of construction of tank:	MS with 4.5 mm thick Rubber lining
viii)	Density meter	1 No. at each mixing tee outlet

3.7 DM pump (for resin transfer)


S. No.	Description / Data	DM Water (for Resin Transfer) Pumps	DM Water (for Regeneration) Pumps
a	Numbers. required	Two (2 x 100% capacity)	Two (2 x 100% capacity)
b	Type	Horizontal, Centrifugal	
c	Pump Speed	Maximum 1500 rpm	
d	Capacity & head of each pump	As required	As required
e	Liquid to be handled	DM Water	DM Water
f	Type of Shaft sealing	Mechanical Seal	Mechanical Seal
g	Casing	ASTM A 351 CF 8M	
h	Impeller	ASTM A 351 CF 8M	
i	Wearing rings	As per manufacturer's Standard	
j	Shaft	SS 316	
k	Shaft Sleeves	SS 410	
l	Mechanical Seal	As per manufacturer's Standard	
m	Recirculation line with motor actuated regulating type butterfly valve	Required	

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2 X 660 MW MOUDA STPP STAGE II	BHEL DOCUMENTS NO.: PE-TS-387-155A-A001	
		VOLUME-IIB	
		SECTION –C1	
		REV. NO. 0	DATE:
		SHEET	of

n	Accessories	Coupling gaurds, drain plug, vent valve, Suction hoses, isolation valves, Y-type strainer etc
3.8	Air-blowers for Resin Mixing (Regeneration area)	
i)	Number	Two (2x100%)
ii)	Type	Centrifugal/Twin lobe type
iii)	Duty	Intermittent
iv)	Capacity & Head	As required
v)	Pressure gauge	One per blower
vi)	Location	Outdoor
vii)	Material of construction	Casing – Cast Iron GR FG 260 to IS 210 Lobe – Cast Iron GR FG 260 to IS 210 Shaft – Carbon Steel to EN 8
3.9	Waste Water Collection Tank	
i)	Number	One
ii)	Type	Vertical Cylindrical type
iii)	Capacity	Suitable for holding water for two resin operations + 20% margin. Bidder to note that one resin transfer operation = Transfer of Resin from Single Service Vessel to Regeneration Vessel and Regeneration Vessel to Service Vessel Area.
iv)	Material	MSRL
3.10	Waste Water pumps	
i)	Number	Two nos (1 working + 1 Standby)
ii)	Type	Horizontal Centrifugal
iii)	Capacity & head	Capacity & Head: Designed for evacuating water from the waste water collection tank within 4 hours and head as required.
vi)	Material of construction	
	• casing, impeller	ASTM A 351 CF 8 M
	• Shaft	SS 316
	• shaft sleeve material	SS 410

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2 X 660 MW MOUDA STPP STAGE II	BHEL DOCUMENTS NO.: PE-TS-387-155A-A001	
		VOLUME-IIB	
		SECTION –C1	
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4.0	NEUTRALISING SYSTEM	
4.1	Neutralization Pit	
i)	Material of Construction	RCC with acid / alkali resistant tiles.
ii)	No. of compartments	Two
iii)	Capacity of each compartment	1.5 times the waste effluent from each regeneration of each vessel.
iv)	Agitation	Air agitation and venture mixing
4.2	Effluent Re-circulation cum disposal pumps	
i)	Number	Three nos (1 working + 2 Standby)
ii)	Type	Horizontal Centrifugal single stage with priming system / or vertical pump mounted on top of pit
iii)	Capacity & head	Suitable to pump the total volume of one section in 8 hours (minimum 50 cum/hr). Head to suit the requirement
iv)	Suction condition	Suction from priming chamber / submerged (suction from pit)
v)	Material of construction	
a)	casing, impeller	Rubber lined cast iron IS: 210 Grade FG 260
b)	Shaft	Stainless steel-SS 316
vi)	Number of priming chamber	Two
4.3	Air-blowers for N.Pit (Air agitation)	
i)	Number	Two (2x100%)
ii)	Type	Centrifugal/Twin lobe type
iii)	Duty	Intermittent
iv)	Capacity & Head	As required
v)	Pressure gauge	One per blower
vi)	Material of Construction	Casing – Cast Iron GR FG 260 to IS 210 Lobe – Cast Iron GR FG 260 to IS 210 Shaft – Carbon Steel to EN 8
4.4	Lime Tank for N.Pit	

	<div>TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2 X 660 MW MOUDA STPP STAGE II</div>	BHEL DOCUMENTS NO.: PE-TS-387-155A-A001	
		VOLUME-IIB	
		SECTION –C1	
		REV. NO. 0	DATE:
		SHEET	of

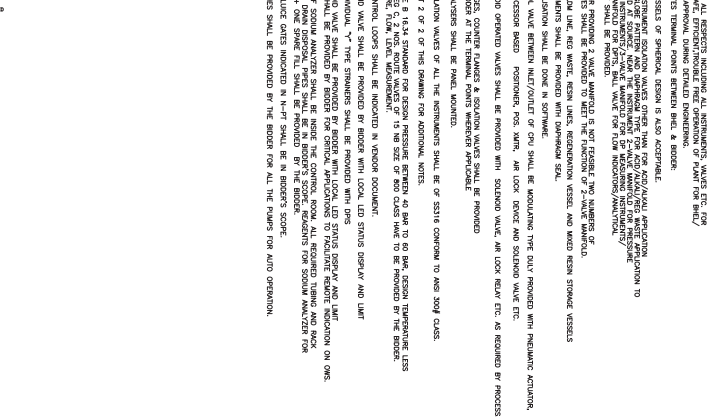
i)	Number	One
ii)	Material of construction	SS-316
iii)	Type	Vertical cylindrical with bottom dish end
iv)	Capacity	2 cum (minimum)

OA FILTER

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

[illegible]

ONLINE SODIUM ANALYSER

DEPT CODE	NAME	SIGN	DATE
DRN	RG		

DEPT CODE	NAME	SIGN	DATE
DRN	RG		
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CHD	AKS		

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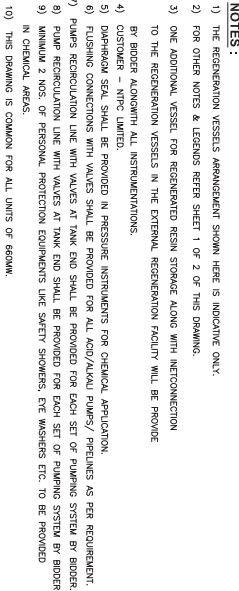
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PE-DG-387-155A-A001


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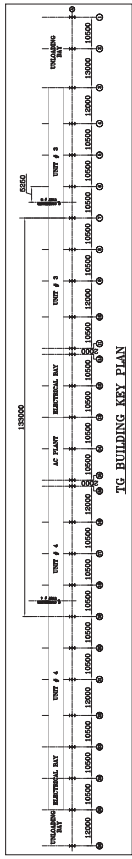


IS NOT IN BIDDER'S SCOPE
HOWEVER EACH ISOLATION GATES
OF N. PIT IS IN BIDDER'S SCOPE

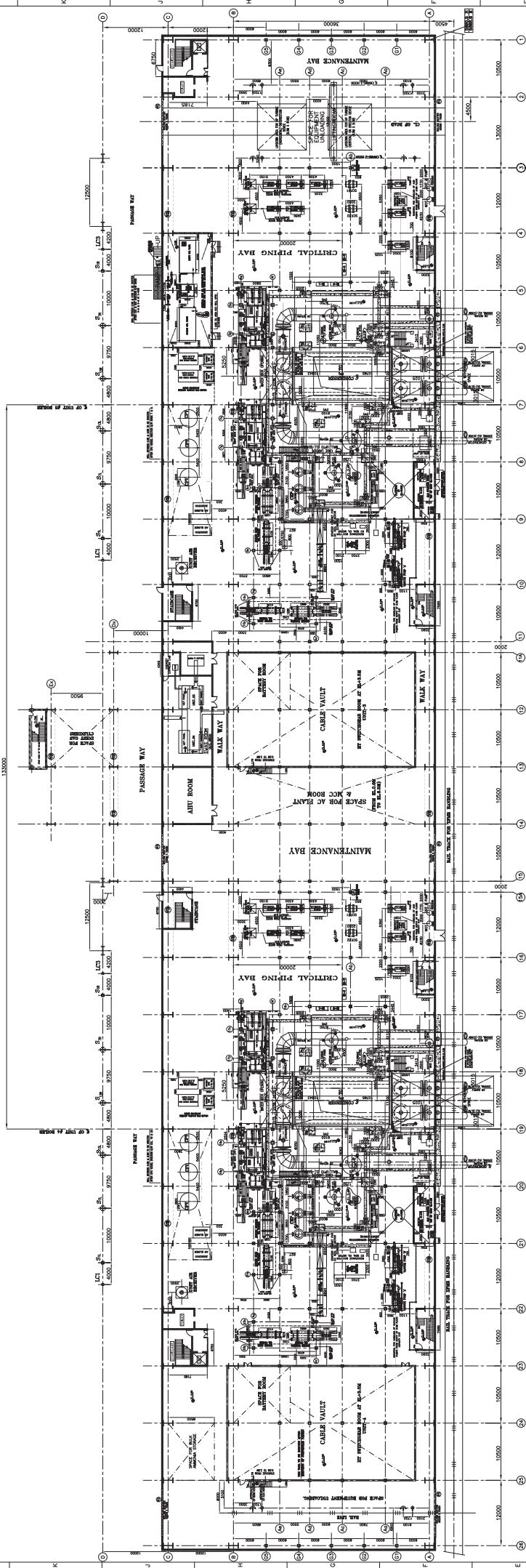
 BHARAT HEAVY ELECTRICALS LTD PROJECT ENGINEERING MANAGEMENT NEW DELHI	DEPT	NAME	SIGN	DATE	
	CDE				
	DRN	RG			
	DESN	RG			
	CHD	AKS			
	APPD	SB			
TITLE P&I DIAGRAM FOR CONDENSATE POLISHING UNIT	DRAWING No. PE-DG-387-155A-A001				
	SHEET	02	OF	02	REV

SIZE-A3

REVISED EQUIPMENT LAYOUT PLAN AT EI.
0.0M.: PE-DG-387-100-M003, SHEET 1 OF 1
REV.03



TG BUILDING KEY PLAN



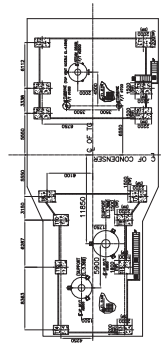
PLAN AT EL 0.0M

The maximum area provided for service vessel area in TG Hall shall be 8mX24mX5.2m (tentative height) for each unit. Bidder to comply to the same. However the layout for service vessel area & regeneration area shall be further discussed and finalized during detailed engineering and shall subject to customer & BH&L approval without any technical, commercial & delivery implications to BH&L Customer.

NOTES













1. ALL DIMENSIONS ARE IN MM'S AND LEVELS ARE IN METRES.
2. ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M. EL. 0.00M CORRESPONDS TO RL +271.5M
3. EQUIPMENTS & FACILITIES SHOWN FOR PACKAGES OTHER THAN TO PACKAGE ARE SUGGESTIVE ONLY. HOWEVER, IT IS PREFERRED THAT SIMILAR DETAILS BE ENSURED FROM RESPECTIVE PACKAGE VENDORS.

FOR CPU REFERENCE ONLY




T.G. STRUCTURE PLATFORMS

LEGEND:

	PIPE HATCH
	VERTICAL BRACING
	FIRE PROOF DOOR
	GRATING
	CHECKERED PLATE
	REMOVABLE
	HAND RAILING
	PIPE & CABLE TRAY
	RCC
	BRICK WALL
	ROLLING SHUTTER
	VERTICAL BRACING

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NTPC DRAWING NO. 95/3-110-2E-PW-17-1910	
NATIONAL THERMAL POWER CORPORATION LTD.	
MOUDA SUPER THERMAL POWER PROJECT	
STAGE-II (2 x 660MW)	
CLIENT'S  MOUDA HEAVY ELECTRICALS LTD. PROJECT ENGINEERING MANAGEMENT INDIA	DATE 19/07/2006 DRAWN 19/07/2006 CHECKED 19/07/2006 APPROVED 19/07/2006
SHEET NO. _____ OF _____ T.G. EQUIPMENT LAYOUT PLAN AT 0.0M	

JOB NO.		387	
STATUS		CONTRACT	
DESCRIPTION			
REV	DATE	ALT	CHD
1	10/1/74	1	1
1. COMMENTS			
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1.G. STRUC

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155A-A001

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34.	TURBINE JB AND LIST & LAYOUT	15
35.	SWMS ROOM LAYOUT	

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : C2	
		REV. NO. 00	DATE:
		SHEET	

SECTION – C2

SPECIFIC TECHNICAL SPECIFICATION - ELECTRICAL

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : C2	
		REV. NO. 00	DATE:
		SHEET	

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Erection and Commissioning spares.
- d) Erection & Maintenance tools & tackles.
- e) Electrical load requirement for CPU.
- f) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the Motor data sheet.
- g) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
- h) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial and delivery implication to BHEL.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet “Electrical equipment Specification for CPU” and sheet “Electrical Scope between BHEL and Vendor” with bidder's signature and company stamp.
- b) List of Erection and Commissioning spares.
- c) List of Erection & Maintenance tools & tackles.
- d) Electrical load requirement

- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES :

- a) Specification Motors
- b) Data sheet of Motors.
- c) Quality Plan.
- d) Load data format.

PROJECT: 2X660 MOUDA STPP Stage –II


S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	CUSTOMER	CUSTOMER	1. 415 V AC/240 V AC supply shall be provided by BHEL/ NTPC based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor.
2	Local Push Button Station (for motors)	CUSTOMER	CUSTOMER	Located near the motor.
3	Power cables, control cables and screened control & Instrumentation cables for a) between one end equipment in Customer & other in vendor (only Power cable) b) between one end equipment in Customer & other in vendor (except Power cable) c) both end equipment in vendor's scope d) between both end equipment in customers scope.	CUSTOMER Vendor Vendor CUSTOMER	CUSTOMER Vendor Vendor CUSTOMER	1. Finalisation of cable sizes shall be done by customer and shall be as per attached Instrumentation & Power Supply Cable Specification. Vendor shall procure and supply screened control cables of required quantity as per customer specification. Vendor shall provide lugs & glands accordingly. 2. Laying of cables by customer except for cables in vendor scope. 3. Termination at customer equipment terminals by customer. 4. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	
5	Cable trays, accessories & cable trays supporting system for cables in 1. Main route 2. Branch route	CUSTOMER Vendor	CUSTOMER Vendor	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to

REV: 02,

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
				customer/ BHEL/ NTPC approval at contract stage.
8	Lighting	BHEL/ NTPC	BHEL/ NTPC	
9	Equipment grounding & lightning protection	BHEL/ NTPC	BHEL/ NTPC	
10	Below grade grounding	BHEL/ NTPC	BHEL/ NTPC	
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to BHEL/ NTPC approval at contract stage.
12	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
13	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
14	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL/ NTPC cable schedule excel format.
15	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL/ NTPC approval.
16	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/ NTPC/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/ NTPC/customer after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by BHEL/ NTPC. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.
4. The distance between regeneration area and DCS (main control room) is 600 metre.
5. The distance between service vessel area and DCS (main control room) is 100 (approx.) metres.

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : C2	
		REV. NO. 00	DATE:
		SHEET	

DATA SHEET -A (LV MOTORS)

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V \pm 10%
	b) Rated frequency (with variation)	:	50 Hz +3 to -5%
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	45 kA RMS for 1 sec
	e) Short time rating for terminal boxes		
	o 110 kW and above (Breaker controlled)	:	45 KA for 0.20 sec.
	o Below 110 kW (Contactor controlled)	:	45 KA protected by fuse
	f) LV System grounding	:	Solidly
5.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage
7.0	Power cables data	:	Shall be given during Detailed engg
8.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg
9.0	Space heater supply	:	240 V, 1 ϕ , 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
11.0	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (Without any further tolerance) : As per clause no. 7.16 of technical spec sec-VI part-B (page 6 of c10)		
12.0	Additional tests	:	As per QP
12.1	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
12.0	Makes	:	As per customer approved vendors

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : C3	
		REV. NO. 00	DATE:
		SHEET	

SECTION – C3

SPECIFIC TECHNICAL SPECIFICATION CONTROL & INSTRUMENTATION


	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : C3	
		REV. NO. 00	DATE:
		SHEET	


Specific Technical Requirements (C&I):

- CONDENSATE POLISHING UNIT shall be controlled from TG-DCS (in BHEL scope of supply).
- Bidder to supply the field instrumentation as required / shown in the P&ID.
- The detailed specification of instruments, JB, control panel are given in section D3.
- The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- Drawings/Documents and data to be furnished after award of the contract:
 - Field instruments data sheet.
 - JB grouping document.
 - Cable schedule and cable interconnection drawing.
 - Instrument schedule.
 - Drive List and Analog / Binary Input / output List
 - Recommended Control write-up and Control Scheme/control logic.
 - Any other document decided during detailed engineering.
 - LIE/LIR Grouping Document
 - Plant Schematics
 - List of Recommended Alarms and SOEs with set points.
- Vendor to use transmitters in place of switches wherever required.
- All temperature elements (RTDs, Thermocouples) shall be supplied along with Temperature Transmitters.
- All motor operated valves shall be with integral starter.
- Instrument installation and accessories required for the same shall be in vendor's scope.
- All vendors supplied Instruments shall be grouped and terminated in the JB. JB's shall be in vendor's scope.
- All JB's, Field instruments, LIE/LIR and the related accessories shall be in Vendor scope of supply.
- All equipment items shall be of latest design with proven on track record.
- The above given scope is minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
- Bidder presence is required (3 man days) at BHEL-EDN, Bangalore for the implementation of control schemes DCS during FAT of DDCMIS.
- Bidder presence is required (around 10 man days) at site during DDCMIS Commissioning.


	TITLE : TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001
		AMENDMENT : 1


TYPE TEST REQUIREMENTS


CLAUSE NO.	TECHNICAL REQUIREMENTS AMENDMENT : 1						
3.00.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS						
	Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate	
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	
	1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes	
	2	Thermocouple	Degree of protection test	IS-2147	No	No	
	3	CJC Box	Degree of protection test	IS-2147	No	No	
	4	RTD	As per standard (col 4)	IEC-60751	No	No	
	5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes	
	6	E/P converter	As per standard (col 4)	Mfr. standard	No	Yes	
	7	Instrumentation Cables Twisted & Shielded (Refer Note-B below)					
		-Conductor	Resistance test	VDE-0815	No	Yes	
			Diameter test	IS-10810	No	Yes	
			Tin Coating test (Persulphate test)	IS-8130	No	Yes	
		-Insulation	Loss of mass	VDE 0472	No	Yes	
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE			TECHNICAL SPECIFICATION SECTION-VI PART-B		IIIC-10 TYPE TEST REQUIREMENTS		PAGE 3 OF 10


CLAUSE NO.	TECHNICAL REQUIREMENTS AMENDMENT : 1				


THIS IS PART OF TECHNICAL SPECIFICATION PE-TS-387-155A-A001

CLAUSE NO.	TECHNICAL REQUIREMENTS					
AMENDMENT : 1						
		Heat shock	VDE 0472	No	Yes	
		Hot deformation	VDE 0472	No	Yes	
		Shrinkage	VDE 0472	No	Yes	
		Bleeding & blooming	IS-10810	No	Yes	
		Colour fastness to water	IS-5831	No	Yes	
		Cold bend/ cold impact test	VDE-0472	No	Yes	
		Oxygen index test	ASTMD-2863	No	Yes	
		Smoke Density Test	ASTMD-2843	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-fillers	Oxygen index test	ASTMD-2863	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-AL-MYLAR shield	Continuity test		No	Yes	
		Shield thickness		No	Yes	
		Overlap test		No	Yes	
-Over all cable	Flammability Test	IEEE 383	No	Yes		
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-B		IIIC-10 TYPE TEST REQUIREMENTS	PAGE 5 OF 10	

CLAUSE NO.	TECHNICAL REQUIREMENTS				
	AMENDMENT : 1				
	Fuse Clearing Capability	Approved procedure	Yes	Yes	
	Total harmonic content	Approved procedure /CIGRE's	Yes	Yes	
	Radio Frequency interference	IEC-CISPR22, IEC-61000-4-12(9b), IEC-61000-4-3, IEC-61000-4-5, IEC-61000-4-6	Yes	Yes	
	Over Load Test	Approved procedure	Yes	Yes	
	Restart Test	Approved procedure	Yes	Yes	
	Output voltage tolerance	Approved procedure	Yes	Yes	
	Parallel operation	Approved procedure	Yes	Yes	
	ESD immunity Test	IEC-61000-4-2-9(1)	Yes	Yes	
	Electrical Fast transient / Burst Immunity Test	IEC-61000-4-4	Yes	Yes	
	Surge Protection	IEC61312, IEC61024, VDE 100-534	Yes	Yes	
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-B	IIC-10 TYPE TEST REQUIREMENTS	PAGE 7 OF 10	

CLAUSE NO.	TECHNICAL REQUIREMENTS AMENDMENT : 1						
			Insulation Test	Approved procedure	Yes	Yes	
			Load Tests.	Approved procedure	Yes	Yes	
			Preliminary light load test (without Battery supply)	Approved procedure	Yes	Yes	
			Load sharing	Approved procedure	Yes	Yes	
	9	Battery (Refer Note-A below)	As per standard (col 4)	IS-10918	No	Yes	
	10	Voltage Stabiliser	Over Load Test	Approved procedure	No	Yes	
			Temp rise test without redundant fans	Approved procedure	No	Yes	
			Input voltage variation test	Approved procedure	No	Yes	
	11	DDCMIS					
		CLCS Systems	Model test	Approved procedure	No	No	
		BMS	Safety requirements	VDE0116 Sec 8.7	No	Yes	
	12	Conductivity Type Level Switch	Degree of protection test	IS-2147	No	No	
	13	Local Gauges	Degree of protection test	IS-2147	No	No	
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE			TECHNICAL SPECIFICATION SECTION-VI PART-B		IIIC-10 TYPE TEST REQUIREMENTS		PAGE 8 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS AMENDMENT : 1						
	14	Process actuated Switches	Degree of protection test	IS-2147	No	No	
	15	Control Valves	CV test	ISA 75.02	No	Yes	
	16	PLCs	As per standard (Col 4)	IEC 1131	No	No	
	17	LIE / LIR	Degree of protection test	IS-2147	Yes	Yes	
	18	Flue gas O2 analyser, other Flue Gas analysers	Degree of protection test	IS-2147	No	Yes	
	19	Flow Nozzles & Orifice plates	Calibration	ASME PTC BS 1042	Yes	Yes	
	<p>Note:</p> <p>Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.</p> <p>A. For batteries with electric power supply system of TG C&I, the contractor shall submit for Employer's approval the reports of all the type tests as per IS-10918 carried out within last five years from the date of bid opening and the tests should have been either conducted at an independent laboratory or should have been witnessed by a client. The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.</p> <p>For batteries with electric power supply system of auxiliary plants, type test reports for batteries shall be as per standard practice of manufacturer.</p> <p>B. All cables to be supplied shall be of type tested quality. The Contractor shall submit for Employer's approval the reports of all the type tests pertaining to cables as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the cables similar to those proposed to be supplied under this contract and</p>						
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE			TECHNICAL SPECIFICATION SECTION-VI PART-B		IIIC-10 TYPE TEST REQUIREMENTS		PAGE 9 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS AMENDMENT : 1 		
	<p>the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>In case the Contractor is not able to submit report of the type test(s) for cables conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Employer and submit the reports for approval.</p>		
MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART-B	IIIC-10 TYPE TEST REQUIREMENTS	PAGE 10 OF 10



TITLE: TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT
2X660 MW MAUDA STPP STAGE II

SPEC. NO. **PE-TS-387-155A-A001**

VOLUME **II-B**

SECTION : **D**

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SECTION – D
GENERAL TECHNICAL REQUIREMENT

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
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SECTION – D1

GENERAL TECHNICAL REQUIREMENT – MECHANICAL

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CONDENSATE POLISHING PLANT

1.00.0 GENERAL

- 1.01.00 The Condensate polishing Plant shall consists of one set of Condensate polishing Units (CPU) for each TG unit inside TG Building and a common regeneration system. Each CPU shall consist of Three (3) service vessels of 33.33% capacity for each TG Unit.
- 1.02.00 The regeneration system shall be external and common to the CPU of all the TG units. Bidder to note that resin transfer can be either hydraulically or Hydro-pneumatically. In case hydro pneumatic mode of resin transfer is offered by bidder, air required for hydro pneumatic transfer shall be arranged by bidder. No air for resin transfer purpose will be provided by BHEL and customer. The exhausted resin charge will be cleaned, separated, regenerated, mixed and rinsed before being stored for the next use.
- 1.03.00 The common influent and effluent headers of each CPU, will be connected to an automatic bypass line (s) to be provided by bidder. On high pressure signal across the service vessel, the automatic control valve(s) in the bypass line(s) shall open, bypassing the service vessel(s).
- 1.04.00 Make-up water to the turbine cycle will be added to the condenser hotwell as required. The analysis of the cycle makeup water (DM Water) is exhibited in the section B of tender specification.
- 1.05.00 In the event of a tube failure in the condenser, circulating water will enter the condensate system and will contaminate it. Typical composition of the circulating water is exhibited in section B of technical specification and the condensate polishing plant shall be designed for such tube leakage condition as mentioned.
- 1.06.00 The condensate polisher service vessel will be located near corresponding units. All the components of the CPP plant shall be located indoor and regeneration system equipments shall be kept under shed and neutralizing pit shall be located outdoor.
- 1.07.00 The equipments covered under this subsection, other than in service vessel areas shall be located outdoor (in open) and no superstructures are envisaged to be provided for these equipments/pump houses. However the equipments may have localized shade provisions and pumps maintenance area shall be provided with roof cover. All the instruments associated with condensate polishing plant shall be provided with proper enclosures by Bidder. All vessels, pumps & blowers and their drives and other electrical and C&I equipments/accessories of regeneration system shall be suitable for outdoor duty and enclosures class of all the equipments shall be suitably selected by the bidder.

2.01.0 SALIENT DESIGN DATA

- 2.01.00 The design flow (through working vessels) for each condensate polishing plant shall be the corresponding condensate flow of TG unit at VWO (Valve wide open) condition at 3% cycle make-up.
- 2.02.00 The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system. The ionic concentrations indicated below are as such.

	Influent	Effluent
Ammonia ppb	100	--
Total solids, ppb	100	20
Silica, ppb	30	5 (refer Note 1 below)
Iron, ppb	50	5
Sodium, ppb	10	2

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Chloride, ppb	10	2
pH	8 – 8.5	--
Effluent conductivity after removal of ammonia and amines (micro mhos/cm) at 25 deg. C.	-	0.1 or less

Note : 1. Silica value in the effluent shall be based on Resin Supplier's recommendation for temperature 50 degree C & above and the same shall subject to the customer approval during detailed engineering without any technical, commercial & delivery implications to BHEL and customer.

Under the above operating and design flow through the polisher units, the un-ammoniated resins shall not reach "ammonia break-point" in less than 30 days (720 hrs) of continuous operation while maintaining the above effluent quality. Whenever specific conductivity starts increasing from 0.1 micro mhos/cm in the effluent, it is deemed that "ammonia break point" is reached. The effluent values indicated above shall be the maximum values.

2.03.00 In addition to the dissolved solids, the influent condensate shall also contain some quantities of suspended solids (crud) derived from the corrosion of water and steam carrying pipelines, turbine condenser, and steam side of the feed water heater. Normally this concentration will not exceed about 25 ppb and the polisher beds shall provide sufficient filtering action to restrict the effluent crud content to less than 5 ppb & same shall be guaranteed.

2.04.00 During start up conditions, quality of the influent may deteriorate to –
TDS, ppb : 2000 maximum
Silica, ppb : 150 maximum
Crud, ppb (mostly black oxide of Iron) : 1000 maximum

For design purposes, average crud loading shall be considered as 500 ppb. Under such conditions, total crud content of the effluent shall not exceed 150 ppb. However the Bidder to check and reduce the crud content at the effluent based on their requirement.

2.05.00 Under condenser tube-leakage condition, the plant shall be designed for 2000 ppb TDS in addition to the normal influent contaminants stated in as specified at clause no 2.02.00 of this Sub-section above. The cation and anion load in 2000 ppb TDS shall be based on the circulating water analysis furnished as section B of the specification. Under such condition, both sodium content and silica content of the effluent shall be limited to 20 ppb maximum. Useful service run between regeneration under the Startup conditions and under condenser tube leakage condition shall not be less than 50 hours each.

2.06.00 Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

2.07.00 The bed cross section shall be such that the velocity of condensate through it, shall not exceed 2 meters/min at the design flow rate. Internal diameter of the service vessels (excluding the rubber lining) of cylindrical type shall be selected meeting the above mentioned velocity criteria. For vessels of spherical shape, where the bed cross section vary, the diameter (excluding the rubber lining) of the vessel shall be selected considering velocity not exceeding 1.75 meters/minute. The effective depth of the mixed resin bed in the condensate polisher service vessels shall not be less than 1100 mm.

2.08.00 At the design flow rate, the pressure drop across the polisher service vessels with clean resin bed shall not exceed 2.1Kg/sqcm. This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty

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conditions will be restricted to 3.5 kg/sq.cm including the pressure drop across effluent resin traps.

- 2.09.00 Cation resins shall be regenerated by technical grade hydrochloric acid to IS:265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS:252 available as 48% lye or as flakes.

In no case, the regeneration levels cannot be lower than the valves indicated below:

- a) Cation resin : 125 kg of 100% HCl per cubic meter of resin
- b) Anion resin : 160 kg of 100% NaOH per cubic meter of resin.

- 2.10.00 Rinse water outlet header of each condensate polishing unit shall be provided with a pressure reducing station with isolating valves, suitably designed to enable the water entry to the condenser hot well which is operating under vacuum. The pressure reducing station shall consist of either a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm² and a pressure reducing valve from 2 kg/cm² to condenser vacuum.

- 2.11.00 While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below:-

- | | | |
|----------------------------|---|-----|
| 1. Carbon Steel pipe | : | 100 |
| 2. CI pipe/ductile Iron | : | 100 |
| 3. Rubber lined steel pipe | : | 120 |
| 4. Stainless steel pipe | : | 100 |

Pump recirculation with a regulating valve shall be provided for all the pumping system.

3.00.00 GUARANTEES

All the design parameters at clause no 2.00.00 of this chapter, i.e. the effluent quality, the design flow, design service length, Chemical consumption for regeneration and Pressure drop across the resin bed in clean and dirty condition at rated design flow shall be guaranteed by the Bidder.

4.00.00 SYSTEM REQUIREMENT

- 4.01.00 The regeneration process offered by the bidder, shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality. Documentary evidence shall be submitted by the bidder to the Customer/BHEL to establish this requirement during detailed engineering stage if required.

- 4.02.00 The bidder shall include inert resin in the system if they feel that it helps in better resin separation.

- 4.03.00 In case, after separation of resins, there are undesired contaminant resins, the bidder shall provide a system either to eliminate this cross contamination of resins or to nullify the detrimental effect of entrapped resins to the effluent quality.

4.04.00 Exchange Resins

- 4.04.01 The bidder shall include with the plant adequate resins for all the condensate polisher service vessels. In addition separate charge of resin shall also be included for using the resins during commissioning stage of unit. Therefore, total number of charges supplied by bidder shall include total resin charges for TG

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units plus one spare charge plus commissioning charge plus one charge to be stored in additional mixed resin storage vessel.

- 4.04.02 The resins shall be in the form of spherical beads. Base of the ion-exchange resins shall be a copolymer of styrene and divinyl benzene forming a macro porous or macrorecticular structure. Other details are as follows:

Cation : Strong acid, with sulfonic acid functional group.

Anion : Strong base, with quaternary ammonium (type I) functional group.

Inert : Non ionic, compatible with the above resin types.

Cation resins shall be supplied in hydrogen form and Anion resins shall be supplied in hydroxide form.

4.04.03 Physical Properties:

- Particle size: The resins shall be in the form of spherical beads. All resins, when wet screened with U.S. standard sieves, shall pass through a No.14 sieve, no more than 2 percent shall be retained on a no. 16 sieve, and no more than 2 percent shall pass through a no. 40 sieve. The particle sizes and densities shall be carefully controlled to facilitate clear separation between the resins during regeneration process.
- Bead Strength: The average force required to fracture individual beads of cation resins in hydrogen form, anion resins in hydroxide form, and the inert resins, shall exceed 350 grams. Not more than 5 percent of the beads tested in each batch shall get fractured by forces less than 200 grams.

4.04.04 Chemical Properties:

- Total wet volume ion-exchange capacities in equivalents/liter shall not be less than the following:

Cation in hydrogen form: 1.7

Anion in hydroxide form: Total Wet volume Exchange Capacity of Anion resin in OH form shall be as per resin supplier's recommendation. However the same shall subject to the customer approval during detailed engineering without any technical, commercial & delivery implications to BHEL and customer.

- The resins shall contain a minimum of metallic and organic impurities consistent with good processing. The processing procedure will include rinsing the resins with demineralized water before packing, so that further rinsing will not be required before use. Foreign objects in the resins shall constitute a basis for its rejection.
- Cation-Anion resin ratio shall be 1.5 parts cation to 1.0 part anion by volume. In case the bidder's process require any non-ionic resin the same shall represent at least 10 percent of the bed volume, but not less than 15 cm of the bed depth in the resin separation tank of the external regeneration facility.
- Manufacturer: It is not the intent to pre-select any specific brand name for this application. Resins will be accepted by the BHEL/Customer strictly on their merits. The resins shall be of reputed manufacturer with adequate past record of successful service for not less than 3 years in similar application.
- Bidder shall submit all necessary data and information in this regard along with his proposal. Some of these possible resin terms are as follows:
 - Duolite C -26 TR & A - 161 TR Rohm and Hass 252 C & TRA-900C.
 - Dowex MSC-1, MSA-1 C grades.

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3. Inert resin – Duolite sec, Rohm & Hass 359 or Dow-buffer beads.

Above listing is by no means exhaustive, and shall not be construed to be a recommendation for their selection for this plant. Bidder shall fully satisfy himself as to the suitability of the resin system selected by him before offering it in his proposal.

- 4.04.05 The resin shall be suitable for the condensate temperature that may be achieved in all operating regimes of TG cycle. However, the anion resin shall be suitable for a maximum temperature of 60 deg.C.

4.05.00 Condensate Polishing Units

- 4.05.01 Operating pressure for service vessels shall be normal operating pressure of condensate extraction pump. Service vessel design pressure shall be equal to shut off pressure of condensate extractions pump plus 5% margin.

- 4.05.02 Design temperature of the service vessel shall take care of all operating regimes including HP-LP bypass operation.

- 4.05.03 Emergency bypass system :

- 1) Each condensate polisher service unit shall be provided with an automatic bypass system for the condensate polisher on the condensate inlet and outlet headers of the unit with a set of control valve with its isolation valves on the upstream and down stream sides of the control valve.
- 2) In the event of excessive pressure differential between the condensate inlet and outlet headers, this control valve will open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a preset limit when all vessels/ two vessels/one vessel/no vessel is in operation.
- 3) Bidder to provide either 2x50% capacity valves or 1x100% control valve to achieve proper control under all operating conditions as per Customer/BHEL's approval of Engineering Documents.
- 4) The isolation valves shall be provided with geared operators for manual operation. The entire system shall be designed for an internal pressure of at least the design pressure of service vessels and for a maximum condensate flow of not less than total design flow of all the working service vessels.
- 5) The control system shall be so designed that the control valve is able to bypass 33% of rated flow when any of the service vessel is out of service, 67% of flow when two vessels are taken out of service and 100% of flow when all the service vessels are out of service.

4.06.00 External Regeneration Facility (Regeneration Plant)

- 4.06.01 Free Board: The pressure vessels in the common external regeneration facility shall be provided with adequate freeboards over the top of the settled resins, to minimize resin loss during their use. Minimum freeboards to be are as follows:

- (i) Mixed resin Storage vessel : 50%
- (ii) Resin separation vessel : 75%
- (iii) Cation regeneration vessel : 75%
- (iv) Anion regeneration vessel and : 75% activated carbon filter

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However, if a vessel is used for more than one service, then the vessel design shall be based on the service which gives maximum freeboard.

4.06.02 Design pressure of the condensate Polisher Service Vessels is indicated elsewhere. For all other Pressure vessels the design pressure shall be at least 8 kg/sq. cm (g).

4.06.03 All equipment for dosing of acid and alkali solutions shall be rated to provide a maximum dosing rate at least 20% in excess of that required from process calculation.

5.04.00 SPECIFIC DETAILS:-

5.01.00 Hot water tank (for alkali)

For heating of alkali diluent water, 2x50% electrical heating coil in a tank of mild steel rubber lined construction shall be provided. The capacity of tank shall be minimum 20% higher than the maximum water demand. This tank shall be provided with burn out protection, pressure relief valve, level switches, temperature indicator etc. The heater shall be controlled by the temperature switches provided on the tank. The heaters shall be sized for heating the water from a temperature of 15 °C to 50 °C at the outlet. The water shall be heated to the required temperature within 5 hours.

5.02.00 Activated Carbon Filter (for alkali):

Rated flow of the filter shall not be less than the design capacity of the alkali transfer-cum recirculation pump, and the maximum velocity through the filter for this flow shall not exceed 12 meters/hour. Depth of the filter material shall not be less than 1 meter.

The filtering medium shall be granulated activated carbon, meeting following minimum requirements.

Total Surface area : Not less than 850 sq.m/gm.

Bulk density : Not less than 400 kg/cu.m.

Iodine number : 850 minimum

Uniformity coefficient : 1.9 or less

Abrasion number : 70 minimum

Ash : 8% maximum

Mean particle diameter shall be about 1.5-1.7 mm with following size distribution:

On 20 mesh : Less than 3%

Through 40 mesh : Less than 10%

Through 50 mesh : Less than 1%

The filter shall be provided with all necessary valves and connections for manual backwashing and rinsing with demineralized water. Rate set valves shall be provided with adjustable limit stops for setting backwash and rinse rates.

5.03.00 DM Water storage tanks for Condensate polishing Plant

5.03.01 Two numbers of DM Tanks shall be provided and the tanks shall be of vertical cylindrical type in Mild steel construction internally painted with epoxy. The design features of the tanks & accessories shall be as per IS:803. However minimum thickness of shell plate, bottom plate and roof plate shall be 8 mm, 10 mm and 6 mm receptively.

1.5 times the DM water required for one regeneration of one TG unit (including resin transfer operation from condensate polishing plant to regeneration plant and vice versa and also for preparation of

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chemicals for regeneration of one unit.) or 450 cum each (whichever is maximum).

Water inlet pipe shall led upto the bottom of DM tanks (preferably through perforated pipe) to avoid turbulence / agitation.

5.04.00 Resin Injection Hopper

5.04.01 The supplier shall provide a hopper type tank for resin make-up, using water slurry, to the condensate polishing systems. This make-up system will constitute a portion of the condensate polishing external regeneration system. The resin hopper shall have a conical bottom an a flat top. The top shall have a piano type hinged port, having a lifting handle, of sufficient size for easy resin loading. The resin shall discharge through a bottom connection to a water ejector for transport. Water shall be added to the hopper to assist in the resin transfer. The ejector discharge shall be to the resin separation-cation regeneration vessel. Demineralized water shall be used throughout for the resin transfer. Piping of the resin make-up system shall be the responsibility of the Bidder as a part of the external resin regeneration system.

a) Capacity

The resin make-up hopper tank shall be sized to handle up to 150 liters of as received new resin per single injection.

b) Material

The resin make-up hopper tank shall be fabricated of mild carbon steel having a minimum thickness of 6 mm and lined.

5.05.00 Piping

5.05.01 Bidder shall design, supply and erect the piping between the service units and the common external regeneration facility, for transferring the exhausted and regenerated resins as required.

5.05.02 All piping shall be laid above ground and generally laid in pipe trestles including crossing of road/pipe/cable trenches if any. Piping of between chemical tanks area and regeneration area etc. may be laid on pedestals if layout permits.

5.05.03 Complete supporting system for the pipeline shall be designed, fabricated and supplied by the Bidder. Inside the building, the overhead portion of the pipeline may be supported from the building structures. In outdoors, the pipeline may run on steel posts. Crossing of the roads shall be on a pipe bridge with a clear height of at least 8 meters over the road surface. All the steel structures of the pipe bridge and the supporting posts along with all necessary hanger, clamps, connecting steel, fixing bolts, nuts, etc. shall be supplied and erected by the bidder.

5.05.04 Routing of this pipe line shall be developed by the bidder and shall be finalized in coordination with the BHEL/Customer, based on the space available and the final layout.

5.05.05 The resin transfer pipeline arrangement shall avoid any sharp bends which cause segregation of the mixed resins, and pockets where the resins can get trapped. Suitable observation ports shall be provided in all critical areas to enable the operator to monitor completeness of the resin transfer operations. All necessary arrangements for venting and draining of the pipeline shall be provided.

5.05.06 The resin transfer pipeline shall be sized for a flow velocity of between 2.3 and 3.0 meters/sec.

5.05.07 The condensate pipeline shall be sized for a flow velocity between 3 and 5 m/sec.

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5.05.08 Remotely operated valves suitably interlocked with the plant operation, shall ensure that the resins get transferred to and from only the particular service vessel which has been selected by the operator.

5.05.09 All lined vessel connections and connections in unlined vessels (25 Nb and larger) shall be flanged to ANSI 125 lb class except the polisher service vessels which shall be ANSI 300 lb class : Flat face flanges shall be used throughout. Nozzle material shall be ASTM-106 Gr.B. Sch.80 pipe for all vessels. All flanged connections shall be supplied complete with matching counter flanges, nuts, bolts and full face gaskets. All the pipeline in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class.

5.06.00 Valves

5.06.01 All valves shall be designed as per applicable AWWA/BID/BS or equivalent international standard / codes.

5.06.02 The isolation valves on the resin transfer line shall be of eccentric plug type/ball valve (full bore type) of stainless steel construction.

5.06.03 Emergency bypass control valve shall be of double flanged butterfly type. Isolation valves of wafer (lugged) type butterfly valves (resilient material seated, to ensure bubble-tight shut off) shall be provided on the upstream and down stream sides of the control valve.

5.06.04 Isolation Valves handling Acid, Alkali, Ammonia etc. shall be diaphragm type in MSRL (mild steel rubber lined) construction.

5.06.05 Isolation Valves handling DM water shall be Butterfly or gate or globe type and shall be SS construction.

5.06.06 Non-return valves for DM Water & alkali shall be SS construction and for acid non return valve shall be lined type or as per manufacturer's standard practice.

5.06.07 All valves in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class.

5.06.08 MOC of butterfly valve at inlet of service vessel seat CS, Disc- SS and outlet of service vessel seat – SS, disc- SS

5.07.00 Pressure Vessels, Atmospheric tanks & Miscellaneous Items

5.07.01 Design pressure of the condensate Polisher Service Vessels shall be as indicated in the data sheet. For all other pressure vessels, unless otherwise mentioned design pressure shall be at least 8 kg/cm²(g)

5.07.02 Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803.

5.07.03 Design of all horizontal cylindrical storage tanks containing water, acid, alkali and other chemicals shall conform to BS EN12285-2:2005.

5.07.04 Unless otherwise mentioned design temperature of all pressure vessels and storage tanks shall be 10 deg.C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation.

5.07.05 In case, tank is subjected to vacuum, the same shall be taken care in designing the tank.

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- 5.07.06 The design of Demineralized water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be “Non-pressure” fixed roof type with atmospheric vents.
- 5.07.07 All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end of torospherical type.
- 5.07.08 Spherical vessels for CPU service vessels are also acceptable.
- 5.07.09 All the atmospheric tanks shall have sufficient free board above the “Level High /Normal Level” as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the “Level High /Normal Level” for all the tank except for the DM tanks for which a minimum height of 300 mm shall be provided over the “High Level”. Further, a minimum 100 mm free board shall be provided above the top of overflow level to the top of tank.
- 5.07.10 Material:
- All pressure vessels shall be designed and constructed in strict accordance with the ASME code Section VIII or acceptable equivalent international standard. Suitable mill tolerances shall be considered for determining the thickness of the shells and dished ends. A minimum thinning allowance of 2 mm shall be considered for the dished ends of torospherical type.
 - Pressure vessel ends shall be of dished design and constructed by forging, pressing or spinning process. Spherical vessels for CPU service vessels are acceptable. Conical or flat ends shall not be accepted. All the atmospheric vessels shall be atleast 6 mm thickness.
 - All pressure vessels shall be fabricated from carbon steel plates to SA-515 / 516 Gr. 70 and lined internally. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore -A meeting the requirements of IS:4682 , Part-I. The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.
- 5.07.11 Vessel internals shall meet the following requirements:
- Inlet water and regenerant distributor :- Hub and internals diffuser splash plate or header and perforated laterals. Material of construction shall be SS-316 except for acid service which will be of Hastelloy-B.
 - Under drains: Same as above with screened laterals with internal perforated pipes and rubber lined flat bottom. For resin separation/regeneration/mixed resin vessels, it may have fully screened bottom (NEVA - clog type with pora septanurese screen, fully supported by subway grid or equal).
 - All internal fastener shall be of SS-316 and heavy duty locknuts shall be used throughout.
- 5.07.12 Resin Traps : Outlet of each condensate polisher vessel, activated carbon filter and waste effluent header of the common regeneration shall be provided with a resin trap. Pressure drop at design flow through a clean resin trap shall not exceed 0.35 kg/sq.cm. Resin trap shall be of rubber lined steel construction and internals (cord & screen) shall be of JOHNSON SCREENS IRELAND or equivalent (SS-316) construction. Resin traps of process effluent line shall have screen opening not exceeding 120 percent of associated process vessel under drain screen opening. Other resin traps shall have screen opening of 60

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mesh. In place manual back flushing shall be provided for all resin traps.

- 5.07.13 Carbon Trap (for ACF) : Outlet of each Activated Carbon filler on Carbon trap (media trap) shall be provided.

6.00.00 CONTROL & OPERATION

6.01.00 General

- 6.01.01 It is not the intent to specify here the complete details of the control system. Basic type of controls required has been specified below. The bidder shall submit with the proposal the complete detail of the system offered by him like the extent of automation offered, operation of the complete system, logic/flow diagrams, type and details of the presentation of information, the type of mimic, hardware details etc. along with detailed circuit descriptions.

- 6.01.02 It shall be possible to operate in Auto/Semi-Auto /Manual mode. In 'Auto' mode, once the sequence has been initiated, it shall proceed from step to step automatically. In 'Semi-Auto' mode each step shall be performed only after initiation by the operator. In 'Manual' mode complete operation shall be by the operator by operation of the Control switches on the panel.

Control for chemical dosing system and alkali preparation facilities shall be provided in it.

- 6.01.03 'Close-Auto-Open' control facility shall be provided from OWS/control panel for solenoid valves. In 'Auto' position, the valves shall receive close / open command from the Control system.

- 6.01.04 'Stop-Auto-Start' Control facility shall be provided from OWS / control panel for the various drives. In 'Auto' position, the drives shall receive stop/start command from the Control system.

- 6.01.05 On control system failure, it shall be possible to operate the valves by means of manual operator of solenoid valves too.

- 6.01.06 The control system shall link the various steps such as closing/opening of different valves, starting/stopping of various pumps etc. which form a sequence. The logic system shall adhere to the correct sequence of operation and predetermined time intervals. The system shall have interlocks so that, criteria necessary for each step are complete prior to proceeding to the next step.

- 6.01.07 It shall be possible to switch mode of operation from one to the other at any moment and the operation shall proceed on the newly selected mode from that time.

- 6.01.08 For steps, which require frequent time adjustment, it shall be possible to change the time setting from the front of the panel. For all other steps it shall be possible to adjust the time setting from inside the panel.

- 6.01.09 For all sequences, the current step number, set time of the step, elapsed time of the step and the total elapsed time of the sequence shall be indicated in the OWS/control panel.

- 6.01.10 Bidder to submit recommended HMI Pictures (MIMIC Diagram) for implementation in DCS for operation & monitoring of CPU.

- 6.01.11 The system shall incorporate the necessary safety features. During automatic sequential operation, if any pre-requisite criterion is not fulfilled or missing for a pre determined time interval, the steps should not

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proceed further, and Alarm shall be provided. Missing criteria, sequence, which is under hold up etc., shall be displayed.

- 6.01.12 The safety system for any sequence/step shall check the opening of the required valves and closure of the remaining valves of the plant to avoid mal-operation.
- 6.01.13 Wherever standby equipments are provided, it shall be possible to select each of the drive on 'standby' duty.
- 6.01.14 The detailed logic for the sequence and for each of the drive shall be subject to the BHEL/Customer's approval.
- 6.01.15 Start, progress and stop of each of the sequence shall be annunciated.
- 6.01.16 The status of vessels of Condensate Polishing Plants shall be available in all the CPP panels of all TG units and as well as in the regeneration plant control panel. Similarly the status of regeneration plant status shall be available in the panels of Condensate Polishing Plants of all TG units.

6.02.00 Control & Operation of the Condensate Polishing Unit

- 6.02.01 The regeneration system control system shall be linked with TG control system for data transfer through a two way link for both information and control.
- 6.02.02 It shall be possible to select each of the CPU vessel for any of the following operations or mode :
 - (1) Standby (Applicable for where spare service vessel (s) are provided)
 - (2) Service
 - (3) Isolation from service.
 - (4) Exhausted Resin Transfer from CPU vessel to Regeneration plant.
 - (5) Regenerated Resin Transfer from Regeneration plant to CPU vessel
 - (6) Rinse mode.

Each mode or operation is described as below:

- 6.02.03 Standby Mode:
 - (1) Among the vessels, any one of the vessels may be selected in this mode.
 - (2) Under this mode, the vessel, which was regenerated in previous cycle and filled with regenerated resin, shall be kept ready for next Service cycle.
 - (3) The selection of any vessel for Standby mode shall be initiated by operator and there shall be indication about the details such as "Condition of the resin ; Whether it is filled with regenerated resin or exhausted resin, whether the standby vessel has undergone rinse cycle or not, date and time of receipt of regenerated resin and completion of rinse cycle etc

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6.02.04 Service mode:

- (1) Service flow rate for each polishing vessel shall be monitored. During periods of low condensate flow the operator may select to remove one of the vessels from service by a manually initiated automatic sequence.
- (2) A differential pressure transmitter installed between the influent and effluent headers will on a high signal cause an alarm and bypass system shall be initiated as described elsewhere in this section.
- (3) By observing the individual vessel flow indicators, or conductivity at vessel outlet the operator can determine which vessel is contributing most to the pressure drop and is in need of resin cleaning.
- (4) Cation conductivity indicators shall monitor the polishing system influent and effluent streams as well as the discharge of each service vessel. A high influent conductivity alarm will alert the plant operator that a problem condition such as air or condenser cooling water leakage has occurred. This conductivity analyzer shall also provide contacts for an alarm at the power station main control room. A high effluent header or service vessel conductivity alarm will alert the operator to the need for regeneration of a polishing vessel.
- (5) When the vessel under Service mode is ready for regeneration, the operator shall change the same into "Isolation mode" in the panel. Subsequently the "Standby vessel" shall be selected for "Service mode" from the OWS/control panel. The selection shall follow, required sequences such as pressurization of the vessel, checking of the effluent quality and putting the vessel in service on satisfactory effluent quality.

6.02.05 Isolation from Service: Normally "Service Vessel" once exhausted shall be isolated from service till the "Resin Transfer" operation is initiated. In addition, provision to be kept for isolation of one or all the vessels from service if required by operator from the panel.

6.02.06 Resin Transfer from CPU vessel to Regeneration plant:

- (1) When a vessel in a service mode needs regeneration as stated above, the resin transfer from the particular vessel to the regeneration plant shall be initiated from the panel of the condensate polishing plant.
- (2) The transfer of resin from the service vessel shall include operations such as isolation of the service vessel, hydraulic transfer of the resin to the external regeneration system (resin separation vessel) and the complete drain down of the service vessel.
- (3) The sequence of "Resin Transfer" operation shall be initiated from the Control system in panel of CPP and shall be controlled in the regeneration Panel.
- (4) The completion of the operation shall be exhibited in the panel.

6.02.07 Resin Transfer from Regeneration Plant to CPU Vessel :

- (1) When the regeneration is completed in the regeneration plant, the resin shall be transferred to the empty vessel of Condensate Polishing plant.
- (2) This shall be initiated by the operator from the control panel of condensate polishing plant of the unit from which resin was transferred to the regeneration plant in previous service. Provision shall also be kept to transfer the regenerated resin to any of the empty vessel of the CPP of any of the TG unit if required.

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- (3) The transfer of resin from the regeneration plant shall include operations such as hydraulic transfer of the resin and the complete drain down of the water.
- (4) The sequence shall be initiated from the panel of CPP and shall be controlled in the regeneration Control Panel.
- (5) The completion of resin transfer operation shall be exhibited in both the Control panels.

6.02.08 Rinse mode :

- (1) After transfer of regenerated resin from the regeneration plant to the empty condensate polisher vessel, this rinse cycle shall be initiated from the Control system of the respective unit so that the vessel may be rinsed and kept ready for next service cycle.
- (2) The rinse mode shall be a manually initiated full automatic sequence. This sequence shall include the rinse down step using condensate at a suitable rate until the unit effluent quality is acceptable for boiler feed water. Prior to rinsing, the resin shall be given air scrub by means of air blowers provided near the CPP.
- (3) The effluent quality shall be determined by conductivity monitoring of the rinse water outlet, which is returned to the condenser hotwell for recycle.
- (4) Cation conductivity values shall be monitored and interlocked to prevent advancing of the automatic sequence until the rinse down is complete.
- (5) The completion of rinse operation shall be annunciated in the panel so that the rinsed vessel may be selected for "Standby mode" or "Service mode" as per requirement.

6.03.00 External Regeneration Control System


- 6.03.01 A manually initiated automatic sequence for physical cleaning and chemical regeneration of the resin shall be provided. Control for chemical dosing system and alkali preparation facility shall also be provided in it.
- 6.03.02 Physical cleaning of the resin shall consist of three steps, drain to level, air scrub and rinse. The air scrub and rinse steps are of short duration, approximately 1 and 2 to 3 minutes respective time. However the program will allow the operator to increase or decrease the number of times the sequence is repeated to meet the requirements existing at that time.
- 6.03.03 The chemical regeneration is a many step sequence. This will include hydraulic reclassification of the resins and the transfer of the resins to the respective regeneration vessels. The Bidder may include a layer of inert, intermediate density resin to achieve a better separation of the cation and anion resins, improve resin regeneration, and reduce leakage. The separated resins are then back washed, regenerated with hydrochloric acid and sodium hydroxide solutions respectively and then rinsed. Following the rinse step the resins shall be given an air scrub followed by a good backwash. The resin is then transferred back to the resin separation vessel and the resins are air mixed. The mixed resins after regeneration are given a final rinse with the discharge conductivity being monitored. The quality of this discharge will determine if the regeneration has been effective. If the quality is not satisfactory the regeneration sequence must be repeated . If satisfactory, the mixed resin is transferred to the resin storage vessel.

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- 6.03.04 A resin mixing and final rinse may occur in the resin storage vessel provided that the system design will permit direct return of the resins to the resin separation vessel in the event of an unsatisfactory regeneration.
- 6.03.05 Upon satisfactory completion of regeneration, the status shall be annunciated audio-visually in the regeneration system OWS/control panel and as well as in the Balance of Plant Control System. This repeat annunciation in the CPP OWS/panel shall facilitate the operator to initiate resin transfer operation from the regeneration plant to the desired vessel of the Unit in which the service vessel is empty.
- 6.03.06 Upon resin transfer operation from regeneration plant as described by the operator from the I Control System, the regeneration plant shall be ready to receive next batch of exhausted resin from any of the CPP. The status of regeneration plant (Whether ready to receive resin for regeneration or under regeneration etc) shall be available in the Control System of CPP.
- 6.03.07 Demineralized water shall be used throughout the regeneration process for backwashing, diluting the regenerant, rinsing and resin transfer.
- 6.03.08 A conical bottom hopper having a water ejector will be used for resin make-up.
- 6.03.09 At any time only one of the sequence shall be in progress.
- 6.04.00 Interlocks**
- 6.04.01 All interlocks for safe operation of the plant shall be provided. They shall specifically include the following as minimum requirement.
- 6.04.02 Service vessels can be back in service, only after they have been pressurized.
- 6.04.03 Service vessels can be taken up for resin transfer only after they have been completely isolated from the condensate system and depressurized.
- 6.04.04 Resin can be transferred to and from only one service vessel at a time.
- 6.04.05 Resin transfer between the service and the regeneration skids shall be permitted only when the receiving vessel is initially empty.
- 6.04.06 Regeneration sequence can commence, only when the level in the waste neutralisation pit is low enough to receive the entire waste quantity of waste water from the regeneration operation.
- 6.04.07 Wherever possible, completion of all timed steps in the regeneration and resin transfer process shall be physically verified by effluent conductivity etc, as applicable. The automatic sequence shall be prevented from advancing to next step, till these required physical conditions are achieved, and at the same time this delay shall be annunciated in the control panel, to draw the attention of the operator. The automatic sequence of operations shall be interruptive at any time by the operator and he shall be able to take over the control to manual from that step onwards. Further operator should be able to over ride sequence, if required. It shall be possible for the operator to extend the timing of a particular step by isolating the timer for the duration. The timer will restart once the operator puts back the system on 'auto' and the other steps will then follow as programmed.
- 6.04.08 The regeneration sequence shall be prevented from advancing further in the event of tripping of a running motor or other fault condition, which do not permit the various desired parameter of this step to be achieved. A manual override for this shall also be provided.

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- 6.04.09 Annunciation logic shall be carefully designed so that the alarms are activated only under abnormal conditions. As for example, low flow of diluent water is only relevant when the chemical dosing is in progress. All other times, when no diluent water flow is required, this annunciation should be blocked. In general, Normal and trouble free operation of the plant shall not activate any of these alarms.
- 6.04.10 Adequate diluent water flow shall be established before starting of the ejectors/ dosing pumps for acid and alkali.
- 6.04.11 The immersion heater in the hot water tank can be put on only when there is adequate water level in the tank.
- 6.04.12 CPU service vessel inlet & isolate valves will close automatically in the event of tripping of condensate extraction pump.

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TECHNICAL SPECIFICATION FOR PRESSURE & STORAGE VESSEL

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1.00.00 GENERAL

The following principal pressure and atmospheric vessels for the system has been covered in this part of specification.

1. Condensate Polisher Service vessels.
2. Condensate Polisher Resin Separation and Cation Regeneration vessel.
3. Condensate Polisher anion regeneration vessel.
4. Condensate Polisher mixed resin storage Vessel.
5. Alkali diluent Heating cum Storage Vessel.(hot water tank)
6. Activated carbon filter
7. Alkali Preparation Tank
8. Alkali Day Tank
9. Resin Injection Hopper
10. Acid Measuring Tank.
11. Acid Storage Tank
12. DM storage tank.
13. Alkali storage tank

1.01.00 Of these, the items specified from sno 1 to 6 shall be designed as pressure vessels and the rest shall be atmospheric vessels.


1.01.01 All other vessels, not specifically listed here, but required for the Bidder's system shall also meet the general requirements of this specification.

1.01.02 Process requirements of these vessels shall be governed by the requirements of the Condensate Polishing System, which will determine their design conditions. Following sections only indicate some of the minimum requirements which must be met, and the actual design of these vessels shall be better than these, if that is required from process considerations.

2.00.00 GENERAL DESIGN FEATURES


2.01.00 Design

2.01.01 Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent international standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 10% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the

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pumps plus static head at pumps suction if any. Design pressure of condensate service vessels is indicated elsewhere in this specification. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g).

- 2.01.02 Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803.
- 2.01.03 Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali and other chemicals shall conform to BS: 2594.
- 2.01.04 Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation.
- 2.01.05 In case, tank is subjected to vacuum; the same shall be taken care in designing the tank.
- 2.01.06 The design of Demineralised water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be "Non-pressure" fixed roof type with atmospheric vents.
- 2.02.00 All vessels / tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end. Vessel ends shall be of dished design and constructed by forging, pressing or spinning process. Conical or flat ends shall not be accepted. All dished ends shall be stress relieved.
- 2.03.00 All the atmospheric tanks shall have sufficient free board above the "Level High"/"Normal Level" as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the "Level High"/"Normal Level" for all the tanks except for the DM tanks for which a minimum height of 300 mm shall be provided over the "High Level". Further, a minimum 100 mm free board shall be provided above the top of overflow level to the top of the tank. Wall thickness of atmospheric tanks shall not be less than 6 mm.
- 2.04.00 Vessels coming under preview of IBR shall be designed accordingly.
- 2.05.00 Interior surfaces of all tanks shall be clear of stiffeners and other structural supports. Tanks shall be reinforced and stiffened externally as required.
- 2.06.00 All welds on inner tank surface shall be free of voids, gaps craters, pits, high spots, sharp edges, abrupt ridges and valleys or undercut edges. High spots, irregularities and sharp edges shall be removed by grinding. Inside weld seams shall be ground flush and smooth applicable for corrosion resistant coating or lining.
- 2.07.00 All internal baffles, wear plates, pipes etc. shall be continuously welded on both sides at all contact points with full fillet welds which shall be free of voids, gaps, craters, high spots, sharp edges, and undercutting. Sharp edges shall be ground to a 3 mm minimum radius.
- 2.08.00 Weld splatter shall be removed.
- 2.09.00 All welding shall be performed by ASME qualified welders under Section-IX of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc.

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2.10.00 The plates for cylindrical tanks shall be accurately formed in bending rolls to the diameters called for, and the completed shells be concentric and plump. Plates shall be cold-rolled by plate bending machine in a number of passes to true curvature and joined by welding.

2.11.00 Vessels seam shall be so positioned that they do not pass through vessel connections.

3.00.00 MATERIAL OF CONSTRUCTION

3.01.00 All pressure vessels shall be fabricated from carbon steel plates to SA-285C or SA- 516 Gr. 70 and lined internally. All atmospheric tanks shall be fabricated of steel conforming to IS 2062 and lined internally.

4.00.00 APPURTENANCES

4.01.00 Manholes

4.01.01 All the pressure vessels and horizontal type storage tanks shall be provided with manhole of 500 mm diameter minimum size, preferably at the top head, complete with cover plate, lifting handle, davit cap, nuts, bolts, gaskets etc. to ensure leak tightness at the test pressure.

4.01.02 The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the DM water storage tanks, manholes shall be provided as per IS:803.

4.01.03 All the vessels and tanks shall be normally provided with a six inch gasketed handhole located near the bottom of the straight side.

4.01.04 The required lining/coating for the inside surface of the manhole/handhole, nozzle and cover plate of the manhole/handhole shall be same as that of the respective vessel/tank.

4.01.05 Sight Glasses

All the vessels mentioned shall be provided with pad type sight glasses on their vertical sides. Locations of these sight glasses shall be as follows:

4.01.06 One with the centre line at the normal level of the bed top, and one near the bottom of the straight side, for each of these vessels.


4.01.07 In addition, item no. 1.00.00 shall be provided with sight glasses, with their center lines at each of the normal separated resin interfaces.

4.02.00 Lifting Lungs

All vessels of diameter 1200mm or greater shall be provided with a minimum of 4 lifting lugs. Smaller vessels shall be provided with at least 2 lifting lugs.

4.03.00 Vessels Supports

Adequate supporting arrangements like straps, saddles, skirt rings, or legs of steel shall be

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provided to transfer all loads to the respective skid structures.

4.04.00 **Vessel Internals**

The internals for pressure Vessels shall be designed for a low pressure drop to promote uniform distribution and flow through the vessels and to withstand the full design pressure of the vessel in both directions.

Specification requirements for vessel internals are as follows:

4.05.00 **Inlet water and Regenerant Distributors**

Hub and laterals with diffuser splash plates or header and perforated laterals. Material of construction shall be type 316 stainless steel, except for acid service which shall be of Hastelloy B.

4.06.00 **Underdrains**

Same as above with screened laterals with internal perforated pipes, and rubber-lined false bottom. For resin separation/regeneration/mixed resin vessels, it may have fully screened bottom (NEVA – clog type with para Septanurse screen, fully supported by subway grid, or equal).

4.07.00 For lined vessels, they shall also be lined in the same manner as the internal surfaces of these vessels. For the caustic diluent heating/storage tank, they shall be of type 304 stainless steel construction.

4.08.00 **Internal Fasteners**

All internal fasteners shall be of type 316 stainless steel and heavy duty locknuts shall be used throughout.

4.09.00 **Piping Connections**


All lined vessel connections and connections in unlined vessels 25 NB and larger shall be to ANSI 300 lb class. Flat face flanges shall be used throughout. Nozzle material shall be ASTMA-106. Grade B. schedule 80 pipe. All flanged connections shall be supplied complete with matching counter flanges, nuts, bolts and full-face gaskets.

4.10.00 All vessel connections in unlined tanks smaller than 25 NB shall be screwed to ANSI 2.1 for schedule 80 pipe.

4.11.00 **Resin Traps**

Outlets of each of the condensate polisher service vessel and the waste effluent header of the common external regeneration facility, shall be provided with a resin trap. These resin traps shall be a minimum, conform to the following:

4.11.01 The resin trap shells shall be of steel construction and lined internally with saran or Polypropylene. The internals for all traps shall be johnson well screen type, of 316 stainless steel in both directions, resin traps located in processes effluent lines shall have a screen

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opening that does not exceed 120 percent of the associated process vessel under drain screen opening. Resin traps located in waste effluent headers shall have a screen opening of approximately 60 mesh.

4.11.02 Each resin trap shall be fully piped and valved for inplace manual back flushing.

5.00.00 **SPECIFIC DETAILS**

5.01.00 **Alkali Diluent Heating – Storage Tank (Hot water tank)**

This vessel shall be sized to hold a minimum of 5000 liters of 80 deg C demineralised water required for the regeneration of condensate polisher. In sizing this vessel, preheating of the anion resins shall not be considered as a requirement. The cold water feed line shall enter the tank through or near the top head and extend downward to within 15 cm of the tank bottom. Recovery time shall not exceed 4 to 5 hours.

All tank internals, including the inlet water tail pipe, shall be fabricated of type 304 stainless steel.

5.02.00 **Atmospheric Tanks**

Wall thickness of these tanks shall not be less than 6mm.

5.03.00 **Resin Injection Hopper**

The supplier shall provide a hopper type tank for resin make-up, using water slurry, to the condensate polishing systems. This make-up system will constitute a portion of the condensate polishing external regeneration system. The resin hopper shall have a conical bottom and a flat top. The top shall have a piano type hinged port, having a lifting handle, of sufficient size for easy resin loading. The resin shall discharge through a bottom connection to a water ejector for transport. Water shall be added to the hopper to assist in the resin transfer. The ejector discharge shall be to the resin separation-cation regeneration vessel. Demineralized water shall be used throughout for the resin transfer. Piping of the resin make-up system shall be the responsibility of the Bidder as a part of the external resin regeneration system.

a) **Capacity**

The resin make-up hopper tank shall be sized to handle up to 150 liters of as received new resin per single injection.


b) **Material**

The resin make-up hopper tank shall be fabricated of mild carbon steel having a minimum thickness of 6mm and lined.

5.04.00 **Chemical preparation and day tanks**

These shall be vertical cylindrical tanks. They shall be of carbon steel fabrication, lined and provided with full height level gauges right up to the overflow levels.

The alkali preparation tank shall be provided with a dissolving basket of type 316 stainless

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steel constructions, and a motorized slow speed stirrer mounted eccentrically to the tank by a bracket fixed to the side wall. The stirrer shall have impellers of type 316 stainless steel.

The alkali day tank shall be provided with an airtight cover complete with a breather arrangement, to prevent absorption of carbon dioxide from the atmosphere by the alkali solution contained in it. The overflow connection shall also be provided with a suitable seal for this purpose.

The tanks for ammonia solution (if applicable) shall also be provided with similar arrangements to prevent escape of ammonia vapor to outside.

5.05.00 **LINING**

All internal lining of vessels provided under this specification shall be of natural rubber, meeting the following minimum requirements.

5.05.01 **Hardness**

Lining used may be soft rubber having a shore durometer reading of 4070 on the D scale, or semi-hard rubber having a durometer reading of 4570 on the D scale. Variations in hardness of the rubber lining between the different areas of a specific tank shall be within +/-5 durometer reading.

5.05.02 **Chemical Resistance**

The lining material shall be suitable for prolonged service in the chemical environment described below:

- Hydrochloric acid, 2 to 8% concentration, at temperature from 10 deg C to 50 deg C.
- Sodium hydroxide, 1 to 4% concentration, at temperature from 30 deg C to 50 deg C.
- 100 to 500 mg /l of sulphuric and hydrochloric acid combined. Ratio of concentration of these two acid 1 : 5 to 5 : 1 and temperatures from 10 deg C to 40 deg C.
- 1 to 10mg/l of sodium hydroxide at temperature from 10 deg C to 40 deg C.


The linings will be subjected to the condition (a) or (b) for intermittent periods of approximately one hour out of eight hours, and to conditions (c) or (d) remainder of the time.

5.05.03 **Thickness**

The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.

5.05.04 **Surface Preparation**

Prior to rubber lining all surfaces must be prepared in the following manner.

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- a) Degrease surface prior to blasting.
- b) The surface is to be blasted with steel grit or sharp silica sand to a white and bright metal surface.
- c) All traces if grit and dust should be removed with a vacuum cleaner or by brushing. Care must be taken to avoid contaminating the surface.
- d) Immediately after blasting and removal of grit, the first coat of primer or cement shall be applied and allowed to dry.

5.05.05

Protection

After the lining is completed the vessels shall not be subjected to any prolonged exposure to direct sunlight in course of it's transportation erection, etc. They shall not also be stored in direct sunlight. No further welding or burning shall be carried out on the vessel, after application of the lining.

All lining projecting outside of the vessel, shall be protected adequately from mechanical damages during shipment, handling, storage etc.

Suitable warning, indicating the special care that must be taken with respect to these lined vessels, shall be stenciled on their outside surfaces with the letter at least 12mm high.

Example:

“Warning – Tank is lined”

“Do not weld or Burn”

“Do not Store in Direct Sunlight” etc.


6.00.00

CODES AND STANDARDS

The design, manufacture, shop testing, site fabrication and erection, testing and commissioning of the pressure and storage vessels shall conform to the latest revisions of the following standards, in addition to other standards mentioned elsewhere in the tender document subject to any modification and requirement, as specified here in after.

- a) IS: 803 - Code of practice for design, fabrication and erection of Vertical Mild Steel cylindrical welded oil storage tanks.
- b) IS: 816 - Code of practice for use of metal arc welding for general construction in mild steel.
- c) IS: 817 - Code of practice for training and testing of metal arc welders.
- d) IS: 822 - Code of procedure for inspection of welds.
- e) IS:1363 - Black hexagonal bolts, nuts and locknuts (dia 6 to 39 mm) and black hexagon screws (dia to 24 mm).


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|----|---------|---|----------------------------------------------------------------------------------------------------|
| f) | IS:1367 | - | Technical supply conditions for threaded fasteners. |
| g) | IS:2062 | - | Specification for weld able structural steel. |
| h) | IS:2002 | - | Steel plates for pressure vessels for intermediate and High temperature service including boilers. |
| i) | IS:2825 | - | Code of unfired pressure vessels. |
| j) | IS:3133 | - | Manhole and inspection opening for chemical equipment. |
| k) | IS:4049 | - | Specification for formed ends for tanks and pressure vessels. |
| l) | IS:4682 | - | Code of practice for lining of vessels and equipment for chemical processes Rubber Lining. |
| m) | BS:2594 | - | Specification for carbon steel welded horizontal cylindrical storage tanks. |
| n) | ASME | - | Boiler and pressure vessel Section VIII code. |
| o) | ASTM | - | American Society for Testing and Materials. |


7.00.00 FABRICATION

- 7.01.00 The vessel ends for storage tanks of vertical type shall have flat bottom. However, the ends of horizontal storage tanks, and all the pressure vessels shall be dished design of Tori-spherical type designed.
- 7.02.00 The plates to be used for fabrication shall preferably have a minimum width of 1500 mm.
- 7.03.00 All the joints (circumferential / longitudinal) shall be continuous butt welded, inside and outside. Connection shall be flush with inner surface of tanks and welded continuously on both sides of shell. Sharp inside edges shall be rounded to a minimum 3 mm radius.
- 7.04.00 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 engineers. Welding shall not be carried out when the surface of the parts to be welded are wet from any cause and during periods of rain and high winds unless the welder and work are properly shielded.
- 7.05.00 All pressure vessels and storage tanks except Demineralised water (D.M.) shall be fabricated complete and tested at manufacturer's works to ensure better workmanship.
- 7.06.00 **Tank Connections**
- 7.06.01 Bidder shall furnish all pipe material required for tank connection for the process requirement. In addition to these, additional connections, if required by the Owner for the inter-connection of their piping, instrumentation etc. shall also be provided. Such additional requirement will be intimated to the successful Bidder later and Contractor shall provide

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these fittings to match with the Owner's items. Adequate pipe support attachments in the external surface of the tank/vessel shall be provided for Owners pipes for all the vessels/tanks. All lined vessels connections shall be conforms to ANSI 300 lb class. Nozzle material shall be ASTM-106 Grade B, Schedule 80.

- 7.06.02 All flanged connections should be supplied complete with matching counter flanges, nuts bolts and gasket materials. The flange design, (thickness and drilling etc.) shall match with the interconnected piping flanges.
- 7.06.03 Bolts and nuts to be used externally to the vessels shall be of hexagonal head conforming to IS:1367. However, internal fasteners if any, shall be of IS:316 /SS-304 or Hastalloy-B as per the duty conditions.
- 7.06.04 Gaskets shall be of full face type.
- 7.06.05 Sight glasses shall be provided for the tanks/vessels as specified in the standard specification. The material for sight glass shall be high quality transparent PLEXIGLASS of sufficient thickness to withstand the test pressure. The sight glass shall be provided with suitable gaskets and bolts to ensure leak tightness at the test pressure.
- 7.07.00 **Vessels Supporting Lifting Lugs**
- 7.07.01 Adequate supporting arrangements like straps, saddles, skirt boards, pillars etc. shall be provided to transfer all loads to civil foundation. All foundation bolts, inserts etc. shall also be provided.
- 7.07.02 All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs.
- 7.07.03 Material of construction for these vessel supports, saddles, lugs shall conform to IS:2062 of tested quality.
- 7.08.00 **Special Accessories Storage Tanks**
- 7.08.01 Vessel internals wherever required shall be provided as detailed out elsewhere in the specification.
- 7.08.02 All the pressure vessels and tanks shall be provided with drain connections along with drain valves of suitable size. Further all the atmospheric storage tanks shall be provided with over flow connection designed for the filling rate of the respective tank.
- 7.08.03 All the pressure and tanks shall be provided with the vent connections. The design shall be as to offer adequate area for venting. Venting area shall be such that over pressure/vacuum is not created in the tank during maximum filling/drain-off rate. The maximum draw off rate for the DM storage tanks shall be intimated later to the successful bidder.
- 7.08.04 Various instrumentation and the fittings required for the same shall be supplied as elaborated in data sheets.
- 7.08.05 Water seal shall be provided for the overflow line of DM and degassed water storage tanks. The vent and overflow lines of alkali preparation /measuring / day tanks and vent line of DM storage tanks shall be provided with Carbon dioxide absorber of proven design to prevent

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contamination from atmospheric air. Carbon dioxide absorber shall preferably be located at ground level. The vent and overflow lines of Acid measuring tanks shall be provided with fume absorber using suitable packing material, such as pall rings/raschig rings.

7.08.06


Conservation vent valves shall be provided in the vent line of DM storage tanks so that, at a vacuum to the extent of 65 mm water column, the valve shall open to relieve the vacuum. Body and trim of the valve shall be Die Cast Aluminum.


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TECHNICAL SPECIFICATION FOR PIPING, VALVES AND FITTINGS


CLAUSE NO.	TECHNICAL REQUIREMENTS			<div>एनडीपीसी NTPC</div>																																					
	<div><u>LOW PRESSURE PIPING</u></div>																																								
1.00.00	EQUIPMENT SIZING CRITERIA																																								
1.01.00	All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.																																								
1.02.00	For all L.P. piping system covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated elsewhere. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.																																								
1.03.00	<p>Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following:</p> <p>a) Water Application</p> <table><tr><th colspan="2"></th><th colspan="3">Water Velocity in m/sec</th></tr><tr><th></th><th>Pipe Size</th><th>Below 50 mm</th><th>50-150 mm</th><th>200 mm & above</th></tr><tr><td>(a)</td><td>Pump suction</td><td>-----</td><td>1.2-1.5</td><td>1.2-1.8</td></tr><tr><td>(b)</td><td>Pump discharge and recirculation</td><td>1.2-1.8</td><td>1.8-2.4</td><td>2.1-2.5</td></tr><tr><td>(c)</td><td>Header</td><td>-----</td><td>1.5-2.4</td><td>2.1-2.4</td></tr></table> <p>Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.</p> <p>WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value:</p> <table><tr><td>(i)</td><td>Carbon steel pipe</td><td>100</td></tr><tr><td>(ii)</td><td>C.I Pipe/ Ductile Iron.</td><td>100</td></tr><tr><td>(iii)</td><td>Rubber lined steel pipe</td><td>120</td></tr><tr><td>(iv)</td><td>Stainless steel pipe</td><td>100</td></tr></table> <p>For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water.</p> <p>(b) Compressed Air Application</p> <p>Compressed air - 15.0 m/sec.(under Average Pressure & Temp. conditions)</p>						Water Velocity in m/sec				Pipe Size	Below 50 mm	50-150 mm	200 mm & above	(a)	Pump suction	-----	1.2-1.5	1.2-1.8	(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5	(c)	Header	-----	1.5-2.4	2.1-2.4	(i)	Carbon steel pipe	100	(ii)	C.I Pipe/ Ductile Iron.	100	(iii)	Rubber lined steel pipe	120	(iv)	Stainless steel pipe	100
		Water Velocity in m/sec																																							
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CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एनटीपीसी NTPC</div>																																														
1.04.00	The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.																																															
1.05.00	Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.																																															
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered.																																															
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																																															
1.08.00	High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.																																															
1.09.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																																															
1.10.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																																															
1.11.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																																															
1.12.00	Threaded joints shall be provided with Teflon sealant tapes.																																															
1.13.00	Following types of valves shall be used for the system/service indicated. <table><thead><tr><th>SYSTEM</th><th colspan="6">TYPES OF VALVES</th></tr><tr><th></th><th>Butterfly</th><th>Gate</th><th>Globe</th><th>Check</th><th>Ball</th><th>Plug</th></tr></thead><tbody><tr><td>Water</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Air</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Drains & vents</td><td></td><td>x</td><td>x</td><td>x</td><td></td><td></td></tr><tr><td>Fuel oil (if any)</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr></tbody></table>	SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x					
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Drains & vents		x	x	x																																												
Fuel oil (if any)		x	x	x	x	x																																										
1.14.00	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.																																															
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.00.00	TECHNICAL SPECIFICATION			
2.01.00	GENERAL			
	Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.			
2.02.00	Pipes and fittings			
2.02.01	All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.			
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.			
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.			
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).			
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.			
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.			
2.02.08	For rubber lined ERW pipes, beads shall be removed.			
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.			
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.			
2.02.11	<p>For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.</p> <p>Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.</p>			
2.03.00	Material			
2.03.01	Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.			
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.			
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.			
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.			
2.03.05	Material of construction for pipes carrying various fluids shall be as follows:			
	1	Raw water, ash water, circulating Water, aux. cooling water, clarified Water, service water, air pre-heater Wash water, clarifier sludge and Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain	IS-2062 Gr. B/ASTM A-36/ASTM A-53 type 'E' Gr.B / IS-3589 Gr. 410 /IS-1239 Heavy. For equipment cooling water system wherever DM water is used or alkaline solution is used for pipes 50NB and below, pipe	
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CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<p>water</p> <p>material shall be stainless steel to ASTM A312 Gr. 304 sch. 40 Seamless.</p> <p>2 Demineralised water, (condenser Make up water, Boiler fill and Deaerator Fill water, equipment cooling Water piping from overhead tank to Suction header of DMCW pumps and chemical dosing system to Primary circuit of equipment Cooling water (DMCW System), ECW overhead tank make-up water</p> <p>Stainless steel to ASTM A-312, Gr.304 welded for sizes above 50mm NB</p> <p>Stainless steel to ASTM A312, Gr. 304 sch. 40 Seamless for sizes 50mm and below</p> <p>3 Drinking water</p> <p>ASTM A-53 type E Gr. B galvanized/ IS 1239 heavy galvanized/IS 3589 Gr 410 Galvanized to IS- 4736 or equivalent.</p> <p>4. Instrument air & plant air.</p> <p>ASTM A-53 type E Gr. B galvanized/ IS 1239 heavy galvanized/IS 3589 Gr 410 galvanized to IS- 4736 or equivalent.</p> <p>5. (Condensate) spill water/ Deaerator Drain</p> <p>ASTM A 106 Gr. B</p> <p>6. Oil piping</p> <p>API 5L</p> <p>2.03.06 In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.</p> <p>2.03.07 Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).</p> <p>2.03.08 In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.</p>	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.</p>			
2.03.09	<p>Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).</p>			
2.03.10	<p>Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.</p>			
2.03.11	<p>Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.</p>			
2.03.12	<p>If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.</p>			
2.04.00	<p>Piping layout</p>			
2.04.01	<p>Piping shall be grouped together where practicable and routed to present a neat appearance.</p>			
2.04.02	<p>Piping routing shall be such as to provide sufficient clearance for removal and maintenance of equipment, easy access to valves, instruments and other accessories. The piping shall not encroach on the withdrawal space of various equipments.</p>			
2.04.03	<p>Over head piping shall have a normal minimum vertical clearance of 2.5 meters above walkways and working areas and 8m above roadways/railways. When several pipe lines are laid parallel, flanged joints must be staggered. Welded and flanged joints should as far as possible be located at one third span from supports. if the support is situated right under the welded joints this joint must be reinforced with a strap. Flanged and welded joints must be avoided in the middle of the span. Valves should be located in such a manner so as to ensure their convenient operation from the floor or the nearest platform.</p>			
2.04.04	<p>Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.</p>			
2.04.05	<p>All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment etc.</p>			
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	<p>Adequate clearance shall be ensured with respect to the above to accommodate insulation and pipe movements, if any.</p>			
2.04.06	<p>Piping shall generally be routed above ground but where specifically indicated/approved by the Project Manager the pipes may be arranged in trenches or buried. Pipes at working temperature above the ambient shall however not be buried.</p>			
2.04.07	<p>Sufficient up stream and down stream lengths shall be provided for flow measuring devices, control valves and other specialties.</p>			
2.04.08	<p>All local instruments shall be located on pipe lines as to render them observable from the nearest available platforms.</p>			
2.04.09	<p>Openings provided in the wall for pipelines must be closed with bricks and mortar with 10-12 mm clearance between brick work and pipe after taking care of insulation and thermal movement, if any. The clear space must be filled with felt or asbestos or approved filling compound.</p>			
2.05.00	Slope/Drains and Vents			
2.05.01	<p>Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.</p>			
2.05.02	<p>Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.</p>			
2.06.00	Pipe Joints			
	<p>In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.</p>			
2.06.01	Screwed			
	<p>(a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/IS: 554 unless specified otherwise.</p>			
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2.06.02	<p>(b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be joined by welding. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.</p> <p>(c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.</p> <p>(d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.</p> <p>(e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.</p>			
	<p>Welded</p> <p>(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt</p>			
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2.06.03	<p>welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.</p> <p>Flanged</p> <p>(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.</p> <p>(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.</p> <p>(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.</p>	
2.07.00	Bends/elbows/mitre bends/ Tees/ Reducers & other fittings	
2.07.01	Unless otherwise specified elbows shall be of long radius type.	
2.07.02	For pipe sizes up to 65Nb, long radius forged elbows or seamless pipe bends shall be used. Pipe bends, if used, shall be cold bent to a radius measured to the centre line of pipe of 3 to 5 times the pipe diameter.	
2.07.03	For steel pipes 80 Nb and above, seamless long radius forged elbows shall be used. For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.	
2.07.04	Mitre bends are not acceptable in case of rubber lined mild steel pipes.	
2.07.05	<p>For pipe fittings such as reducers and tees, the material shall be to astm-a-234 gr. WPB up to 300 NB. For pipe reducers and tees above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9.</p> <p>However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.</p> <p>For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.</p>	
2.07.06	Stainless steel fittings shall conform to either ASTM-A-182, Gr. 304 (316 for Sea water application, if any) or ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any) Class-S, for sizes up to and including 50mm NB, i.e., the fitting shall be of seamless construction.	
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	<p>However, for stainless steel fittings above 50mm NB, the same shall conform to ASTM-A-403, Gr. WP 304 (316 for Sea water application, if any), Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.</p>			
2.07.07	<p>In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.</p>			
2.08.00	<p>Flanges</p>			
2.08.01	<p>Flanges shall be slip on type. Welding of flanges in tension is not permitted.,</p>			
2.08.02	<p>All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 (316 for Sea water application, if any) or equivalent.</p>			
2.09.00	<p>Specific technical requirement of laying buried pipe with anti corrosive treatment</p> <p>The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.</p>			
2.09.01	<p>Trenching</p> <p>(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822.</p> <p>(b) Free access shall be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained.</p> <p>(c) The free working space shall conform to IS: 5822. The trench shall be excavated so as to provide minimum cover of 1000mm between the top of the pipe and finished grade.</p> <p>(d) Prior to lowering and laying pipe in any trench, the bidder shall backfill and compact the bottom of the trench or excavation in accordance with is: 5822 to provide an acceptable bed for placing the pipe.</p> <p>(e) Coating and Wrapping shall be done as under</p>			
2.09.02	<p>Preparation and cleaning of piping</p> <p>(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Kerosene will not be permitted for</p>			
<p>MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION - VI PART-B</p>	<p>A-6 LOW PRESSURE PIPING</p>	<p>PAGE 10 OF 28</p>


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2.09.03	<p>cleaning. This cleaning operation shall be immediately followed by priming with the mechanical priming machine.</p> <p>(b) Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.</p> <p>(c) The cleaning and priming operation shall be carried out at site. The entire pipe length shall be cleaned but the ends of the pipes shall be left without coating for a distance of 230mm for joints, which shall be coated manually at site after laying, welding and testing the pipe.</p> <p>(d) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.</p>			
	<p>Coating and wrapping</p> <p>(a) Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:</p> <p>(1) Coating primer (coal tar primer)</p> <p>(2) Coating enamel (coal tar enamel)</p> <p>(3) Wrapping materials.</p> <p>(b) All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.</p> <p>(c) Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat</p> <p>(d) Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.</p> <p>(e) Total thickness of completed coating shall not be less than 4.0 mm.</p> <p>(f) Alternatively, the anti-corrosive protection can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to AWWA-C-203. These-tapes shall be applied hot over the cold coal tar primer preferably in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.</p>			
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2.09.04	<p>Trench bed preparation and back filling</p> <p>Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.</p>			
2.09.05	<p>Laying of galvanized steel (GI) pipes</p> <p>All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.</p> <p>All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.</p>			
2.10.00	<p>Cleaning and flushing</p>			
2.10.01	<p>All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.</p>			
2.10.02	<p>Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done in such a manner that the coating on MS pipe is not affected.</p>			
2.10.03	<p>After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.</p>			
2.10.04	<p>All compressed air pipe work shall be cleaned by blowing compressed air.</p>			
2.11.00	<p>Surface preparation and painting</p> <p>Pipes shall be cleaned both internally and externally thoroughly by blast-cleaning or power tool cleaning method as indicated above.. In case of oil piping, cleaning will have to be done by pickling. No painting is required on stainless steel pipe / equipment surface, galvanized pipe surface or galvanized steel surface. However, necessary color banding for identification as per color code shall be done. External surface of piping shall be cleaned and prepared as indicated below.</p>			
2.11.01	<p>Primer painting</p> <p>(a) After the surface is prepared two coats of red oxide (zinc chromate/zinc phosphate) primer conforming to IS-2074/IS-12744 or equivalent shall be applied. Primer coat shall be immediately applied without any time lag after the surface preparation.</p>			
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2.11.02	(b)	Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with a touch up coat of primer wherever the shop coat has been abraded, removed or damaged during transit/erection, or defaced during welding.		
	Finish painting			
	(a)	Paint to be used shall be synthetic enamel paint conforming to IS-2932 or equivalent. Finish painting shall be carried out in three coats consisting of one intermediate coat and two finishing coats. Dry film thickness (DFT) of painting inclusive of primer thickness shall be at least 150 micron.		
	(b)	The primed surface shall be cleaned of dust/dirt/grease etc. without scratching or in any way damaging the primer coat. The intermediate coat shall be allowed to dry before applying the finish coat or as recommended by paint manufacturer.		
	(c)	Paint shall be applied by brushing. It shall be ensured that brush marks are a minimum and the requirements of workmanship is as specified in IS-1477.		
	(d)	Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted.		
2.11.03	(e)	No painting shall be done in frost/foggy weather or when the humidity is high to cause-condensation on the surface to be painted.		
	(f)	The dry film thickness (DFT) after the painting shall not be less than 150 microns.		
	Other requirements			
	(a)	Paint manufacturers instructions shall be followed in method of application, handling, drying time etc.		
	(b)	The color of the finish paint shall be as per approved color-coding.		
2.11.04	(c)	If finish paint was applied in shop, one coat of finish paint shall be applied at site.		
	(d)	The dry film thickness of paint shall not be less than 0.15 mm.		
	Color code for identification			
	The pipes shall be color painted/banded for identification as per the approved color-coding scheme and shall be generally as per IS-9404.			
2.12.00	Specification for hangers and supports			
2.12.01	All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.			
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2.12.02	While designing supports for rubber lined pipes special consideration should be given. Any kind of welding on these pipes is not allowed after rubber lining.			
2.12.03	Hanger for piping 65mm Nb and larger and all spring support assemblies regardless of size shall be completely engineered in conformance with the provisions of power piping code ANSI B 31.1.			
2.12.04	Hangers, saddles, supports etc. shall be fabricated from plates/pipes sections conforming to ASTM A 53/IS: 2062/IS: 226/or equivalent. They shall be designed to provide the required supporting effects and allow pipe line movements as necessary. The structural steel work shall be as per IS: 800/BS: 4360. Insulation protection saddles shall be used at support point of all insulated piping.			
2.12.05	The support shall be so interspaced as to minimize sagging of the pipes and to keep them within permissible limits where pipes are full with the conveying media.			
2.12.06	The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.			
2.12.07	All pipe supports shall be designed to provide an absolute minimum head room of 2.5 m from floor in passages/walkways.			
2.12.08	At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.			
2.12.09	All components of hangers/supports shall be provided with two coats of primer (red oxide paint) at shop before dispatch to site. After erection they shall be given finish coat of Long Oil Synthetic enamel to IS: 2932 of total DFT 100 to 140 microns. CLH & VLH will be primed with Epoxy Zinc rich primer of 50 micron followed by finish painting of Aliphatic Acrylic Polyurethane or equivalent of DFT 65 microns.			
2.13.00	Design/Construction/Material Particulars of Gate/ Globe/Check Valves/ Globe Stop Valve/Butterfly valve			
2.13.01	GENERAL (a) All valves shall be suitable for the service conditions i.e flow, temperature and pressure, at which they are required to operate. (b) The valves as well as all accessories shall be designed for easy disassembly and maintenance. (c) Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.			
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	<p>(d) All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be of outside screw and yoke type.</p> <p>(e) All valves shall be closed by rotating the hand wheel in the clockwise direction when looking at the face of the hand wheel. In case where the hand wheel is not directly attached to the valve spindle suitable gearing shall be introduced.</p> <p>(f) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.</p> <p>(g) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required. For valves of size 350mm and above either bevel or spur gearing shall be provided to facilitate manual operation.</p> <p>(h) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.</p> <p>(i) The actuator-operated valves shall be designed on the basis of the following:</p> <ol style="list-style-type: none"> (1) The internal parts shall be suitable to support the pressure caused by the actuators; (2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc. (3) All actuator-operated valves shall be provided with hand operated gearing mechanism also. (4) All actuators operated valves shall open/ close fully within time required by the process. <p>(j) Valves coming under the purview of IBR shall meet IBR requirements.</p> <p>(k) Gate/slucice valves shall be used for isolation of flow. Gate valves shall be provided with the following accessories in addition to other standard items:</p> <ol style="list-style-type: none"> (1) Hand wheel (2) Position indicator (for above 50 mm NB valve size) (3) Draining arrangement wherever required. <p>(l) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction.</p>			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 15 OF 28


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2.13.02	<p>(m) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB</p> <p>(n) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing.</p> <p>(o) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.</p> <p>(p) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.</p> <p>(q) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer.</p> <p>(r) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.</p> <p>(s) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.</p>			
	<p>VALVE BODY MATERIAL</p> <p>Valve body material for various services shall be as follows:</p> <p>Valve body material for water application like circulating water, Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) & drinking water shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below.</p> <p>For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.</p> <p>DM water: SS body and disc along with SS internals.</p> <p>Condensate: Cast Carbon Steel / Forged Carbon Steel.</p>			

CLAUSE NO.	TECHNICAL REQUIREMENTS				
2.13.03	The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.				
	Standards and Codes				
	AWWA-C-504		Rubber seated butterfly valves.		
	BS-5155/EN-593		Cast iron and steel body butterfly valves for general purpose.		
	IS-778		Gun-metal gate, globe and check valves for general purpose.		
	BS-5154		Copper alloy globe/globe stop and check and gate valves for general purpose.		
	IS-780		Sluice valves for water works purpose (50-300 mm size)		
	IS-2906		Sluice valves for water works purpose (350-1200 mm size)		
	IS-5150		Cast iron wedge and double disc gate for general purpose.		
	BS-5152		Specification for cast iron globe valves.		
	BS-5153		Cast iron check valves for general purpose.		
	IS-5312		Swing check type reflux (non-return) valves.		
	ANSI B 16.34		Standard for valves.		
	API-594		Standard for Dual-check valves.		
	API-600		Steel gate valves.		
	ANSI-B-16.10		Valves face to face and other relevant dimension.		
	API-598		Valves inspection test.		
	2.13.04	End Connections			
		The end connections, shall comply with the following:			
Socket welding (SW) - ANSI B 16.11					
Butt Welding (BW) - ANSI B 16.25.					
Threaded (SC) - ANSI B 2.1					
Flanged (FL) - ANSI B 16.5& AWWA-C-207(steel flanges), ANSI B 16.1 (Cast Iron flanges)					
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B		A-6 LOW PRESSURE PIPING	PAGE 17 OF 28


CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.13.05	All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).			
2.13.06	All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.			
2.13.07	All gun metal body valves shall have screwed ends.			
2.13.08	All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.			
2.14.00	Check Valves			
2.14.01	Check valves shall comply with the following characteristics: (a) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal); (b) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position. (c) In the case of swing check valves, the body seat shall be inclined at such an angle from the vertical as will facilitate closing and prevent chatter.			
2.14.02	Drilling on flanges of flanged valves must correspond to the drilling on flanges of the piping system on which the valves are to be installed.			
2.14.03	All flanged valves intended for installation in steel piping systems shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class.			
2.14.04	Counter flanges to be installed on air pipes shall be screwed-on type irrespective of size.			
2.15.00	Globe Valves			
2.15.01	The globe valves shall have the following characteristics: Straight conveyed flow. Right angle Preferably, the valves shall be of the vertical stem type.			
2.15.02	Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 18 OF 28


CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.15.03	The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.			
2.15.04	For the regulating valves, valves with regulating plug & parabolic outline disc type is preferred.			
2.15.05	All motorized globe valves with regulating plug for which indication of percentage (%) opening are required in the control room shall be provided with necessary position transmitter.			
2.16.00	Gate valves All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate. Gate valves shall be of the solid/elastic or articulated wedge disc and rising stem type.			
2.17.00	Air Release Valve (a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint. (b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure. (c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass. (d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.			
2.18.00	Butterfly valves			
2.18.01	Design/Construction (a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. B) butterfly valves instead of cast iron body valves are also acceptable for size above			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 19 OF 28


CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एन.टी.पी.सी. NTPC</div>		
	<p>300 mm nb diameter. In such a case, however, the bidder will have to necessarily submit thickness calculations, in order to establish the integrity of the fabricated valve body under the system operating pressure condition.</p> <p>(1) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable</p> <p>(2) The seals, both on the body (sleeve) and on the disc shall be of the material specified. Necessary shaft seal shall be provided and adequately designed to ensure no leakage across the seal. This seal shall be designed so that they will allow replacement without removal of the valve shaft. The sealing ring on the disk shall be continuous type and easily replaceable.</p> <p>(3) For all types of valves, the design with shaft eccentric to the disc is preferred. The shaft shall be solid type and shall pivot on bushings. Bushings/sleeve type bearings shall be contained in the hub of valve body. The bearing shall be self-lubricated type with low coefficient of friction and should not have any harmful effect on water and on valve components.</p> <p>(4) The design of the shaft shall be such that it will safely sustain maximum differential pressure across the closed valve. The shaft and any key (taper pin etc.) for transmitting the torque between shaft and disc shall be capable of withstanding the maximum torque required to operate the valve. However, the shaft diameter shall not be less than the minimum shaft diameter specified in relevant code. Necessary Torque Calculation and the torque class selected on the basis of the same shall be furnished to the Employer for information.</p> <p>(5) The disc shall rotate from the full open to the tight shut position. The disc shall be contoured to ensure the least possible resistance to flow and shall be suitable for throttling operation. While the disc is in the throttled position, valve shall not create any noise or vibration.</p> <p>(6) The operating mechanism shall be mounted directly on or supported from the valve body.</p> <p>(7) All valves shall be complete with:</p> <p>Position indicator (located in a visible place)</p> <p>Arrow indicating the flow direction;</p> <p>Adjustable mechanical stop limiting devices to prevent over</p> <p>Travel of valve disc in open/close position.</p>			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 20 OF 28


CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.18.02	<p>All valves shall be "tight shut off"</p> <p>(8) Hand operated valves shall have the following</p> <p>Local hand controls</p> <p>The hand controls shall close the valve with clockwise rotation.</p> <p>The hand controls shall be dimensioned to guarantee an easy maneuver under most severe conditions.</p> <p>The hand controls shall be provided with locking systems suitable to avoid the disc assuming a non-desirable position during the operation.</p> <p>Hand wheel shall be made of malleable iron with arms and rims of adequate strength. The hand wheel of diameters 300mm or less shall be provided with handles for ease of operation. The pulling force required on the hand wheel rim shall not exceed 25 Kgf when operating the valve under full flow and operating pressure.</p> <p>Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.</p> <p>Valves-350Nb and above shall also be provided with gear operator arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.</p> <p>Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.</p> <p>Material of Construction (Butterfly Valves)</p> <p>Materials and other design details shall be as indicated below :</p> <p>(a) Cast Iron Butterfly Valves</p> <p>Body & Disc ASTM A48, Gr. 40 with 2% Ni/</p> <p>IS: 210. Gr. FG-260, with 2%</p> <p>Ni and epoxy coated</p>			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 21 OF 28


CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	<p>Shaft BS 970 431 S: 291 / EN 57, or</p> <p>AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.</p> <p>Seat ring 18-8 Stainless steel</p> <p>Seal Nitrile Rubber</p> <p>(b) Stainless Steel Butterfly Valves</p> <p>Body & Disc ASTM A 351, Gr. CF8M / ASTM-A-182-Gr.304.</p> <p>Shaft ASTM A 182, Gr. 316 / ASTM-A-479 Gr.316/Equivalent</p> <p>Disc & Seat Rings EPT/BUNA-N/Neoprene</p> <p>(c) Carbon steel Butterfly Valves</p> <p>Body & Disc ASTM A 216, Gr. WCB</p> <p>Shaft ASTM A 182, Gr. 304 / ASTM-A-479 Gr.304/Equivalent</p> <p>Disc & Seat Rings EPT/BUNA-N/Neoprene</p>	
2.18.03	<p>Proof of Design Test (Type Test) for Butterfly Valves</p> <p>Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder in the presence of Employer's representative.</p> <p>All valves that are designed and manufactured as per AWWA-C-504 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504.</p>	
2.19.00	<p>MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)</p> <p>(a) The materials shall generally comply with the following:</p> <p>(1) Cast Steel Valves</p> <div style="margin-left: 40px;"> <p>Body & bonnet ASTM A 216 Gr. WCB/ ASTM A 105</p> <p>Disc for non-return Valves ASTM A 216 Gr. WCB/ ASTM A 105</p> <p>Trim. ASTM A 182 Gr. F6 or Equivalent</p> </div>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 33%;"> MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE </div> <div style="width: 33%; text-align: center;"> TECHNICAL SPECIFICATION SECTION - VI PART-B </div> <div style="width: 33%; text-align: center;"> A-6 LOW PRESSURE PIPING </div> <div style="width: 33%; text-align: right;"> PAGE 22 OF 28 </div> </div>		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.20.00	(2) Stainless steel valves			
	Body & Bonnet	ASTM A 351 Gr. CF 8M/ ASTM A 182 Gr. 304		
	Disc	-do-		
	Trim.	ASTM 182 Gr. F. 316 /ASTM-A-479Gr.316 or Integral with body		
	(3) Cast iron valves			
	Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260		
	Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay		
	Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260		
	Hinge pin for non-return valves	AISI 316		
	Stem for gate globe valves	13% chromium steel or Equivalent		
	Back seat	13 % chromium steel / 13% Chrome overlay		
	(4) Gun Metal valves			
	Body and bonnet	IS 318 Gr. 2/ Equivalent Standard		
	Trim.	-do-		
	(b) Cast iron body valves shall have high alloy steel stem and seat.			
	(c) Material for counter flanges shall be the same as for the piping.			
	Float operated valves			
	(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.			
	(b) DESIGN AND CONSTRUCTION FEATURES			
	The following design and construction feature of the valve shall be the minimum acceptable.			
	(c) Valves shall be right-angled or globe pattern.			
	(d) Valves shall be balance piston type with float ball.			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 23 OF 28

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.21.00	<p>(e) Leather liner shall not be provided.</p> <p>(f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.</p> <p>(g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.</p> <p>(h) The valves shall have flanged connections.</p> <p>PAINTING OF VALVES:</p> <p>Two (2) coats of primer followed by three (3) coats of enamel of approved color code/shade (usually same as that of connected piping) shall be applied to all exposed surfaces except stainless steel surface, Galvanized steel surface and gun metal surface at shop as required to prevent corrosion, before dispatch. The use of grease/oil other than light grade mineral oil, for corrosion protection is prohibited. The total DFT of painting shall be 150 micron (minimum). If during transport, unloading/unpacking or erection at site any part of the painted surface gets damaged, the same shall be made good by the contractor by repainting with compatible painting primer and enamel to the satisfaction of the project manager.</p>			
2.22.00	Tanks and Accessories			
2.22.01	The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.			
2.22.02	<p>DESIGN AND CONSTRUCTION</p> <p>(a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650.</p> <p>(b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement.</p> <p>(c) Design temperature of vessels shall be 10 deg.C higher than the maximum temperature that any part of the vessel is likely to attain during the course of operation.</p> <p>(d) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.B (or equivalent).</p> <p>(e) The joint efficiency factors to be adopted for design calculations shall be in accordance with the specified design code.</p>			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 24 OF 28

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.22.03	<p>(f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.</p> <p>(g) The material for flanges shall be of ASTM A 105/ IS-2062 Gr.B.</p> <p>(h) For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.</p> <p>(i) Vessel seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessel consisting of more than two sections longitudinal seams shall be offset.</p> <p>(j) Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.</p> <p>(k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals. Similarly for equipment cooling water overhead tank, the overflow & drain from tank shall be combined together and shall be led to nearest drain (at zero level) via. a seal-trough so as not to come directly in contact with atmosphere.</p> <p>(l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.</p> <p>(m) Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.</p> <p>(n) Piercing nozzles/pipes from tank body / dish ends shall be adequately compensated as per relevant code.</p> <p>(o) Tank fabrication drg. and design calculations shall be approved by the Project Manager.</p>			
	<p>Corrosion protection</p> <p>(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required, shall be taken into consideration.</p> <p>(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.</p>			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 25 OF 28

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.22.04	(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.		
	(d) Epoxy-coating shall be provided on the inside of vessel in three coats (minimum) resulting in total thickness of not less than 150 micron in which ever case required, such as equipment cooling water overhead tank, sodium hydroxide tank, condensate storage tank, condensate surge tank etc.		
	Cleaning & Painting (a) Inside surface of all tanks shall be protected by anti-corrosive paints as required. (b) For tanks/vessel requiring epoxy painting, all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing. (c) Outside surfaces of all vessels shall be provided with two coats of primer with three (3) coats of epoxy resin based paint of approved color.		
2.23.00	RUBBER EXPANSION JOINTS		
2.23.01	All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.		
2.23.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.		
2.23.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.		
2.23.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.		
2.23.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.		
2.23.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.		
2.23.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.		
2.23.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.		
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING PAGE 26 OF 28

CLAUSE NO.	TECHNICAL REQUIREMENTS												
2.23.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.												
2.23.10	The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges.												
2.23.11	All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.												
2.23.12	Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.												
2.23.13	Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.												
2.23.14	Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.												
2.24.00	STRAINERS												
2.24.01	Simplex type The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows: <table><tr><td>(a)</td><td>Body</td><td>IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)</td></tr><tr><td>(b)</td><td>Strainer Element</td><td>Stainless steel (AISI 316)</td></tr><tr><td>(c)</td><td>End connection</td><td>Screwed upto 50 mm Nb, and Flanged above 50 mm Nb</td></tr></table>				(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)	(b)	Strainer Element	Stainless steel (AISI 316)	(c)	End connection	Screwed upto 50 mm Nb, and Flanged above 50 mm Nb
(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)											
(b)	Strainer Element	Stainless steel (AISI 316)											
(c)	End connection	Screwed upto 50 mm Nb, and Flanged above 50 mm Nb											
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 27 OF 28									

CLAUSE NO.	TECHNICAL REQUIREMENTS			<div>एनटीपीसी NTPC</div>
2.24.02	<div>Duplex type</div> <div><div>(a)</div><div>The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.</div></div> <div><div>(b)</div><div>Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.</div><div><div>Body</div><div>IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. B and internally epoxy-painted above 50 mm NB.</div></div><div><div>Strainer element</div><div>Stainless steel (AISI 316)</div></div><div><div>End connection</div><div>Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type</div></div><div><div>(c)</div><div>The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.</div></div><div><div>(d)</div><div>The size of the strainer and the flow direction will be indicated on the strainer body casting.</div></div><div><div>(e)</div><div>Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.</div></div></div>			
2.24.03	Three shop coats of paint preceded by two coats of primer shall be applied to all exposed surfaces as required to prevent corrosion.. All parts shall be adequately protected for rust prevention. The use of grease or oil other than light grade mineral oils for corrosion protection is prohibited.			
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION - VI PART-B	A-6 LOW PRESSURE PIPING	PAGE 28 OF 28

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TECHNICAL SPECIFICATION FOR HORIZONTAL CENTRIFUGAL PUMPS

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1.00.0 SCOPE

- 1.01.0 This specification covers the design, material, construction features, manufacture, inspection, testing the performance at the Vendor's/Sub-Vendor's Works and delivery to site of Horizontal Centrifugal Pumps.

2.00.00 CODES AND STANDARDS

- 2.01.0 The design, material, construction, manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in these specifications shall be construed to relieve the Vendor of this responsibility. The Equipment supplied shall comply with the latest applicable Indian Standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.

- 2.02.0 List of Applicable Standards.

1	IS : 1520	Horizontal Centrifugal Pumps for clear cold fresh water.
2	IS : 5120	Technical requirements of roto dynamic special purpose pumps.
3	API : 610	Centrifugal pumps for general refinery service.
4	IS : 5639	Pumps Handling Chemicals & corrosion liquids.
5	IS : 5659	Pumps for process water.
6	HIS	Hydraulic Institute Standards, USA
7	ASTM-1-165-65	Standards Methods for Liquid Penetration Inspection.

- 2.03.03 In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.

3.00.00 DESIGN REQUIREMENTS

- 3.01.00 The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve over the operating range of 40% to 120% of the duty point. The maximum efficiency of pump shall be preferably be within +/- 10% of the rated design flow as indicated in the data sheets.

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- 3.02.00 The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability and with a minimum shut-off head of 15% more than the design head.
- 3.03.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.
- 3.04.00 Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation:

SPEED	Antifriction Bearing	Sleeve Bearing
1500 rpm and below	75.0 micron	75.0 micron

- 3.05.00 The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment.
- 3.06.00 The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Continuous Motor rating (at 50 deg.C ambient) shall be atleast ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump.
- 3.07.00 The kW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).
- 3.08.00 Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.
- 3.09.00 The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.

4.00.0 DESIGN CONSTRUCTION

- 4.01.00 DESIGN AND CONSTRUCTION OF VARIOUS COMPONENTS OF THE PUMPS SHALL CONFORM TO THE FOLLOWING GENERAL SPECIFICATIONS. FOR MATERIAL OF CONSTRUCTION OF THE COMPONENTS, DATA SHEETS SHALL BE REFERRED TO.

4.02.0 Pump Casing

- 4.02.01 Pump casing shall have axially or radially split type construction. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.
- 4.02.02 Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.

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4.03.00 Impeller

- 4.03.01 Impeller shall be closed, semi-closed or open type, and it shall be designed in conformance with the detailed analysis of the liquid being handled.
- 4.03.01 The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.

4.04.00 Impeller/Casing Wearing Rings

- 4.04.01 Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.

4.05.00 Shaft

- 4.05.01 The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.
- 4.05.02 The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.

4.06.00 Shaft Sleeves

- 4.06.01 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland.
- 4.06.02 Shaft sleeve shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

4.07.00 Bearings

- 4.07.01 Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished
- 4.07.02 The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hrs. of continuous operation at maximum axial and radial loads and rated speed.
- 4.07.03 Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.
- 4.07.04 Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.

4.08.00 Stuffing Boxes

- 4.08.01 Stuffing box design should permit replacement of packing without removing any part other than the gland.

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- 4.08.02 Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection.

4.09.00 Mechanical Seals

- 4.09.01 Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.

- 4.09.02 The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.

4.10.00 Pump Shaft Motor Shaft Coupling

- 4.10.01 The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.

4.11.00 Base Plate

- 4.11.01 A common base plate mounting both for the pump and motor shall be provided. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.

4.12.00 Assembly and Dismantling

- 4.12.01 Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.

4.13.00 Drive Motor (Prime Mover)

- 4.13.01 The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps are specified, the actual motor rating is to be selected by the tenderer considering overloading of the pumps in the event of tripping of operating pumps.

5.00.00 TESTING FOR HORIZONTAL CENTRIFUGAL PUMPS

The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with the requirement of applicable Codes and Standards. The particulars of the proposed tests shall be submitted to the Owner for approval before conducting the tests.

5.01.00 Hydrostatic Tests

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All pressure parts shall be hydraulically tested at 200% of pump rated head or at 150% shut off head whichever is higher. The test pressure shall be maintained for 1/2 hr. and no leakage shall be permitted. While arriving at the above pressure, the maximum suction head specified in Data Sheet shall be taken into account.

5.02.00 Performance Tests

- 5.02.01 All the pumps shall be tested in the Manufacture's Works at rated speed for capacity, efficiency and brake horse power. Pumps shall be given running test over the entire operating range covering from the shut off head to the maximum flow. The duration of test shall be minimum one (1) hour. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standards or as applicable equivalent
- 5.02.02 The test shall be preferably conducted with the actual motor being furnished.
- 5.02.03 Only those pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and excessive vibration is observed during the performance test. Otherwise strip down examination is limited to bearing inspection only.
- 5.02.04 The pump accessories e.g. the thrust bearing, couplings etc. shall be subjected to tests as per manufacturer's standards.

5.03.00 Mechanical Balancing

All rotating components of the pumps shall be statically balanced. In addition to static balancing, rotating components of the pumps shall be balanced dynamically at or near the operating speed. Tenderer shall furnish acceptance norm for this test.

5.04.00 Visual Inspection

Pumps shall be offered for visual inspection by the bidder before shipment. The components of the pumps shall not be painted before inspection.

5.05.00 NPSH Test

NPSH test shall be conducted with water as medium if required. NPSH shall not be mandatory in case type test certificates are furnished for the similar rating of pumps.

5.06.00 Noise and Vibration Measurement

Noise and vibration shall be measured during the performance testing at shop as well as during the site test.

- 5.06.01 The noise level shall not exceed 85 dBA. Noise level measurement will be made as per applicable internationally acceptable standard. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC:651 or BS:5969 or IS:9779. Sound pressure level will be measured all round the pump and motor set at a distance of one meter from the nearest surface of the machine and at a height of 1.5 m from the floor level. A minimum of six (6) points should be covered for measurement. The measurement shall be done with a slow response on the A-weighted scale. The average of the A-Weighted sound pressure measurements expressed in decibels to a reference 0.0002 microbars shall not exceed the specified value.

The tests shall be carried out on the machine operating at rated speed and as near as possible to the rated power. Corrections for background noise and correction on account of test environment will be considered in line with applicable standard. For this purpose all the additional data required should necessarily be collected during the test.

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- 5.06.2 Vibration check will also be done as per HIS. Vibration would be checked at thrust bearing locations on horizontal, radial and vertical direction. The acceptance limits would be as per HIS. The instrument used would be IRD 308 or equivalent with velocity pick-up. Vibration limits to be specified as per the speed of the pump.

5.07.00 Material Test Certificate

- 5.07.01 Material of the various pump components shall be tested in accordance with the relevant standards. Test certificates for these shall be furnished for the Owner's approval.
- 5.07.02 Where stage inspection is desired by BHEL/customer all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication by BHEL/customer's inspector who will stamp the material. In case mill test certificate for the material are not available, the supplier shall carry out physical and chemical tests at his own cost from a testing agency, approved by BHEL/Customer, as per the requirement of specified material standard. The sample for physical and chemical testing shall be drawn up in presence of BHEL/Customer's inspector who shall also witness the testing.

5.08.00 Non Destructive Testing

- (a) UT shall be carried out on shafts of diameter more than 50 mm.
- (b) DP tests shall be carried out on shaft and impeller.
- (c) No weld repair shall be allowed on cast iron.

5.09.00 Field Testing

- 5.09.01 After installation, the pumps offered shall be operated to prove satisfactory performance as individual equipment as well as a system run. If the performance at site is found not to the requirements then the equipment shall be rectified or replaced by the Vendor, at no extra cost to the Owner. The procedure of the above testing will be mutually agreed between the Owner and the contractor. Noise and vibration tests shall also be repeated at site.
- 5.09.02 Based on observation of the trial operation, if modifications and repairs are necessary, the same shall be carried out by the contractor to the full satisfaction of the engineer and then the performance and guarantee tests to be repeated at site as per relevant clauses of the specification.

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TECHNICAL SPECIFICATION FOR METERING PUMPS

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1.00.0 GENERAL

- 1.01.01 Specification cover the design, material, construction features, manufacture, inspection, testing the performance at the vendor's/sub-vendor's works, delivery to site, erection, commissioning and testing of metering pumps.

2.00.0 GENERAL DESIGN FEATURES

- 2.00.01 Pumps shall be simplex positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.
- 2.00.02 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.
- 2.00.03 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.
- 2.00.04 Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard $\pm 1\%$ of capacity setting.
- 2.00.05 Pumps shall be provided with an integral relief valve, spring operated to release pressure when delivery line blockage occurs.
- 2.00.06 Crankcase shall be constructed of high quality cast iron, which will also house the gearbox and guides of cross head.
- 2.00.07 Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge side.
- 2.00.08 Material of construction of the various parts shall be as per the details furnished elsewhere in the specification. However all parts coming in contact with acid shall be of Haste alloy 'B' and for alkali it should be of SS-316 only.
- 2.00.09 Suitable gland seal shall be provided to prevent leakage.
- 2.00.10 Electric drive motor particulars should follow enclosed electrical chapters.

3.00.0 TESTING

3.01.00 Testing and Inspection at Manufacturer's Works

- 3.01.01 The manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of this Specification and is in compliance with requirements of the applicable codes. The particulars of the proposed tests and the procedures for the tests shall be submitted to Owner for approval before conducting the tests.
- 3.01.02 The Owner's representatives shall be given full access to all tests for which the Manufacturer shall inform the Owner allowing adequate time so that if the Owner so desires, his representatives can witness the test.
- 3.01.03 All materials and castings used for the equipment shall be of tested quality. The test certificates shall be made available to Owner.

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- 3.01.04 The pump casing shall be hydraulically tested at 200% pump operating pressure or 150% of design pressure whichever is higher. The test pressure shall be maintained at least for ½ an hour.
- 3.01.05 The rotating parts of pump drive shall be subjected to static balancing.
- 3.01.06 All pumps shall be tested at the shop for capacity, volumetric accuracy, repetitive accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. and Indian Standards as applicable.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per manufacturer's standards. The test results shall be furnished to the Owner.
- 3.01.08 The combined variation of the pump and motor should be restricted within limits specified by Hydraulic Institute Standard, USA when the pump operated singly or in parallel.
- 3.01.09 All pumps shall be subject to strip down examination visually to check for mechanical damages after performance testing at shop.
- 3.01.10 Diaphragm of the metering pump shall be type tested as per applicable code/standard.
- 3.01.11 Performance test shall be carried out for the setting of pressure relief valve.
- 3.01.12 Test reports and certificates of all the above-mentioned tests to ensure satisfactory operation of the system shall be submitted to the Owner for approval before dispatch.

3.02.00 Test at Site

After erection at site pumps as detailed under different groups shall be operated to prove satisfactory performance as individual equipment as well as a system. If the performance at site is found to be not to the requirements, then the equipment shall be rectified or replaced by the Vendor at no extra cost to the Owner.

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SECTION – D2

GENERAL TECHNICAL SPECIFICATION – ELECTIRCAL



SUB-SECTION-III:E1


MOTORS


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /
RAGHUNATHPUR TPP PHASE-II (2 x660MW)
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2

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CLAUSE NO.	TECHNICAL REQUIREMENTS			<div>एनटीपीसी NTPC</div>	
2.00.00	iii)	CW motors (in case of Screen protected Drip proof)	-	IP 23	
	iv)	Cable box - indoor area	-	IP 54	
	v)	Cable box - outdoor area	-	IP 55	
	CODES AND STANDARDS				
	1)	Three phase induction motors	:	IS:325, IEC:60034	
3.00.00	2)	Single phase AC motors	:	IS:996, IEC:60034	
	3)	Crane duty motors	:	IS:3177, IEC:60034	
	4)	DC motors/generators	:	IS:4722	
	5)	Energy Efficient motors	:	IS 12615	
	3.01.00	TYPE			
3.02.00	AC Motors:				
	(a)	Squirrel cage induction motor suitable for direct-on-line starting.			
	(b)	Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature) ,shall be Energy Efficient motors ,Efficiency class-Eff1, conforming to IS 12615.			
	(c)	Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.			
4.00.00	DC Motors	Shunt wound.			
5.00.00	RATING				
	(a)	Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.			
	(b)	Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.			
5.00.00	TEMPERATURE RISE				
	Air cooled motors				
	70 deg. C by resistance method for both thermal class 130(B)& 155(F) insulation.				
	Water cooled				
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.				
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2		PART-B SUB SECTION-III: E1 (MOTORS)	PAGE 2 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.			
6.00.00	OPERATIONAL REQUIREMENTS			
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement			
	(a) 85% upto 1500KW			
	(d) 80% from 1501 KW to 4000KW			
	(e) 75% > 4000KW			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.			
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below			
	(a) Fuel oil area : Group - IIB			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB SECTION-III: E1 (MOTORS)	PAGE 3 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS 
7.03.00	<p>Winding and Insulation</p> <p>(a)Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b)Starting duty : Two hot starts in succession, with motor initially at normal running temperature</p> <p>(c) 11kV, 3.3 kV AC motors : Thermal Class 155(F) insulation with winding temperature rise limited to thermal class 130(B). The winding insulation process shall be total Vacuum Pressure Impregnated i.e.resin poor method. The lightning impulse & interturn insulation surge withstand level shall be as per IEC-60034 Part-15.</p> <p>(d)415V AC & 220V DC motors : Thermal Class130(B) or better</p>
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB (A). Bearing housing vibration shall be limited within the limits prescribed in IEC 60034-14/IS:12075 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and duplex platinum resistance type temperature detectors preferably 2 numbers.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable terminal boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable terminal box is offered, then Employer shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel for three core cables) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable terminal boxes.
7.10.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.
7.11.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.12.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.13.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<div> <div> TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 </div> <div> PART-B SUB SECTION-III: E1 (MOTORS) </div> <div> PAGE 4 OF 8 </div> </div>

CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एन टी पी सी NTPC</div>									
7.14.00	11kV and 3.3 kV motors Cable Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively.Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.										
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box, cable glands & lugs suitable for the same.										
7.16.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance).</p> <table><tr><td>(a) Upto 110KW:</td><td>11.0</td></tr><tr><td>(b) Above 110KW & upto 1500KW:</td><td>10.0</td></tr><tr><td>(c) Above 1500KW & upto 4000KW:</td><td>9.0</td></tr><tr><td>(d) Above 4000KW:</td><td>6 to 6.5</td></tr></table>	(a) Upto 110KW:	11.0	(b) Above 110KW & upto 1500KW:	10.0	(c) Above 1500KW & upto 4000KW:	9.0	(d) Above 4000KW:	6 to 6.5		
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(c) Above 1500KW & upto 4000KW:	9.0										
(d) Above 4000KW:	6 to 6.5										
8.00.00	TYPE TEST										
8.01.00	HT MOTORS										
8.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.										
8.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.										
8.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.										
8.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.										
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x 660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB SECTION-III: E1 (MOTORS)								
			PAGE 5 OF 8								

CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एन टी पी सी NTPC</div>		
8.01.05	<p>LIST OF TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <p>(a) No load saturation and loss curves upto approximately 115% of rated voltage</p> <p>(b) Measurement of noise at no load.</p> <p>(c) Momentary overload test (subject to test bed constraint).</p> <p>(d) Full load test (subject to test bed constraint).</p> <p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p> <p>(f) Lightning Impulse withstand test on the sample coil shall be as per clause 5.1.3.2, IEC-60034,Part-15.</p> <p>(g) Surge withstand voltage test on interturn insulation as per IEC 60034-15</p>			
8.01.06	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <p>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</p> <p>(b) Fault level withstand test for each type of cable terminal box of HT motors.</p>			
8.02.00	<p>LT Motors</p>			
8.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>			
8.02.02	<p>However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>			
8.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p>			
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART-B SUB SECTION-III: E1 (MOTORS)</p>	<p>PAGE 6 OF 8</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS 
	<ol style="list-style-type: none"> 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Locked rotor readings of voltage, current and power input at a suitable reduced voltage. 5. Full load test to determine efficiency power factor and slip . 6. Temperature rise test . 7. Momentary overload test . 8. Insulation resistance test . 9. High voltage test . 10. Test for vibration severity of motor. 11. Test for noise levels of motor . 12. Test for degree of protection and 13. Overspeed test. <p>8.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p> <p>8.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.</p>
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	<div> <div> TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 </div> <div> PART-B SUB SECTION-III: E1 (MOTORS) </div> <div> PAGE 7 OF 8 </div> </div>

CLAUSE NO.	<div> <div>TECHNICAL REQUIREMENTS</div> <div>एनटीपीसी NTPC</div> </div>																												
	<p style="text-align: center;">TABLE - I</p> <p style="text-align: center;">DIMENSIONS OF TERMINAL BOXES</p> <p>FOR LV MOTORS:</p> <table> <tr> <th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr> <tr> <td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr> <tr> <td>Above 3 KW - upto 7 KW</td><td>85</td></tr> <tr> <td>Above 7 KW - upto 13 KW</td><td>115</td></tr> <tr> <td>Above 13 KW - upto 24 KW</td><td>167</td></tr> <tr> <td>Above 24 KW - upto 37 KW</td><td>196</td></tr> <tr> <td>Above 37 KW - upto 55 KW</td><td>249</td></tr> <tr> <td>Above 55 KW - upto 90 KW</td><td>277</td></tr> <tr> <td>Above 90 KW - upto 125 KW</td><td>331</td></tr> <tr> <td>Above 125 KW-upto 200 KW</td><td>203</td></tr> </table> <p>FOR HT MOTORS:</p> <p>The distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table> <tr> <th>Motor MCR in KW</th><th>Clearance</th></tr> <tr> <td>UP to 110 KW</td><td>10mm</td></tr> <tr> <td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr> <tr> <td>Above 150 KW</td><td>19mm</td></tr> </table>	Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203	Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
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Clause No.	MOTORS		
DE-1B	<p style="text-align: right;">..... (Bidder's Name)</p> <p>LT MOTORS</p> <p>A. GENERAL</p> <p>1. Manufacturer & Country of origin. (Shall be as per approved QA make)</p> <p>2. Equipment driven by motor</p> <p>3. Motor type</p> <p>4. Quantity</p> <p>B. DESIGN AND PERFORMANCE DATA</p> <p>1. Frame size</p> <p>2. Type of duty</p> <p>3. Type of enclosure /Method of cooling/Degree of protection</p> <p>4. Applicable standard to which motor generally conforms</p> <p>5. Efficiency class as per IS 12615</p> <p>6. (a) Whether motor is flame proof Yes/No</p> <p style="padding-left: 40px;">(b) If yes, the gas group to which it conforms as per IS:2148</p> <p>7. Type of mounting</p> <p>8. Direction of rotation as viewed from DE END</p> <p>9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)</p> <p>10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)</p>		
	NAME OF THE PROJECT..... STEAM GENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)

Clause No.	MOTORS				
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>11. Maximum continuous load demand of driven equipment in KW</p> <p>12. Rated Voltage (volts)</p> <p>13. Permissible variation of :</p> <p style="margin-left: 40px;">a. Voltage (Volts)</p> <p style="margin-left: 40px;">b. Frequency (Hz)</p> <p style="margin-left: 40px;">c. Combined voltage and frequency</p> <p>14. Rated speed at rated voltage and frequency(RPM)</p> <p>15. At rated Voltage and frequency:</p> <p style="margin-left: 40px;">a. Full load current</p> <p style="margin-left: 40px;">b. No load current</p> <p>16. Power Factor at</p> <p style="margin-left: 40px;">a. 100% load</p> <p style="margin-left: 40px;">b. NO load</p> <p style="margin-left: 40px;">c. Starting.</p> <p>17. Efficiency at rated voltage and frequency,</p> <p style="margin-left: 40px;">a. 100% load</p> <p style="margin-left: 40px;">b. 75% load</p> <p style="margin-left: 40px;">c. 50% load</p> <p>18. Starting current (amps) at</p> <p style="margin-left: 40px;">a. 100 % voltage</p> <p style="margin-left: 40px;">b. 85% voltage</p>				
NAME OF THE PROJECT..... STEAMGENERATORPACKAGE	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"> TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 </td> <td style="width: 50%; text-align: center;"> PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL) </td> </tr> <tr> <td colspan="2" style="text-align: right;"> PAGE 11 OF 16 </td> </tr> </table>	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 11 OF 16	
TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)				
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Clause No.	MOTORS		
	<div>..... (Bidder's Name)</div> <div><div><div>c.80% voltage</div><div>19.Minimum permissible starting Voltage (Volts)</div><div>20.Starting time with minimum permissible voltage</div><div><div>a.Without driven equipment coupled</div><div>b.With driven equipment coupled</div></div><div>21.Safe stall time with 100% and 110% of rated voltage</div><div><div>a.From hot condition</div><div>b.From cold condition</div></div><div>22.Torques :</div><div><div>a.Starting torque at min. permissible voltage(kg-mtr.)</div><div>b.Pull up torque at rated voltage.</div><div>c.Pull out torque</div><div>d.Min accelerating torque (kg.m) available</div><div>e.Rated torque (kg.m)</div></div><div>23.Stator winding resistance per phase (ohms at 20 Deg.C.)</div><div>24.GD² value of motors</div><div>25.No of permissible successive starts when motor is in hot condition</div></div></div>		
NAME OF THE PROJECT..... STEAM GENERATOR PACKAGE		TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)
		PAGE 12 OF 16	

Clause No.	MOTORS				
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>26. Locked Rotor KVA Input</p> <p>27. Locked Rotor KVA/KW</p> <p>28. Vibration limit :Velocity (mm/s)</p> <p>29. Noise level limit (dBA)</p> <p>C. CONSTRUCTIONAL FEATURES</p> <p>1. Stator winding insulation</p> <p style="margin-left: 40px;">a. Class & Type</p> <p style="margin-left: 40px;">b. Winding Insulation Process</p> <p style="margin-left: 40px;">c. Tropicalised (Yes/No)</p> <p style="margin-left: 40px;">d. Temperature rise over specified maximum ambient temperature of 50 deg C</p> <p style="margin-left: 40px;">e. Method of temperature measurement</p> <p style="margin-left: 40px;">f. Stator winding connection</p> <p>2. Main Terminal Box</p> <p style="margin-left: 40px;">a. Type</p> <p style="margin-left: 40px;">b. Location (viewed from NDE side)</p> <p style="margin-left: 40px;">c. Entry of cables(bottom/side)</p> <p style="margin-left: 40px;">d. Recommended cable size (To be matched with cable size envisaged by owner)</p> <p style="margin-left: 40px;">e. Fault level (MVA), Fault level duration (sec)</p> <p style="margin-left: 40px;">f. Cable glands & lugs details (shall be suitable for power cable)</p>				
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Clause No.	MOTORS				
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>3. Type of DE/NDE Bearing</p> <p>4. Motor Paint shade</p> <p>5. Weight of</p> <p style="padding-left: 40px;">a. Motor stator (KG)</p> <p style="padding-left: 40px;">b. Motor Rotor (KG)</p> <p style="padding-left: 40px;">c. Total weight (KG)</p> <p>D. List of accessories.</p> <p>1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)</p> <p>2. Terminal Box for Space Heater (Yes/No)</p> <p>3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch</p> <p>4. Insulation of bearing (Yes/No)</p> <p>5. Noise reducer (Yes/No)</p> <p>6. Grounding pads</p> <p style="padding-left: 40px;">i) No and size on motor body</p> <p style="padding-left: 40px;">ii) Nos on terminal Box</p> <p>7. Vibration pads</p> <p style="padding-left: 40px;">i) Nos and size</p> <p style="padding-left: 40px;">ii) Location</p> <p>8. Any other fitments</p>				
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Clause No.	MOTORS			
	<div>..... (Bidder's Name)</div> <div><div>E. List of curves.</div><div><div>1. Torque speed characteristic of the motor</div><div>2. Thermal withstand characteristic</div><div>3. Starting. current Vs. Time</div><div>4. Starting. current Vs speed</div><div>5. P.F. and Effi. Vs Load</div></div><div>F. Additional Data to be filled for each rating of DC Motor</div><div><div>1. Rated armature voltage (Volt)</div><div>2. Rated field excitation (Amp)</div><div>3. Permissible % variation in voltage</div><div>4. Minimum Permissible Starting voltage (volt)</div><div>5. At rated voltage<div><div>i) Full load Armature current.(Amp)</div><div>ii) Full load Field current (Amp)</div><div>iii) No load Armature current (Amp)</div></div></div><div>6. Full load Field current (Amp)</div><div>7. No load Aramature current (Amp)</div><div>8. Minimum permissible field current(Amp) to avoid overspeeding at<div><div>i) Maximum permissible voltage</div></div></div></div></div>			
NAME OF THE PROJECT..... STEAMGENERATORPACKAGE		TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 15 OF 16

Clause No.	MOTORS
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>ii) Rated voltage</p> <p>iii) Minimum Permissible Voltage</p> <p>9. Resistance (indicative Values) in ohm</p> <p>i) Armature winding (Arm + IP + Series) at 25 deg.C</p> <p>ii) Field Winding at 25 deg. C</p> <p>10. Inductance (indicative values)</p> <p>i) Armature winding</p> <p>ii) Field winding</p> <p>11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at</p> <p>i) 220 V DC</p> <p>ii) 250 V DC</p> <p>iii) 187 V DC</p> <p>12. Value of the external resistance (ohm) required to be connected in series with armature during starting only</p> <p>13. Technical data sheet for external resistance box</p> <p>14. GA drawing of motor</p> <p>15. Starting time calculation</p> <p>16. Starter resistance design calculation</p> <p>17. Electrical connection diagram of motor</p>
NAME OF THE PROJECT..... STEAMGENERATORPACKAGE	<div> <div> TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 </div> <div> PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL) </div> <div> PAGE 16 OF 16 </div> </div>

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : D2	
		REV. NO. 00	DATE:
		SHEET	

MOTOR – QUALITY PLAN

CLAUSE NO.	QUALITY ASSURANCE								एनटीपीसी NTPC	
INDUCTION MOTOR & SYNCHRONOUS MACHINE										
TESTS/CHECKS TEMS/COMPONENTS		Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.		Y	Y	Y	Y					Y
Shaft		Y	Y	Y	Y	Y	Y			Y
Magnetic Material		Y	Y	Y	Y	Y		Y		
Rotor Copper/Aluminium		Y	Y	Y	Y		Y	Y		Y
Stator copper		Y	Y	Y	Y			Y		Y
SC Ring		Y	Y	Y	Y	Y	Y	Y	Y	Y
Insulating Material		Y		Y	Y			Y		
Tubes for Cooler		Y	Y	Y	Y	Y				Y
Sleeve Bearing		Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils		Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.		Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box		Y	Y			Y				Y
Wound stator		Y	Y					Y	Y	
Wound Exciter		Y	Y					Y	Y	
Rotor complete		Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly		Y	Y					Y		
Accessories, RTD, BTDC, CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.		Y	Y	Y						
Motor (IS 325 / 4722/ 9283)		Y	Y	Y						

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-B SUB-SECTION-VII:QE1 MOTOR	PAGE 1 OF 2
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CLAUSE NO.	QUALITY ASSURANCE										<div>एनटीपीसी NTPC</div>
INDUCTION MOTOR & SYNCHRONOUS MACHINE											
TESTS/CHECKS ITEMS/COMPONENTS		Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All routine & acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC 60079-I	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	
Plates for stator frame, end shield, spider etc.											
Shaft											
Magnetic Material		Y		Y							
Rotor Copper/Aluminium											
Stator copper				Y							
SC Ring											
Insulating Material				Y							
Tubes for Cooler			Y								
Sleeve Bearing			Y								
Stator/Rotor, Exciter Coils											
Castings, stator frame, terminal box and bearing housing etc.											
Fabrication & machining of stator, rotor, terminal box											
Wound stator											
Wound Exciter											
Rotor complete					Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly											
Accessories, RTD, BTD,CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.											
Motor (IS 325 / 4722 / 9283/2148/IEC 60079-I)							Y	Y	Y	Y1	
<p>Note : 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalisation. However, No QP for LT motor upto 50KW.</p> <p>2. Makes of all major bought out items will be subject to NTPC approval.</p> <p>Y1 = for HT Motor / Machines only.</p>											
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2					PART-B SUB-SECTION-VII:QE1 MOTOR			PAGE 2 OF 2	


SUB-SECTION-IV: I7


INSTRUMENTATION AND POWER SUPPLY CABLE

MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) /
NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) /
RAGHUNATHPUR TPP PHASE-II (2 x 660MW)
STEAM GENERATOR PACKAGE


TECHNICAL SPECIFICATION
SECTION-VI
BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	INSTRUMENTATION AND POWER SUPPLY CABLE			
1.00.00	INSTRUMENTATION CABLE, POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL			
1.01.00	General Requirements			
1.01.01	All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.			
1.01.01	The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope as illustrated in the enclosed Drg. No. 0000-101/102-POI-A-021 and ensuring completeness of the control system.			
1.01.02	Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Contractor.			
1.01.03	Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.			
1.01.04	Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.			
1.01.05	Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sump price without any further cost implication to the Employer.			
2.00.00	Specification of Instrumentation cable			
2.01.00	Common Requirements			
	S. No.	Property	Requirement	
	1	Voltage grade	225 V (peak value)	
	2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.	
	3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.	
	4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.	
<div> <div>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</div> <div>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</div> <div>PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)</div> <div>PAGE 1 OF 14</div> </div>				

CLAUSE NO.	TECHNICAL REQUIREMENTS				
2.02.00	5.	Marking to read 'FRLS'	To be provided at every 5 meters on outer sheath except for Type-C cable.		
	6.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet		
	7.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.		
	8	Ovality at any cross-section	Not more than 1.0 mm		
	9	Others	a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided.		
				b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation	
				c) Repaired cables shall not be acceptable.	
	<hr/>				
	Specific Requirements				
	<hr/>				
Specification Requirements		Type-A cable	Type-B cable	Type F & G cable	Type-C cable
<hr/>					
A. Conductors					
Cross section area		(Same as T/C)		0.5 sq. mm	0.5 sq. mm.
Conductor material		ANSI type KX	ANSI type SX	High conductivity Annealed bare copper	ANSI type KX
Colour code		Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
Conductor Grade		As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
No & dia of strands		7x0.3 mm (nom)			
No. of Pairs		2	2	2,4,8,12,16,24,48	2
Max. conductor resistance per Km (in ohm) at 20 deg. C		As per ANSI MC 96.1		73.4 (loop)	As per ANSI MC 96.1
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2		PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 2 OF 14


CLAUSE NO.	<div> <div> TECHNICAL REQUIREMENTS </div> <div>  </div> </div>			
	<div> <div>Reference Standard</div> <div>As per ANSI MC 96.1</div> <div>VDE 0815</div> <div>As per ANSI MC 96.1</div> </div> <div> <div>B. Insulation</div> <div>Material</div> <div>PVC type YI 3 Teflon (i.e. extruded FEP)</div> <div>Thickness in mm (Min/Nom/Max)</div> <div>0.25/0.3/0.35</div> <div>0.4/0.50</div> <div>Volume Resistivity (Min) in ohm-cm</div> <div>1 x 10¹⁴ at 20 deg. C & 1x10¹¹ at 70 deg. C.</div> <div>---</div> <div>Voltage Rating</div> <div>225 V peak operating voltage</div> <div>Reference Standard</div> <div>VDE 0207 Part 4</div> <div>VDE 0207 Part 6 & ASTM D 2116.</div> <div>Core diameter above insulation</div> <div>Suitable for cage clamp connector</div> </div> <div> <div>C. Pairing & Twisting</div> <div>Max. lay of pairs (mm)</div> <div>50</div> <div>Single layer of polyester numbered tape on each pair provided</div> <div>Yes</div> <div>Unit formation of four pairs with printing of no. of Unit provided</div> <div>N.A.</div> <div>Yes</div> <div>N.A.</div> <div>Conductor /pair identification as per VDE0815</div> <div>N.A.</div> <div>To be provided (color coding attached).</div> <div>N.A.</div> </div> <div> <div>D. Shielding</div> <div>Type of shielding</div> <div>←----- Al-Mylar tape -----→</div> <div>Individual pair shielding</div> <div>No</div> <div>To be provided for F-type cable</div> <div>No</div> <div>Minimum thickness of Individual pair shielding</div> <div>No</div> <div>28 micron</div> <div>No</div> </div>			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 3 OF 14


CLAUSE NO.	TECHNICAL REQUIREMENTS			<div>एनटीपीसी NTPC</div>
	Overall cable assembly shielding	To be provided		
	Minimum thickness of Overall cable assembly shielding	55 micron		
	Shielding coverage	100% with at least 20% overlap		
	Drain wire provided for individual shield	N.A.	Yes (for F-type) 7-strand 20 AWG (0.51 mm2) annealed Tin coated copper	N.A.
	Drain wire provided for overall shield	Yes. 7-strand 20 AWG (0.51 mm2) annealed Tin coated copper		
	E. FILLERS			
	Non-hygroscopic, flame retardant	To be provided		
	F. Outer Sheath			
	Material	←--- Extruded PVC compound YM1 with---→ FRLS properties		Teflon (i.e. extruded FRP)
	Minimum Thickness at any point	1.8 mm	0.4 mm	
	Nominal Thickness at any point	>1.8 mm	0.5 mm	
	Color	Blue		
	Resistant to water, fungus, termite & rodent attack	Required		
	Oxygen index as per ASTM D-2863	not less than 29%	N.A.	
	Temperature index as per ASTM D-2863	not less than 250 deg.C	N.A.	
Acid gas generation by weight as per IEC-60754-1	Maximum 20%	N.A.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 4 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Smoke Density Rating as per ASTMD-2843	Maximum 60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)		N.A.
	Reference standard	VDE207 Part 5		VDE207 Part 6 & ASTM D2116
	G. Electrical Parameters			
	Mutual Capacitance Between Conductors At 0.8 KHz (Max.)	200 nF/km	120 nF/km for F type 100 nF/km for G-type	200 nF/km
	Insulation Resistance (Min.)	100 M Ohm/Km		
	Cross Talk Figure (Min.) At 0.8 KHz	60 dB	60 dB	N.A.
	Characteristic Impedance (Max) At 1 KHz	N.A.	320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	N.A.
	Attenuation Figure at 1 KHz (Max)	N.A.	1.2 db/km	N.A.
	H. Complete Cable			
	Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.		N.A.
	Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification		N.A.
	I. Accessories			
	Cable accessories of flame retardant quality.	Yes. (Accessories such as harnessing components, markers, bedding, cable jointer, binding tape etc.)		
	J. Tests			
	Routine & Acceptance tests	Refer sub-section IIIE		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 5 OF 14


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>Type tests Submission of type test results and certificate shall be acceptable provided the test has been conducted within last 5 years from the date of bid opening. In case the test is not conducted within last 5 years or spec requirements are not met, the same shall be conducted by contractor free of cost to Employer. Also, refer sub-section-IV:19 TYPE TEST REQUIREMENTS FOR C&I.</p> <p>K Cable Drum</p> <p>Type Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.</p> <p>Outermost layer covered with waterproof paper Yes</p> <p>Painting Entire surface to be painted</p> <p>Length 1000 m + 5% for up to & including 12 pairs 500 m + 5% for above 12 pairs</p>			
3.00.00	SPECIFICATION OF OPTICAL FIBER CABLES (OFC)			
3.01.00	Optic Fiber cable shall be 4/8/12 core, galvanised corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multi mode fibers on as required basis so as to avoid the usage of any repeaters. The core and cladding diameter shall be 9 +/- 1 micrometer and 125 +/- 1 micrometer respectively. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturer, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.			
3.02.00	The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Steel central member, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for a maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be - 20 deg. C to 70 deg. C			
3.03.00	All testing of the fiber optic cable being supplied shall be as per the relevant IEC, EIA and other international standards.			
3.04.00	Bidder to ensure that minimum 100% cores are kept as spares in all types of optical fibre cables.			
3.05.00	Cables shall be suitable for laying in conduits, ducts, trenches, racks and under ground buried installation.			
3.06.00	Spliced / Repaired cables are not acceptable.			
3.07.00	Penetration of water resistance and impact resistance shall be as per IEC standard.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x 660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 6 OF 14

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CLAUSE NO.	TECHNICAL REQUIREMENTS				
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT & VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.		
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking, etc.		
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.		
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
6.06.00	For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalized as per application during detail engineering stage subject to Employer's approval without any cost repercussions.		
6.07.00	Internal wiring in factory pre-wired electronic equipment cabinets may be installed according to the Bidder's standard as to wire size and method of termination or internal equipment. Terminal blocks for connection of external circuits into factory prewired electronic equipment cabinets shall meet all the requirements as specified above.		
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	Wiring to door mounted devices shall be done by 19 strand copper wire provided with adequate loop lengths of hinge wire so that multiple door opening shall not cause fatigue breaking of the conductor.		
7.03.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends in Employer's approved format. All wires directly connected to trip devices shall be distinguished by one additional red color ferrule.		
7.04.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.05.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.06.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
9.02.00	3	Cable tray numbering and marking.		
		To be provided at every 10m and at each end of cable way & branch connection.		
	4	Joints for less than 250 Meters run of cable shall not be permitted.		
	5	Buried cable protection		
		With concrete slabs; Route markers at every 20 Meters along the route & at every bend.		
	6	Road Crossings		
		Cables to pass through buried high density PE pipes encased in PCC. At least 300 mm clearance shall be provided between		
		- HT power & LT power cables,		
		- LT power & LT control cables		
		- LT control & instrumentation cables,		
	Spacing between cables of same voltage grade shall be in accordance with the de-rating criteria adopted for cable sizing.			
	7	Segregation (physical isolation to prevent fire jumping)		
	a	All cable associated with the unit shall be segregated from cables of other Units.		
	b	Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire.		
	8	Cable clamping		
		All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.		
	9	Optical fiber cables inside conduit shall be laid on cable trays wherever available and feasible. In areas where the same are required to be buried, the same shall be buried in separate trench approx.1.6 meter depth, to be laid in 2" GI/rodent proof HDPE conduits covered with sand, brick and soil along the pipe line route;		
		While crossing roads - to be laid in GI/rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;		
		While crossing canals/river- to be laid in GI/rodent proof HDPE conduits within hume pipe.		
		Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.		
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)	PAGE 11 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एनटीपीसी NTPC</div>				
9.03.00	Bidder shall furnish two completely new sets of cable termination kits like Crimping tools, etc., which are required for maintenance of the system as per the type of termination used.					
9.04.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.					
9.05.00	No splices shall be made in conductors for instrument and control circuits except where required at connections to devices equipped with factory installed pigtails. Such splices shall be made only in approved splicing boxes of fitting with removable cover. The splices shall be made with sufficient slack left in the wires to permit withdrawal of the splice from the splicing box for ease of future disconnection of the splices. All exposed conductor or connector surfaces shall be covered with a minimum of three half-lapped layers of all weather vinyl plastic electrical tape. Taping shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the other insulation or connections requiring insulation.					
9.06.00	The Bidder shall be responsible for proper grounding of all equipment under C&I package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.					
9.07.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.					
10.00.00	FIELD MOUNTED LOCAL JUNCTION BOXES					
	(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.			
	(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).			
	(iii)	Type	Door gasket shall be of synthetic rubber.			
	(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.			
	(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided.			
	(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.			
	(vii)	Grounding	To be provided.			
	(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2		PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)		PAGE 12 OF 14

CLAUSE NO.	TECHNICAL REQUIREMENTS	
<p>11.00.00</p> <p>11.01.00</p> <p>11.02.00</p> <p>11.03.00</p> <p>11.04.00</p> <p>11.05.00</p> <p>11.06.00</p> <p>11.07.00</p> <p>11.08.00</p>	<p>CONDUITS</p> <p>Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanized rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, The temperature rating of flexible conduit shall be suitable for the following areas:</p> <ul style="list-style-type: none"> (i) Mills (ii) Drum (iii) Main steam, RH steam (iv) Air Heaters (v) Furnace, BFPDTs <p>For the remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided.</p> <p>The Bidder shall install conduits according to the general routing as approved by Employer and shall coordinate conduit locations with other works.</p> <p>All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductor. Conduit runs to individually mounted equipment shall be grounded to the Employer's cable tray grounding conductor with 12 AEG bare copper conductor. All grounding bushings, clamps and connectors shall be subject to approval of the Employer.</p> <p>All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.</p> <p>All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one meter of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.</p> <p>Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room framing.</p> <p>Conduit supports shall be furnished and installed in accordance with these specifications. Support material shall comply with the following requirements.</p> <ul style="list-style-type: none"> i) Hanger rods shall be 12 mm diameter galvanized threaded steel rods. ii) Single conduit supports shall be one-hole cast metal straps and clamp backs unless other types are acceptable to the Employer. Multiple conduit bank supports shall be constructed of special galvanized support channels with associated conduit clips. <p>Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations</p>	
<p>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</p>	<p>PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)</p> <p>PAGE 13 OF 14</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS	<div>एन टी पी सी NTPC</div>		
	shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.			
11.09.00	Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilized for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.			
11.10.00	Conduits shall be securely fastened to all boxes and cabinets.			
12.00.00	CABLE SUB-TRAY & SUPPORT			
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JBs and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).			
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded. The cable trays shall not have sharp edges, burrs or projections injurious to the insulation or outer sheath of the cables.			
12.03.00	The supporting arrangement of cable tray system shall be able to withstand the weight of the cable and cable tray system. The supporting interval shall not be more than the recommended span for the above loading for the type of cable tray selected. The tray shall not overhang by more than one meter from the support at the dead end. As far as practicable the cable sub-tray system shall be supported from one side only, in order to facilitate installation and maintenance of cables.			
12.04.00	The Bidder shall furnish and install the estimated quantities and sizes of sub trays/troughs including all required fittings and adaptors on as required basis.			
MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2		PART - B SUB-SECTION-IV: 17 (INSTR. AND POWER SUPPLY CABLE)
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	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : D3	
		REV. NO. 00	DATE:
		SHEET	

SECTION – D3

GENERAL TECHNICAL REQUIREMENT CONTROL & INSTRUMENTATION

	2X660 MW MOUDA ST-II TPS	SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT	
<p><u>MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)</u></p> <p>1.0 Measuring instruments / equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment. The instrumentation vendor shall be subject to BHEL's / customer's approval. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes / numbers as approved by BHEL / customer during detailed engineering.</p> <p>1.1 Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.</p> <p>1.2 All local gauges as well as transmitters, sensors and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm².</p> <p>1.3 Instruments envisaged for sea water application shall be provided with wetted parts made of Monel / Hastelloy C.</p> <p>1.4 All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.</p>		
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	2X660 MW MOUDA ST-II TPS			SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT			
1.5 Specification for Pr. Gauge, D.P. Gauge, Temp. Gauge and Level Gauge				
Sl. No.	Features	Essential / Minimum Requirements		
		Pr. Gauge / D.P. Gauge	Temp. Gauge	Level Gauge
1	Sensing Element and Material	Bourdon for high pressure, Diaphragm / Bellow for low pr. of 316 SS	Mercury in steel below 450 Deg.C and inert gas actuated for above 450 Deg.C of SS bulb and capillary	Tempered toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel / 304 SS
3	Dial size	150 mm	150 mm	Tubular covering entire range.
4	End connection	½ inch NPT (M)	¾ inch NPT (M)	Process connection as per ASME PTC and drain / vent 15 NB.
5	Accuracy	±1% of span	±1% of span	±2%
6	Scale	Linear, 270 Deg. Arc graduated in metric units.	Linear, 270 Deg. Arc graduated in Deg. C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. For the assembly shall be 1.5 to the max. design pr. at 38 Deg. C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero / Span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or engraved phenolic laminated tag plate	Engraved with service legend or laminated phenolic name plate	Engraved with service legend or laminated phenolic name plate
12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel / SS as per CS / Alloy process requirement.
13	Material of Bourdon movement	316 SS / 304 SS	316 SS / 304 SS	

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	2X660 MW MOUDA ST-II TPS				SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT				
1.6 Process Actuated Switches					
Sl. No.	Features	Essential / Minimum Requirements Switches devices (Pr., Temp., Flow, Level Switches)			
		Pr. Switch / D.P.	1 <u>TEMP. SWITCH</u>	2 <u>LEVEL SWITCH</u>	3 <u>LIMIT SWITCH</u>
1	Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr. / vacuum	Vapour pressure sensing, liquid filled bellow type with bulb and capillary (10 m minimum)	1.Capacitance types for oil and dirty medium, water, condensate application. Capacitance / conductivity / ultrasonic type for acid / alkali application Radio-frequency / ultrasonic type for ash hopper, ash slurry application Float type for application decided during detailed eng.	Micro switch
2	Material	316 SS	Bulb: 316 SS Capillary: 304 SS	316 SS	Silver plated high conductivity non-corrosive
3	Repeatability	±0.5% for full range	±0.5% for full	±0.5% for full range	±0.5%
4	End connection	½ Inch NPT (F)	½ Inch NPT (F)	1” NB Socket Weld	
5	Over range proof pressure	150% of max. design press.	---	150% of max. design press.	---
6	No. of contacts	2 NO + 2 NC, SPDT snap action dry contact			
7	Rating of contacts	60V DC, 6VA (or more if required by DCS).			
8	Enclosure	Weather and dust proof as per IP-55			
9	Set point / dead	Provided over full range			
10	Accessories	Syphon, snubber, chemical seal, pulsation dampener as required by process	Thermowell of 316 SS and packing glands	All mounting accessories	

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	2X660 MW MOUDA ST-II TPS	SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT	

11	Mounting	Suitable for enclosure / rack mounting or direct mounting	Direct factory mounting on valves, equipment with provision for adjusting at site.
12	Elect. Connection	Plug in socket	
13	General	Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seal shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.	

1.7 Thermocouple

Sr. No.	Features	Essential/Minimum Requirements
1	Type of Thermocouple. :	16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium-PT (Type R) depending on operating temperature Range (ungrounded type).
2	No. of element :	Duplex
3	Housing/ Head :	IP-55/ Diecast Aluminium. Plug in connectors are to be provided for external signal cable connection.
4	Sheathing of Thermocouple:	Swaged type magnesium oxide insulation.
5	Calibration and accuracy :	As per IEC-751/ANSI-C-96.1(special class) for T/C.
6	Characteristic :	Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7	Accessories :	Thermowell (as specified in sl. no.1.9) and shall be spring loaded for positive contacts with the well.
8	Standard :	ANSI C 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well.

1.8 Resistance Temperature Detector (RTD)

Sr. No.	Features	Essential/Minimum Requirements
1	Type of RTD. :	Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2	No. of element:	Duplex
3	Housing/Head:	IP-55/Die cast Aluminium. Plug in connectors are to be provided for external signal cable connection.
4	Sheathing of RTD:	Metal sheathed, ceramic packed
5	Calibration and accuracy:	As per DIN-43760 Class-A for RTD
6	Characteristic:	Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7	Accessories:	Thermo well (as specified in sl. no.1.9) and shall be spring loaded
		for positive contacts With the well.
8	Standard:	DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.

	2X660 MW MOUDA ST-II TPS	SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT	
<p>1.9 Thermo well</p> <p>Thermo well (for all process temp. elements) shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3 1974). For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided. For Air & Flue Gas 316 SS protecting tube with welded cap.</p> <p>1.10 Temperature Transmitter</p> <p>Following types of 2-wire temperature transmitter (directly powered from 4-20 mA input cards of PLC / DDCMIS) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself.</p> <p>(a) Single Input DIN-rail mounted Temperature Transmitter</p> <p>These shall be suitable for mounting on DIN-rails in JBs. The specifications of the JBs shall be as specified elsewhere in the spec. CABLE with additional DIN-rails and IP 65 Protection Class. This temperature transmitter shall be the ones, which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category.</p> <p>(b) Dual-input Temperature Transmitter with Indicator</p> <p>These shall be suitable for mounting on pipes/support. These shall be provided for temperature measurement which are used for tripping/protection of auxiliaries e.g. for bearing temperature on which trip is envisaged. Indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to second sensor in case first sensor fails. This change over is to be alarmed. Protection class shall be IP 65 minimum.</p> <p>Common requirements for each of the above type of temperature transmitters:</p> <ul style="list-style-type: none"> (i) Output : 2-wire (power supply from input card of Control System) with 4-20 mA output with Superimposed HART protocol signal. (ii) Input : Same transmitter shall be capable to handle Pt- 100 RTD, Thermocouples-K&R types (input type to be selectable at site through HART terminal). (iii) Isolation : min. 500 V AC (iv) EMC : as per EN 61326 compatibility (v) Operating ambient : 0 to 85 deg C (without indicator) temperature 0 to 70 deg. C (with indicator) (vi) Power supply : Compatible with input module of Control System (vii) Accessories : Mounting arrangements including clamps etc. (viii) Composite Accuracy: <p>(a) For head mounted and DIN-rail mounted</p> <p>Accuracy (Refer types note 2)</p>		

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<p>RTD =<0.4% of 0-250 deg C. span</p> <p>T/C-K type =<0.4% of 0-600 deg C. span</p> <p>T/C-R type =<0.4% of 0-1000 deg C. Span</p> <p>CJC accuracy (for thermocouples) shall be =<1 deg.</p> <p>(b) For dual input type:</p> <p>RTD =<0.25% of 0-250 deg C. Span</p> <p>T/C-K type =<0.2% of 0-600 deg.C span</p> <p>CJC accuracy (for thermocouples) shall be =< 1 deg. C.</p> <p>Notes:</p> <p>1. In case of failure (open or burn-out) of RTD/thermocouple, temp. transmitter shall provide low temperature output.</p> <p>2. Composite Accuracy is to be calculated as summation of all applicable accuracies of temp. transmitter, for converting sensor input to output in 4-20 mA (e.g. basic accuracy, digital accuracy, D/A accuracy. etc.) and temperature effect on these accuracies at ambient temperature of 50 deg. C. based on the figure / formula given in the standard product catalogue for span as specified above for various types of Temperature Elements specified. All such accuracy/temperature effect figures in catalogue shall be first converted to deg. C, and then percentage of these converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures.</p> <p>1.11 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL ELECTRONIC TRANSMITTERS:</p> <table> <tr> <th>Sr. No.</th><th>Features</th><th>Essential/Minimum Requirements</th></tr> <tr> <td>1.</td><td>Type of Transmitter</td><td>Microprocessor based 2 wire type, Hart protocol compatible.</td></tr> <tr> <td>2.</td><td>Accuracy</td><td>± 0.1% of calibrated span (minimum)</td></tr> <tr> <td>3.</td><td>Output signal range</td><td>4-20 mA DC (Analog) along with superimposed digital signal based on HART protocol</td></tr> <tr> <td>4.</td><td>Turn down ratio</td><td>10:1 for vacuum/very low pressure applications. 30:1 for other applications.</td></tr> <tr> <td>5.</td><td>Stability</td><td>± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm².</td></tr> </table>			Sr. No.	Features	Essential/Minimum Requirements	1.	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible.	2.	Accuracy	± 0.1% of calibrated span (minimum)	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal based on HART protocol	4.	Turn down ratio	10:1 for vacuum/very low pressure applications. 30:1 for other applications.	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm ² .
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	<p>± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm² (g).</p>	
6.	Zero and span drift	+/- 0.015% per deg.C at max span. +/-0.11% per deg.C at min. span.
7.	Load impedance	500 ohm (min.)
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant Coating.
9.	Over Pressure	150% of max. Operating pressure
10.	Connection (Electrical)	Plug and socket type
11.	Process connection	1/2 inch NPT (F)
12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability Manual from instrument with zero suppression and elevation facility.
13.	Accessories	-Diaphragm seal, pulsation dampeners, siphon etc. as required by service and operating condition. -2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters. -For hazardous area, explosions proof enclosure as described in NEC article 500.
14.	Diagnostics	Self Indicating feature
15.	Power supply	24V DC ± 10%.
16.	Adjustment/calibration/	Centralized PC based system.
<p>Notes :</p> <p>In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold.</p> <p>LVDT type is not acceptable.</p> <p>Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.</p>		
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	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT																																																										
<p>1.12 Ultrasonic Type Level Transmitter</p> <table> <tr> <th>Sl. No</th><th>Features</th><th>Essential/Minimum requirements</th></tr> <tr> <td>1.</td><td>Type of Transmitter</td><td>Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter.</td></tr> <tr> <td>2.</td><td>Output signal</td><td>Galvanic ally isolated 4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol).</td></tr> <tr> <td>3.</td><td>Sensor Accuracy</td><td>+/- 0.5% of calibrated span.</td></tr> <tr> <td>4.</td><td>Sensor Repeatability</td><td>3 mm or better.</td></tr> <tr> <td>5.</td><td>Power supply</td><td>24 V DC +/- 10%</td></tr> <tr> <td>6.</td><td>Temperature compensation</td><td>To be provided within transducer.</td></tr> <tr> <td>7.</td><td>Configuration</td><td>Sensor unit and Electronic units are to be separate. It shall be possible to mount the Electronic unit at a remote accessible location from the transducer. All cables and weather proof fittings to interconnect transducer to electronic unit shall be provided.</td></tr> <tr> <td>8.</td><td>Housing</td><td>Weather proof as per IP-55 with durable corrosion resistant epoxy coating.</td></tr> <tr> <td>9.</td><td>Calibration</td><td>Through HART Communicator.</td></tr> <tr> <td>10.</td><td>Zero and Span adjustment</td><td>Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc</td></tr> <tr> <td>11.</td><td>Sensor Material</td><td>Corrosion resistant material to suit individual application requirement.</td></tr> <tr> <td>12.</td><td>False signal tolerance</td><td>Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry</td></tr> <tr> <td>13.</td><td>Range</td><td>Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc</td></tr> <tr> <td>14.</td><td>Display</td><td>Minimum 4 character display with integral keypad, access protected by user code.</td></tr> <tr> <td>15.</td><td>Diagnostics</td><td>Loss of echo alarm etc</td></tr> <tr> <td>16.</td><td>Load Impedance</td><td>500 ohms minimum</td></tr> <tr> <td>17.</td><td>Electrical Connection</td><td>Plug and socket</td></tr> <tr> <td>18.</td><td>Accessories</td><td> <ul style="list-style-type: none"> • All weather canopy for protection from direct sunlight and direct rain. • All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316. • For hazardous areas, explosion proof enclosure as described in NEC article 500. </td></tr> </table> <p>1.13 Guided Wave Radar Type Level Transmitter</p>			Sl. No	Features	Essential/Minimum requirements	1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter.	2.	Output signal	Galvanic ally isolated 4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol).	3.	Sensor Accuracy	+/- 0.5% of calibrated span.	4.	Sensor Repeatability	3 mm or better.	5.	Power supply	24 V DC +/- 10%	6.	Temperature compensation	To be provided within transducer.	7.	Configuration	Sensor unit and Electronic units are to be separate. It shall be possible to mount the Electronic unit at a remote accessible location from the transducer. All cables and weather proof fittings to interconnect transducer to electronic unit shall be provided.	8.	Housing	Weather proof as per IP-55 with durable corrosion resistant epoxy coating.	9.	Calibration	Through HART Communicator.	10.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc	11.	Sensor Material	Corrosion resistant material to suit individual application requirement.	12.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry	13.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc	14.	Display	Minimum 4 character display with integral keypad, access protected by user code.	15.	Diagnostics	Loss of echo alarm etc	16.	Load Impedance	500 ohms minimum	17.	Electrical Connection	Plug and socket	18.	Accessories	<ul style="list-style-type: none"> • All weather canopy for protection from direct sunlight and direct rain. • All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316. • For hazardous areas, explosion proof enclosure as described in NEC article 500.
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Type	Guided wave Radar	
Principle	TDR (Time domain reflectometry)	
Probe Type & Material	Coaxial, SS316/316L. If required probe shall be suitable for overfill Prevention.	
Signal o/p	4-20mA with HART signal suitable for overfill prevention.	
Display	Integral	
Power supply	24 VDC	
Accuracy	5mm	
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and Amdt A1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2	
Mounting	External cage mounting	
The transmitters shall be provided with IP-55 protection class with durable corrosion resistant coating.		
The transmitters shall be able to provide digital signals super imposed on 4-20 mA signal as per HART protocol.		
1.14 DEW POINT METER		
Sensor		
Type :	Capacitance type with change in output proportional to moisture present.	
Service :	Dry Air	
Range :	-50 to 0 Degree Centigrade Dew-Point	
Sensor Accuracy :	Better than +/-0.5^	
Operating Temperature:	0 to 50 degree C.	
Operating Pressure :	0-10 Kg./Cm2, suitable for process application.	
Analyser		
Input :	Change in capacitance from dew point sensor.	
Display :	Combined enclosure with two three-digit seven segments LED display with decimal point after two digits. LED height shall be 4 inches, clearly legible from a distance of atleast 10 meters.	
Range :	-50 to 0 Degree Centigrade Dew-Point	
Display Accuracy :	Better than +/-2 Degree C.	
Mounting :	Table top/Flush mounting, to be finalised during detailed engineering.	
Power supply :	240V AC, 50 Hz to be arranged by the supplier.	
Output :	4-20 mA DC capable of driving a load impedance of 500 ohms minimum.	

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<p>1.15 ROTAMETERS</p> <table> <tr> <th>SR. NO.</th><th>FEATURES</th><th>ESSENTIAL / MINIMUM REQUIREMENTS</th></tr> <tr> <td>1.</td><td>TYPE</td><td>VARIABLE AREA METAL TUBE</td></tr> <tr> <td>2.</td><td>FLUID MEDIA</td><td>WATER/OIL</td></tr> <tr> <td>3.</td><td>TUBE BODY</td><td>SS316</td></tr> <tr> <td>4.</td><td>MATERIAL OF FLOAT</td><td>316 SS</td></tr> <tr> <td>5.</td><td>INDICATOR</td><td>LINEAR SCALE</td></tr> <tr> <td>6.</td><td>ACCESSORIES</td><td>FLANGE, ORIFICE IN CASE OF BYPASS ROTAMETER (FOR LINE SIZE ABOVE 100 MM)</td></tr> <tr> <td>7.</td><td>HOUSING PROTECTION CLASS</td><td>IP-55</td></tr> <tr> <td>8.</td><td>ACCURACY</td><td>+ 2% OF MEASURED VALUE.</td></tr> </table> <p>1.16 FIELD MOUNTED LOCAL JUNCTION BOXES</p> <table> <tr> <td>(i)</td><td>No. of ways</td><td>12/24/36/48/64/72/96/128 with 20% spare terminals.</td></tr> <tr> <td>(ii)</td><td>Material and Thickness</td><td>4mm thick Fiberglass Reinforced Polyester.</td></tr> <tr> <td>(iii)</td><td>Type</td><td>Screwed at all four corners for door. Door handle shall be self Locking with common key. Door gasket shall be of synthetic rubber.</td></tr> <tr> <td>(iv)</td><td>Mounting clamps and accessories</td><td>Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.</td></tr> <tr> <td>(v)</td><td>Type of terminal blocks</td><td>Rail mounted maxitermi or cage-clamp type suitable for conductor size up to 2.5 mm². A M6 earthing stud shall be provided.</td></tr> <tr> <td>(vi)</td><td>Protection Class</td><td>IP: 55 minimum for indoor & IP-66 minimum for outdoor</td></tr> <tr> <td>(vii)</td><td>Colour</td><td>to be decided during detailed engineering & Subject to Employer's approval.</td></tr> </table> <p>2.0 CABINET/PANELS</p> <p>Bidder shall design the cabinet internal arrangement, floor cutout and cable gland plate such that all the cables entering or leaving the cabinet can be properly glanded in the gland plate. In case, glanding is not possible Bidder shall indicate in his proposal his suggested procedure for cable entry and securing the cable at place. If gland plate is not provided, then a suitable plate of 2mm size shall be provided to close bottom entry of panels with proper fixing through screw at number of points for giving rigid support. Bidder shall furnish the number of cables that can be connected in each cabinet and Bidder shall provide the number of marshalling and termination cabinets required to connect all the specified input and output points as per the arrangements decided by the Employer during detail Engg. Bidder shall also provide after the final installation of the cable, a suitable fire proof sealing material on the gland plates to</p>			SR. NO.	FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS	1.	TYPE	VARIABLE AREA METAL TUBE	2.	FLUID MEDIA	WATER/OIL	3.	TUBE BODY	SS316	4.	MATERIAL OF FLOAT	316 SS	5.	INDICATOR	LINEAR SCALE	6.	ACCESSORIES	FLANGE, ORIFICE IN CASE OF BYPASS ROTAMETER (FOR LINE SIZE ABOVE 100 MM)	7.	HOUSING PROTECTION CLASS	IP-55	8.	ACCURACY	+ 2% OF MEASURED VALUE.	(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spare terminals.	(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester.	(iii)	Type	Screwed at all four corners for door. Door handle shall be self Locking with common key. Door gasket shall be of synthetic rubber.	(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.	(v)	Type of terminal blocks	Rail mounted maxitermi or cage-clamp type suitable for conductor size up to 2.5 mm ² . A M6 earthing stud shall be provided.	(vi)	Protection Class	IP: 55 minimum for indoor & IP-66 minimum for outdoor	(vii)	Colour	to be decided during detailed engineering & Subject to Employer's approval.
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<p>ensure absolute sealing of the cabinet bottom, thereby ensuring that no dust ingress takes place from the cable entry zones. The grouping, layout of all the above cabinets shall be as approved by the Employer during detail engg.</p> <p>The Bidder shall furnish with the proposal, detailed drawings and photographs giving sufficient information to demonstrate to the Employer, the internal layouts of cabinets offered, constructional features of cabinets, system of packaging of control modules in racks, wiring and cabling techniques, termination method for field cables, test facilities provided, etc.</p> <p>The cabinets shall be IP-55 protection class. The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. This shall be demonstrated to the Employer during the factory testing of the system. The Contractor shall ensure that the temperature rise is limited to 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition. Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper enclosure and details shall be furnished with proposal. Suitable louvers with wire mesh shall be provided on the cabinet.</p> <p>The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables.</p> <p>The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications, preferred height of the cabinet is 2345 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Bidder during detailed engineering.</p> <p>Cabinet doors shall be hinged and shall have turned back edges and additional bracing where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.</p> <p>Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm. The finish colors for exterior and interior surfaces shall conform to following shades:</p> <p>Front & Rear-RAL 9002; End panels sides- RAL 5012. Internal colour shall be same as external colour.</p> <p>Paint films which show sags, checks or other imperfections shall not be acceptable.</p>		

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<p>Cabinets shall be designed for a grounded installation on the building structure. Any isolation from the building ground which is required by equipment design shall be provided internal to the cabinet.</p> <p>All panels, cabinets shall be provided with a continuous bare copper ground bus, for grounding, bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels.</p> <p>All alarm contacts located within cabinets as well as inputs/outputs from other related system shall be suitably terminated in the cabinets.</p> <p>The Bidder may submit details of his standard wiring practice for similar application for consideration and approval of Employer.</p>		
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 1.0 FIELD MOUNTED LOCAL JUNCTION BOXES		
(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spare terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester.
(iii)	Type	Screwed at all four corners for door. Door handle shall be self Locking with common key. Door gasket shall be of synthetic rubber.
(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply.
(v)	Type of terminal blocks	Rail mounted maxitermi or cage-clamp type suitable for conductor size up to 2.5 mm2. A M6 earthing stud shall be provided.
(vi)	Protection Class	IP: 55 minimum for indoor & IP-66 minimum for outdoor
(vii)	Colour	to be decided during detailed engineering & Subject to Employer's approval.
 2.0 ANALYSER INSTRUMENTS:		
Common Requirements		
1 Output signals Analog Binary	4-20 mA DC 2 NO + 2 NC for high alarm	
2. Zero & span Adjustment	Available	
3. Ambient temp.	50°C	
4. Indication	Digital	
5. Enclosure Type/Material	Weather & Dust proof (IP 65) Die cast Aluminium/SS	
6. Type of Electronics	Microprocessor based	
7. Digital Signal transmission	RS 232 Link & to suit connections protocol to DDCMIS	
8. Calibration	Auto & Manual (from Remote)	


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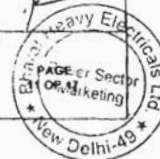
	2X660 MW MOUDA ST-II TPS	SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT	
9. Error Diagnostic	To be provided	
10. Others	Auto temperature compensation. If analyser provides superimposed HART signal on 4-20 mA DC output, It shall also be connected to PC based station (In Employer's Scope).	
2.1 PH Analyser		
1. TYPE	CELL - FLOW THROUGH	
2. ACCURACY	< ± 1% OF SPAN	
3. RANGE	0 - 14 PH, PROGRAMMABLE	
4. NO. OF STEAMS	SINGLE	
5. STABILITY	< 0.001 PH / WEEK	
6. TEMP. COEFFICIENT / TEMP. ERROR	0.001 PH / DEG. C	
7. TYPE OF ELECTRONICS	MICROPROCESSOR BASED WITH SELFDIAGNOSTIC FACILITY.	
8. INDICATION	DIGITAL	
9. ENCLOSURE	WEATHER DUST PROOF (IP55) DIE CAST ALUMINUM with IP-65.	
2.2 Conductivity Analyser		
1. TYPE	CELL - FLOW THROUGH	
2. ACCURACY	< ± 1% OF SPAN	
3. RANGE	As per system requirement, PROGRAMMABLE	
4. STABILITY	< 0.001 PH / WEEK	
5. TEMP. COEFFICIENT / TEMP. ERROR	0.001 PH / DEG. C	
7. TYPE OF ELECTRONICS	MICROPROCESSOR BASED WITH SELFDIAGNOSTIC FACILITY.	
8. INDICATION	DIGITAL	
9. ENCLOSURE	WEATHER DUST PROOF (IP55) DIE CAST ALUMINUM with IP-65.	
2.3 Silica Analyser		
1. ACCURACY	< ± 2ppb	
2. RANGE	As per system requirement, PROGRAMMABLE	
3. RESPONSE TIME	Better than 12 min for 90% change	
4. TYPE OF ELECTRONICS	MICROPROCESSOR BASED WITH SELFDIAGNOSTIC FACILITY.	
5. INDICATION	DIGITAL	

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	2X660 MW MOUDA ST-II TPS	SECTION: C
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSATE POLISHING UNIT	
6. ENCLOSURE	WEATHER DUST PROOF (IP55) DIE CAST ALUMINUM with IP-65.	
7. SELF DIAGNOSTIC	Yes with alarms for no reagent, calibration fault and silica concentration low / high.	
3.0 SIGHT Flow GLASS		
01. Type :	Flap-type	
02. End connection :	Screwed / Flanged	
03. Material :	a) Body : SS-304	
	b) Cover Plate : SS-304	
	c) Indicator : SS-316	
04. Sight Glass :	Toughened Borosilicate	
05. Gasket :	Neoprene	
06. Bolts & Nuts :	High tensile steel	
07. Hydraulic Test Pressure :	1.5 times maximum working pressure	
08. Accessories :	As required	
4.0 TOTALIZER/COUNTER		
Technical Particulars		
01. Type :	Electronic	
02. Number of digits and digit size :	Six, 9 mm high (approx.)	
03. Input :	DC pulse from electronic integrator	
04. Reset :	Manual	
05. Readable distance :	3 meters (minimum)	
06. Mounting :	Flush	
07. Face Dimension :	72 mm (H) x 144 mm (W) (approx.)	
08. Depth :	600 mm (maximum)	
09. Performance :		
a) Accuracy :	± 0.1% of span	
10. Operating ambient temp. :	0 - 50 °C	
11. Connection between totalizer & tray	Prefab cable with quick connecting plug and socket with adequate cable length to permit full withdrawal of totalizer from with cables connected.	
:		
12. Accessories :	a) 4-20 mA DC (linear) input type electronic integrator. b) Mounting tray c) Engraved phenolic nameplate affixed to front flange to identify tag number and measured variable.	
13. Preferred Features :	Power supply on / failure LED visible from front.	

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CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<p>6. TEMP. COEFFICIENT / TEMP. ERROR 0.001 PH / DEG. C</p> <p>7. TYPE OF ELECTRONICS MICROPROCESSOR BASED WITH SELF-DIAGNOSTIC FACILITY.</p> <p>8. INDICATION DIGITAL</p> <p>9. ENCLOSURE WEATHER DUST PROOF (IP55) DIE CAST ALUMINUM.</p>	
6.00.00	SPECIFICATION FOR FLOW ELEMENTS	
6.01.00	Orifice Plate	
	Features Essential/Minimum Requirements	
	Type Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042	
	Material 316 SS	
	Thickness 3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm.	
	Material of branch pipe Same as main pipe	
	Root valve type Globe	
	Root valve material 316 SS	
	Root valve size 1 inch	
	Impulse pipe of same material up to root valve Required	
	Tappings Flanged weld neck. 3 pairs. of tapping.	
	Beta Ratio 0.34 to 0.7	
	Beta Ratio calculation to be submitted Yes	
	Assembly drg. and flow Vs DP Curves Yes	
	Accessories Root valves, flanges, Vent/drain hole (As required)	
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / HADINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		
TECHNICAL SPECIFICATION SECTION-VI PART-B		
INC-04 MEASURING INSTRUMENTS		







SUB-SECTION – IIIC – 08


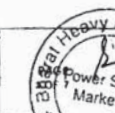
CONTROL VALVE & ACTUATORS

MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) /
NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) /
RAGHUNATHPUR TPP-II (2X660MW)
STEAM TURBINE GENERATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
PART-B



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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	CONTROL VALVES AND ACTUATORS		
1.00.00	CONTROL VALVES, ACTUATORS & ACCESSORIES		
1.01.00	General Requirements		
1.01.01	<p>The control valves and accessories equipment furnished by the Bidder shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, the ASME Boiler & pressure vessel code, Indian Boiler Regulation (IBR), ISA, and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards. All the Control Valves, their actuators and accessories to be furnished under this Sub-section will be fully suitable and compatible with the modulating loops covered under the Specification.</p>		
1.01.02	<p>All the control valves and accessories offered by the Bidder shall be from reputed, experienced manufacturers of specified type and range of valves.</p>		
1.01.03	<p>This specification does not cover special type of control valves such as combined pressure and temperature control valve for Aux PRDS applications, Separator Drain Control Valves etc.</p>		
1.02.00	CONTROL VALVE SIZING & CONSTRUCTION		
1.02.01	<p>The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.</p>		
1.02.02	<p>The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. The sizing shall be in accordance with the latest edition of ISA handbook on control valves. While deciding the size of valves, Bidder shall ensure that valves trim exit outlet velocity as defined in ISA handbook does not exceed 8 m/sec for liquid services, 150 m/sec. for steam services and 50% of sonic velocity for flashing services. Bidder shall furnish the sizing calculations clearly indicating the outlet velocity achieved with the valve size selected by him as well as noise calculations, which will be subject to Employer's approval during detailed engineering.</p>		
1.02.03	<p>Control valves for steam and water applications shall be designed to prevent cavitation, wire drawing, flashing on the downstream side of valve and down stream piping. Thus for cavitation/flashing service, only valve with anti cavitation trim shall</p>		
<div>MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (2X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE</div> <div>TECHNICAL SPECIFICATION SECTION-VI PART-B</div> <div>IIC-08 CONTROL VALVE AND ACTUATORS</div> <div></div>			


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CLAUSE NO.	TECHNICAL REQUIREMENTS	NTPC
	be provided. Detailed calculations to establish whether cavitation will occur or not any given application shall be furnished.	
1.02.04	Control valves for application such as HP/LP heater Emergency level control, Emergency Make-up to Condenser hotwell, GSC minimum flow, Deaerator Drain condenser hotwell, condensate spill to condensate reserve tank, condenser no make-up and valve gland sealing supplying pressure control, CEPS minimum control, BFP recirculation control valve shall have permissible leakage rate as leakage Class V. All other control valve shall have leakage rate as per leakage Class-IV.	
1.02.05	The control valve induced noise shall be limited to 85 dBA at 1 meter from the surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.	
2.00.00	VALVE CONSTRUCTION	
2.01.00	All valves shall be of globe body design & straightaway pattern with single or port, unless otherwise specified or recommended by the manufacturer to angle body type. Rotary valve may alternatively be offered when pressure drops permit.	
2.02.00	Valves with high lift cage guided plugs & quick-change trims shall be supplied.	
2.03.00	Cast Iron valves are not acceptable.	
2.04.00	Bonnet joints for all control valves shall be of the flanged and bolted type construction acceptable to the Employer. Bonnet joints of the internal thread union type will not be acceptable.	
2.05.00	Plug shall be of one-piece construction cast, forged or machined from stock. Plug shall be screwed and pinned to valve stems or shall be integral valve stems.	
2.06.00	All valves connected to vacuum on down stream side shall be provided with suitable for vacuum applications (e.g. double vee type chevron packing)	
2.07.00	Valve characteristic shall match with the process characteristics.	
2.08.00	Extension bonnets shall be provided when the maximum temperature of is greater than 280 deg. C.	
2.09.00	Flanged valves shall be rated at no less than ANSI pressure class of 300 lb:	
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (2X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		IBC-04 CONTROL VALVE AND ACTUATORS

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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	VALVE MATERIALS			
	Sr. No.	Service	Body material	Trim Material
	1	Non-corrosive, non-flashing and non-cavitation service except DM service	Carbon steel ASTM-A216 Gr. WCB for fluid temperature below 275 Deg. C Alloy steel ASTM-A217Gr. WC9 for fluid temperature above 275 Deg. C	316SS stellited with stellited facedguide posts and bushings.
	2.	Severe flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC9	440 C
	3.	Low flashing/cavitation service	Alloy steel ASTM-A217 Gr. WC6	17-4 PH SS
4.	DM water service	316 SS	316 SS	
	<p>NOTE Valve body rating shall meet the process pressure and temperature requirement as per ANSI B16.34.</p> <p>However, Bidder may offer valves with body and trim materials better than specified materials and in such cases Bidder shall furnish the comparison of properties including cavitation resistance, hardness, tensile strength, strain energy, corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Employer's consideration and approval.</p>			
4.00.00	END PREPARATION			
	<p>Valve body ends shall be either butt welded/socket welded, flanged (Rubber lined for condensate service) or screwed as finalised during detailed engineering and as per Employer's approval. The welded ends wherever required shall be butt welded type as per ANSI B 16.25 for control valves of sizes 65 mm and above. For valves size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.</p>			
MOUDA STPP-8 (2X660MW) / SOLAPUR STPP (2X660MW) / NABINAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-8 (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-B		IIC-08 CONTROL VALVE AND ACTUATORS

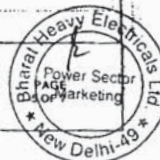
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
5.00.00	VALVE ACTUATORS All control valves shall be furnished with pneumatic actuators. The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously. Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the selection of the actuator to ensure tight seating unless otherwise specified. The travel time of the pneumatic actuators shall not exceed 10 seconds.		
6.00.00	CONTROL VALVE ACCESSORY DEVICES		
6.01.00	All pneumatic actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.		
7.00.00	SPECIFICATIONS FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER		
	Electrical	Input Signal	4-20 mA
		Power Supply	Loop Powered from the output card of Control System.
		Hart Protocol	Compatibility For Remote Calibration & Diagnostics (Super-Imposed HART signal on Input Signal 4-20 mA)
		Valve Position Sensing	Position Sensing (Non Contact-Type), 4-20 mA O/P Signal For Control System to be provided
	Environment	Operating Temp	(-)30 To 80 Deg. C
		Humidity	0-95 %
		Protection Class	IP-65 Minimum
	Remote Configuration and Diagnostics	a. The following functions shall be provided in the positioner:	
		Remote Configuration, Calibration and Testing of the Actuator and advanced Diagnostic Features Like Stroke Counter or	
	MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / RAJNAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI PART-B



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CLAUSE NO.	TECHNICAL REQUIREMENTS	
		
	Travel Counter, Leakage In Actuators, On Line Partial Closure Test, Valve Signature Analysis, Step Response Test, Valve Friction/ Jamming Detection etc. (See Note* below) b. Factory Valve Signature Tests Reports (Pr Vs Valve Travel And Travel Vs I/P Signal) are to be provided.	
Tests Certificates	Test certificates as per Manufacturer Standard/Relevant Standard are to be submitted	
Configuration/	Remote Calibration, Auto & Manual Calibration Shall Be Possible	
Operating Range	Operating Range	Full Range & Split Range Signal Range
Modes	Valve Action	Direct & Reverse. Valve Action
	Flow Characterisation	Possible To Fit Valve Characteristic Curve Linear & Equal Percentage
Fail Safe/Fail Freeze	Fail Safe/Fail Freeze Feature is to Be Provided.	
Pneumatic	Air Capacity	Sufficient To Handle The Valves Selected/Boosters To Be Supplied If required.
	Air Supply Pressure	To Suit The Air Supply Pressure/Quality Available.
	Process Connection	1/4 Inch NPT
Performance	Characteristic Deviation	$\leq 0.5\%$ Of Span
	Ambient Temp Effect	$\leq 0.01\%$ /Deg C Or Better
EMC & CE Compliance	Required International Standard Like EN/IEC.	To En50081-2 & En50082 Or Equivalent
Accessories	In Built Operator Panel	Display With Push Buttons For Configuration And Display On The Positioner Itself (Password Protected/Hardware Lock)
	Hand Held Hart Calibrator	Universal Hart Calibrator To Be Provided, One Per Unit
MOUDA STPP-II (2X660MW) / SOLAPUR STPP (2X660MW) / NABHAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RACHURATHUR TPP-II (2X660MW) STEAM TURBINE GENERATOR PACKAGE		
TECHNICAL SPECIFICATION SECTION-VI PART-B		
IEC-08 CONTROL VALVE AND ACTUATORS		

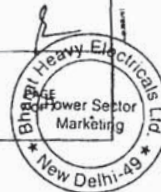


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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	Press Gauge Block		For Supply & Output Pr., Filter Regulator Other Accessories Shall Be Provided As On Required Basis For Making System Complete.
	Electrical Cable Entry		1/2-Npt, Side Or Bottom Entry To Avoid Water Ingress
	Valves Mounting Assembly		For Sliding Stem/Rotary/Single Acting/Double Acting On Required Basis
	<p>* Note:</p> <p>Employer is providing a centralized HART management system including the HART multiplexing/interfacing system. The HART signals shall be picked up from marshalling terminals of DDCMIS (SG/TG DDCMIS as well as BOP DDCMIS), as applicable. The details of the above mentioned employer's HART management system are as below:</p> <p>The following functionalities are provided through software of the HART management system:</p> <ol style="list-style-type: none"> 1. For electronic transmitters, temperature transmitters and analysers: <ol style="list-style-type: none"> a. Constant scanning to monitor faults or changes to instrument configuration. b. Employer-defined and standard calibration and configuration procedures for all transmitters. c. Constant signal data collection facilities to maintain continuously updated records. d. Automatic tracking of configuration changes made in the field, such as may be introduced by hand-held communicator. All configuration function associated with hand-held communicators shall be available in the system. e. Event and log reports on screen as well as on printer. f. Any addition/deletion of transmitter will be reported on printer and logged in hard disk. 2. For electronic positioners: <ol style="list-style-type: none"> a. Remote Configuration, Calibration and Testing of the Actuator b. Advanced Diagnostic Features Like Stroke Counter or Travel Counter, Leakage In Actuators, On Line Partial Closure Test, Valve Signature Analysis, Step Response Test, Valve Friction/ Jamming Detection etc. 		
MOJDA STPP-8 (2X660MW) / SOLAPUR STPP (2X660MW) / NABHAGAR STPP (3X660MW) / MEJA TPP (2X660MW) / RAGHUNATHPUR TPP-8 (2X660MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART-B	SIC-08 CONTROL VALVE AND ACTUATORS	


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THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-387-155A-A001

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-326-145-I007	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 05.01.10
			SHEET 1	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	

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GENERAL *	* PROJECT	2x660 MW MOUDA ST-II	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
	CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55
MECHANICAL POSITION INDICATOR		TO BE PROVIDED FOR 0-100% TRAVEL	
BEARINGS		DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION		METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
SIZING		OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM	
HANDWHEEL	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED	
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.	
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 C: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11	
	COLOUR SHADE	<input checked="" type="checkbox"/> BLUE (RAL 5012) ENAMEL <input type="checkbox"/>	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 24 VDC <input type="checkbox"/> 110 V	
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF <input checked="" type="checkbox"/> IP 55, TOTALLY ENCL, SELF VENTILATED.	
	@ INSULATION CLASS	<input checked="" type="checkbox"/> CLASS-B <input type="checkbox"/> CLASS-F	
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE) <input type="checkbox"/> -----	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-SS-326-145-I007

VOLUME

SECTION

REV. NO.

00

DATE: 05.01.10

SHEET

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OF

3

Data Sheet A & B


DATA SHEET-A
(TO BE FILLED BY PURCHASER)

DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

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	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	<input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS		
	TYPE	<input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)		
	STEP DOWN CONT. TRANSFORMER	<input checked="" type="checkbox"/> REQUIRED		
	OPEN / CLOSE PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STOP PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INDICATING LAMPS	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	LOCAL REMOTE S/S	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)		
INTERPOSING RELAY (Applicable for integral Starter)	INTERPOSING RELAYS	REQUIRED		
	INTERPOSING RELAY (QUANTITY)	<input checked="" type="checkbox"/> 2 NOs. <input type="checkbox"/> 3 NOs.		
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC		
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX		
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms		
TORQUE SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-387-155A-A001

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-326-145-I007			
		VOLUME			
		SECTION			
		REV. NO.	00	DATE:	05.01.10
		SHEET	3	OF	3
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		

314

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	<input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/>		
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA		
	ACCURACY	\pm 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY			
	@ RATING	415v, 3PH, AC FOR RATING > 0.2KW; SINGLE PHASE FOR RATING < 0.2KW		
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED		
	ACTUATOR TERMINAL BOX	REQUIRED		
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	<input type="checkbox"/> IP 65 @ <input type="checkbox"/> <input checked="" type="checkbox"/> IP65 <input type="checkbox"/>		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET(9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED <input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/>		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:--DURING DETAIL ENGINEERING		
	@ SPACE HEATER CABLE GLAND	SIZE: 2C x 2.5 sq. mm		
	OTHER CONTROL CABLE GLANDS-1	<input type="checkbox"/> NOT APPLICABLE		
	OTHER CONTROL CABLE GLANDS-2	<input type="checkbox"/> NOT APPLICABLE		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.
NOTES: <ol style="list-style-type: none"> SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY. -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. 				
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME II-B	
		SECTION : D3	
		REV. NO. 00	DATE:
		SHEET	


STANDARD QUALITY PLAN (C&I)

STANDARD QUALITY PLAN FOR FLOW NOZZLE ASSEMBLY										QUALITY PLAN NO.: PE-QP-387-155A-A005					
										VOLUME		IIB			
										SECTION		D			
										REV. NO.		05		DATE: 30.08.12	
										SHEET		1		OF 3	
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
1.0	RAW MATERIAL Flow Nozzle, pipe, adapter	Physical, Chemical properties Ultrasonic testing (nozzle only)	MA MA	Physical, Chemical tests Ultrasonic test	One / Heat 100%	AP / DP / SP ASTMA388 & ANSI B 16.34	AP / DP / SP ASTMA388 & ANSI B 16.34	TC TC	3/2 3	---	2,1 1	Refer Note-1			
2.0	IN PROCESS														
2.1	Welding procedure specification (WPS)	Correctness	MA	Scrutiny	100%	IS:7307 / ASME IX	IS:7307 / ASME IX	Format of IS / ASME	3/2	---	2,1	IBR certification to be verified by BHEL,if applicable			
2.2	Procedure Qualification Record(PQR) & Welders qualification	Weld soundness	MA	Physical test / Radiographic Test	IS:7307/ IS:7310/ ASME IX	IS:7307/ IS:7310/ ASME IX	IS:7307/ IS:7310/ ASME IX	Format of IS / ASME	3/2	2	1	Welding to be done by qualified welders.			
2.3	Weld FIT-UPS	Dimension, Alignment, Orientation.	MA	Measurement & Visual	100%	WPS/Approved drg.	WPS/Approved drg.	IR / Log Book	3/2	---	2	Refer Note-3			
2.4	Weldments final run	1. Surface defects 2. Sub Surface defects(After PWHT)	MA MA	Penetrant Test Radiographic Test	100% 100%	IS:3658 / ASTM 165/ ASME VIII Div. I ASME SEC. V	ASTM. / 165ASME VIII Div I ASME SEC. VIII	IR / Log Book IR	3/2 3/2	2 2	1 1	100% by Vendor,10 % by BHEL Films to be reviewed by BHEL.			

LEGEND: * CR		- Critical characteristics	IR - Inspection Reports	DS – Data Sheet	MR- Manufacturer records	\$ P - Agency Performing the Test.	1 - BHEL
MA		- Major characteristics	TC - Test Certificates	SP – Tech. Spec.	MS- Manufacturer standards	W - Agency Witnessing the Test.	2 - Vendor
MI		- Minor characteristics	AP – Approved Drawings/doc		V - Agency Verifying the Test.		3 - Sub-vendor

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LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics		IR - Inspection Reports TC - Test Certificates AP - Approved Drawings/doc	DS - Data Sheet SP - Tech. Spec.	MR- Manufacturer records MS- Manufacturer standards	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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 PEM :: C&I		STANDARD QUALITY PLAN FOR FLOW NOZZLE ASSEMBLY					QUALITY PLAN NO.: PE-QP-387-155A-A005					
							VOLUME IIB					
							SECTION D					
							REV. NO. 05 DATE: 30.08.12					
							SHEET 3 OF 3					
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
		2. Calibration	CR	Measurement	1 per type per size	----	Tech Spec.	TC	2	---	1	Refer note-4
4.0	FINAL ASSEMBLY	1. Marking – Tag No., direction of flow	MI	Visual	100%	AP / DS	AP / DS	IR	2	---	1	
		2. Workmanship, surface flaw on weld edge preparation on end of pipe (for site welding)	MA	Visual, Penetrant test	100%	ASTM165 / IS: 3658	No Surface Flaw	TC /IR	3/2	2	1	
		3. Dimensions and end connection	MA	Measurement	100%	AP / DS	AP / DS	IR	3/2	2	1	Refer Note-2 before dispatch
5.0	PACKING & DISPATCH	Soundness of Packing against transit damage	MA	Visual	100%	SP / MS	SP /MS		2	---	----	Refer Note-5

NOTE:

1. Test Certificates to be verified by BHEL at final inspection stage.
2. Minimum 2 coats of primer paint to be applied before dispatch.
3. In case of NTPC / LLOYDS / BHEL qualified welders available, then prequalification and WPS, PQR not required, only TC to be verified.
4. CALIBRATION Test to be carried out at IIT-DELHI / IIT- MUMBAI / FCRI or BHEL approved laboratory.
5. Sea Worthy packing ,if applicable
6. Qualification records of the Vendors can be verified.
7. For P91 & P22 material welding should be continuously done. No interruptions shall be allowed.

LEGEND:

* CR	- Critical characteristics	IR - Inspection Reports	DS – Data Sheet	MR- Manufacturer records	\$ P - Agency Performing the Test.	1 - BHEL
MA	- Major characteristics	TC - Test Certificates	SP – Tech. Spec.	MS- Manufacturer standards	W - Agency Witnessing the Test.	2 - Vendor
MI	- Minor characteristics	AP – Approved Drawings/doc			V - Agency Verifying the Test.	3 - Sub-vendor


STANDARD QUALITY PLAN FOR FLOW ORIFICE PLATE										QUALITY PLAN NO. PE-QP-387-155A-A005			
 PEM :: C&I										VOLUME	IIB		
										SECTION	D		
										REV. NO.	05	DATE: 30.08.12	
										SHEET	1	OF	2
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
1.0 1.1	MATERIAL Orifice Plate	1. Physical, Chemical properties	MA	Physical, Chemical Tests	One / Plate OR One/ Heat	AP / DS / SP	AP / DS / SP	Lab Report	3/2	---	2,1	IBR certification (if applicable) to be verified by BHEL	
		2. Dimensions	MA	Measurement	100%	AP	AP	IR	3/2		1		
	Flanges A. Forgings	Chemical, Mech Properties, UT & Heat Treatment	MA	Chem & Mech UT test	Sample	Material Spec as per ASTM A 388 for UT	ANSI B 16.34	MTC, UT cert, HT cert	3/2	---	1		
1.2	B. Machining	Dimensions	MA	Measurement	100 %	AP / DS	AP / DS	IR	3/2	----	1		
		1. Dimension	MA	Measurement	100%	AP	AP	IR	3/2	2	2		
		2. Surface finish	MA	Visual	100%	-----	Mirror Finish	-----	3/2	2	----		
2.0	IN PROCESS Machine	3. Surface flaw on machined surface	MA	Penetrant test	100%	ASTM 165 / IS:3658	No surface flaw	IR / TC	3/2	2	1		
		1. Overall dimensions	MA	Measurement	100%	AP	AP	IR	3/2	2,1	----		
		2. Marking, Tag no. Direction of flow	MA	Visual	100%	AP / DS	AP / DS	IR	3/2	2	1		
3.0	ASSEMBLY and FINAL INSPECTION	3. Calibration	MA	Performance Test	One per type	-----	SP	TC	3/2	---	1		
		4. Painting	MA	Visual	100%	SP / MS	SP / MS	IR / MR	3/2	----	1		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			
										1 - BHEL 2 - Vendor 3 - Sub-vendor			

<div><div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div>प्रीमियम</div><div>BHEL</div><div>PEM :: C&I</div></div></div></div>		STANDARD QUALITY PLAN FOR FLOW ORIFICE PLATE										QUALITY PLAN NO.: PE-QP-387-155A-A005				
												VOLUME IIB				
												SECTION D				
												REV. NO. 05		DATE: 30.08.12		
												SHEET 2		OF 2		
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
4.0	PACKING	Soundness of Packing against transit damage	MA	Visual	100%	SP / MS	SP / MS	-----	3/2	-----	-----					

NOTE:

- . All test reports & dimension reports shall be verified by BHEL wherever verification is by BHEL at the time of Final Inspection.
- Minimum 2 coats of primer paint to be applied before dispatch.
- CALIBRATION Test to be carried out at IIT-DELHI / IIT- MUMBAI / FCRI or BHEL approved laboratory.
- Sea Worthy packing ,If applicable

LEGEND:	* CR	- Critical characteristics	IR - Inspection Reports	DS – Data Sheet	MR- Manufacturer records	\$	P - Agency Performing the Test.	1	- BHEL
	MA	- Major characteristics	TC - Test Certificates	SP – Tech. Spec.	MS- Manufacturer standards	W	- Agency Witnessing the Test.	2	- Vendor
	MI	- Minor characteristics	AP – Approved Drawings/doc			V	- Agency Verifying the Test.	3	- Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)										QUALITY PLAN NO.: PE-QP-387-155A-A006 VOLUME IIB SECTION D REV. NO. 05 DATE: 24.07.2010 SHEET 1 OF 6			
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
											P	W	V		


1.0 MATERIAL													
1.1	Body & Bonnet casting / forgings, plug, stem.	1.	Physical, Chemical properties	MA	Physical, Chemical tests	One/Heat(HT Batch)	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3	---	2,1	
		2.	Heat Treatment	MA	Review of H.T. Chart	Each H.T.	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3/2	2	1	IBR Certification (if applicable) to be verified by BHEL
		3.	Internal quality of castings	MA	RT for Body & UT for Bonnet(NDT)	100%	ASME B 16.34	ASME B 16.34	Test Report / FILM	3/2	2	1	Only for rating ANSI 900 and above. Applicable for Body and Bonnet only. For Lower rating only if called for in specification.
		4.	Surface Quality	MA	1. Visual 2. MT/PT	100% 100%	MSS-SP-55 ASME B 16.34	MSS-SP-55 ASME B 16.34	Test Certificate Test Certificate	3/2 3	--- 2	2,1 1	
		5.	Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	After Machining on machined surface only For Body & Bonnet after machining

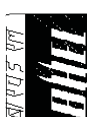
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics														\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			1 - BHEL 2 - Vendor 3 - Sub-vendor		
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<div><div><div></div><div></div><div></div></div><div>PEM :: C&I</div></div>		STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)										QUALITY PLAN NO.: PE-QP-387-155A-A006 VOLUME IIB SECTION D REV. NO. 05 SHEET 2 OF 6 DATE: 24.07.2010					
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
1.2	Diaphragm	1. Surface Quality 2. Hardness 3. Endurance / Life cycle	MA	Visual Measurement Cyclic test 10,000 cycles	100% 100% One / Type	Mfr. standard Mfr. standard 10,000 cycles/ Mfr. standard.	Mfr. standard Mfr. standard No damage	Test Certificate Test Certificate Test Certificate	3/2 3/2 3/2	--- --- ---	2,1 2,1 2,1						
1.3	Spring	1. Composition 2. Mech. Properties 3. Performance	MA	Chemical-Analysis Mech. Test 1. Stiffness ratio 2. Scrapping 3. Cyclic test (Endurance) 4. Dimension (Measurement)	One sample/ Heat One sample/ Heat 100% 100% One / type	Material spec. / Mfr. standard Material spec. / Mfr. standard Material spec. / Mfr. standard Material spec. / Mfr. standard 10,000 cycles	Material spec. / Mfr. standard Material spec. / Mfr. standard Material spec. / Mfr. standard Material spec. / Mfr. standard Appd Drg	Test Certificate Test Certificate Test Certificate Test Certificate Test Certificate Test Certificate Record	3 3 3 3 3 3 3	--- --- --- --- --- ---	2,1 2,1 2,1 2,1 2,1 2,1						
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test 2. Degree of protection	MA	HV, IR, Continuity function IP/NEMA Tests	100% One sample / Lot One sample / type	Rele. Standards Approved Data sheet	Rele. Standards Approved Data sheet	Test Certificate Test Certificate	3 3	--- ---	2,1 2,1	In case TC is not available, Actual test shall be conducted					
<div>LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics RT- Radiographic Test UT - Ultrasonic Test PT - Dye penetrant Test MT- Magnetic Test \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor</div>																	

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)													QUALITY PLAN NO.: PE-QP-387-155A-A006					
													VOLUME		IIB			
													SECTION		D			
													REV. NO.		05		DATE: 24.07.2010	
													SHEET		3		OF 6	
													Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check
									P	W	V							
1.5	Pressure Gauges	1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2,1							
		2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Records	3	---	2,1							
2.0	IN PROCESS INSPECTION																	
2.1	Body & Bonnet after machining, Plug with actuator stem	1. Surface flaws	MA	Visual & MT/PT	100% (on accessible surfaces)	ASME B 16.34	ASME B 16.34	Test Records	2	---	1	Butt weld ends shall be included.						
		2. Dimensional checks	MA	Measurement	100%	Mfr. Standard	Mfr. Standard	Records	2	---	1							
		3. Hard facing (wherever applicable)	MA	Hardness Measurement	One sample/Lot	Mfr. Standard	Mfr. Standard	Records	2	---	1							
2.2	Lapping	Machining surface contact	MA	Blue Matching	One sample/lot	-----	Proper Physical Contact	Test Records	2									
3.0	TESTS ON COMPLETED VALVE																	
3.1	Actuator Chamber	Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	No Leakage	Test Certificate	2	1	1	Refer Note-4						
3.2	Body	Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19	No Leakage	Test Certificate	2	1	1	Refer Note-4						
3.3	Seat leakage test for completed valve	Seat Leakage	MA	Pneumatic Test	100%	FCI-70.2	FCI-70.2	Test Certificate	2	1	1	Refer Note-4						
4.0	OPERATION TEST ON COMPLETED VALVE (Final inspection)	1. Valve Travel	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4						
		2. Opening/Closing time	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4						

LEGEND:	* CR	- Critical characteristics	RT- Radiographic Test	PT – Dye penetrant Test	\$ P	1 - BHEL
	MA	- Major characteristics	UT – Ultrasonic Test	MT- Magnetic Test	W - Agency Witnessing the Test.	2 - Vendor
	MI	- Minor characteristics			V - Agency Verifying the Test.	3 - Sub-vendor

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)													QUALITY PLAN NO.: PE-QP-387-155A-A006											
<div></div> <div>PEM :: C&I</div>													VOLUME IIB			SECTION D			REV. NO. 05			DATE: 24.07.2010		
													SHEET 4			OF 6								
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks												
		3. Linearity/cam characteristic	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4												
		4. Repeatability	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4												
		5. Hysteresis	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4												
		6. Sensitivity	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4												
		7. Accuracy (Overall)	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4												
		8. Control Valve characteristics / CV Test	MA	◆ Measurement (Press. vs. discharge vs. opening 0-100% in steps of 10%)	One per type	As per specs/ Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	--	1	◆ Size = Body & port size Or Body size & CV for non std port. Refer Note 1.												
		9. Operation of limit switch & solenoids and other accessories	MA	Function	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Report	2	1	1	On assembled valve Refer Note-4												
		10. Overall dimensions	MI	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Records	2	1	1	Refer Note-4												
		11. Pre defined valve position in case of air failure	MA	Visual	100%	As per spec & Appd drg	As per spec & Appd drg	Test Certificate	2	1	1													
		12. Cleanliness, painting, stamping (for direction of flow), Tag No.	MA	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1	1													
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			1 - BHEL 2 - Vendor 3 - Sub-vendor								

<div> PEM :: C&I</div>		STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)										QUALITY PLAN NO.: PE-QP-387-155A-A006			
										VOLUME		IIB			
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										SHEET		5 OF 6			
Sl. No.	Component / operation	Characteristics Checked	*	Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
										P	W	V			

5.0 AUXILIARY ITEMS

5.1	Positioner	Overall leakage after assembly including Nozzles leakage	MA	Leak Test (in the steady state input signal)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	Overall leakage including tubing
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.4	Electronic position transmitter(not applicable if provided integral to smart positioner)	1. Accuracy	MA	Operation	100%	Approved data sheet /	Approved data sheet /	Test Certificate	2	1	1	On completed valve
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	

LEGEND: *				\$				1 - BHEL			
CR	- Critical characteristics	RT- Radiographic Test	PT - Dye penetrant Test	P	- Agency Performing the Test.	W - Agency Witnessing the Test.	V - Agency Verifying the Test.	2 - Vendor			
MA	- Major characteristics	UT - Ultrasonic Test	MT- Magnetic Test					3 - Sub-vendor			
MI	- Minor characteristics										

<div><div><div></div></div><div>BHEL</div></div> <div>PEM :: C&I</div>		STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)										QUALITY PLAN NO.: PE-QP-387-155A-A006 VOLUME IIB SECTION D REV. NO. 05 SHEET 6 OF 6 DATE: 24.07.2010				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks			
									P	W	V	V				
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1					
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1					
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1					
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1					
		5. Calibration with Hand Held Communicator	MA	Measurement	Each type	Approved data sheet / Mfr. Standard	Approved data sheet / Mfr. Standard	Test Certificate	2	1	1					
6.0	PAINTING	Soundness of Painting	MA	Visual and Measurement	100%	BHEL specn. / Mfr. Standard	BHEL specn. / Mfr. Standard	Inspection Report	2	---	1		Refer Note-2			
7.0	PACKING	Soundness of Packing against transit damage	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---		Refer Note-3			

NOTES:

1. Cv test will be conducted if Test Certificate for a similar Model / Size / Cv is not available. Validity of the certificate considered as last 3 years. Cv test conducted at IIT/FCRI/any govt. approved laboratory shall not be witnessed by BHEL/customer/consultant.
2. In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
3. Sea worthy packing, if applicable.
4. The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency.
5. IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
6. Copies of all TC's (Test Certificates) for materials duly correlated with Heat Nos., TC's for electrical items and mechanical tests (Leak/Operation) shall be submitted to BHEL for verification and acceptance.


LEGEND: *		CR - Critical characteristics	RT- Radiographic Test	PT - Dye penetrant Test	\$ P - Agency Performing the Test.	1 - BHEL
		MA - Major characteristics	UT - Ultrasonic Test	MT- Magnetic Test	W - Agency Witnessing the Test.	2 - Vendor
		MI - Minor characteristics			V - Agency Verifying the Test.	3 - Sub-vendor

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II	SPEC. NO. PE-TS-387-155A-A001	
		VOLUME III	
		SECTION :	
		REV. NO. 00	DATE:
		SHEET	

SCHEDULE OF CLARIFICATION/DEVIATION

All clarification/deviation from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X660 MW MAUDA STTP STAGE II * SCHEDULE OF DECLARATIONS	SPECIFICATION NO. PE-TS-387-155A-A001
		VOL III
		SHEET OF.....

DECLARATIONS

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name

Authorized representative's
Signature

Name

Bidder's Name with The bidder hereby agrees to fully comply
the requirements and intent of this
specification for the price indicated

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				COMPANY SEAL
NAME	DESIGNATION	SIGNATURE	DATE	

[illegible]

SUGGESTIVE PRICE SCHEDULE (ANNEXURE-A)

ANNEXURE -A				
1	Total lump sum firm price on FOR site basis for design, engineering, manufacture, fabrication, assembly, inspection / testing at manufacturers works, delivery at site including startup and commissioning spares as required, properly packed for transportation, unloading /handling and storage at site, in site transportation, assembly, erection, testing, commissioning, trial run, preparation and submission of "As Built" drawings and carrying out performance guarantee tests at site etc. inclusive of all prevailing taxes, duties and other levies and handover to customer for CONDENSATE POLISHING UNIT complete with all accessories for the total scope defined as per BHEL tender technical specification (PE-TS-387-155A-A001) for project 2 X 660 MW MOUDA STPP, STAGE II.			
a)	Bidder to note that total price indicated above at 1 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.			
b)	In case, price indicated above does not match with item wise break-up given at 2, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.			
2	MAJOR BREAK-UP OF PRICES GIVEN IN 1 ABOVE			
2.1	Total lumpsum firm price for EQUIPMENT (SUPPLY, DESIGN & ENGINEERING) i.e. manufacture, inspection, testing at vendor/sub vendor works, packing, forwarding etc inclusive of all taxes & duties for the complete scope of supply of CONDENSATE POLISHING UNIT defined as per tender specification.			
2.2	Total lump sum firm price for all services including unloading, taking delivery of material at site, storage, handling at site, erection and commissioning, trial run etc, required for completion of CONDENSATE POLISHING UNIT as per tender specification.			
2.3	Price for PG. test and handing over the plant to the customer.			
3	Import Content Currencywise import content, if any (list of items which shall be imported for this contract shall be indicated) included in prices under S.No.1 above. All currencies to be indicated. (as per Annexure-B)			
Bidder shall furnish this price schedule in his price offer only				
particulars of bidder / authorised representative				
name	designation	signature	date	company seal

SUGGESTIVE PRICE SCHEDULE (ANNEXURE-A)

ANNEXURE-B			
LIST OF CIF CONTENTS FOR CONDENSATE POLISHING UNIT FOR 2X660 MW MOUDA STPP STAGE IIPROJECT			
S.NO.	DESCRIPTIONS	UNIT	TOTAL CIF CONTENT
1)	High Pressure Ball Valves		
2)	Resins		