

	TITLE: 2X660 MW ENNORE SEZ STPP	SPECIFICATION NO. PE-TS-412-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION: IA	
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SECTION – I
SUB-SECTION – IA-SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

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1.0 GENERAL

This specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance / special tools & tackles, mandatory spares alongwith spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, erection & commissioning, final painting at site, minor civil work, trial run at site, preparation and submission of drawing /documents including "As Built" drawings and O & M manuals, layout drawings in 2D & 3D (As applicable) and carrying out performance guarantee /Functional / Demonstration tests at site (As applicable) & equipment /system guarantee/Aux. Guaranteed power consumption etc. inclusive of all prevailing taxes, duties and other levies and handover in flawless condition of the package specified above for above mentioned project to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification no. PE-TS-412-155A-A001 for condensate polishing unit package of **2X 660 MW ENNORE SEZ STPP**.

The Condensate Polishing Units with a common external regeneration system and associated accessories shall conform to the technical specification (PE-TS-412-155A-A001) for **CONDENSATE POLISHING UNIT** of **2X 660 MW ENNORE SEZ STPP**.

2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING UNIT

There shall be three service vessels (3X50%) for each 660 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet) & all HP heaters out of service condition.

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 / hydro pneumatically.

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)

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 (3X50%) for each 660 MW unit, each polishing 50 % of the condensate flow.
- 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.

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- 3) One no External resin traps at the condensate & rinse outlet of each of the condensate polisher mixed beds each designed for in-place manual back flushing facility.
- 4) Condensate inlet and outlet headers for each installation with pipe connections to the condensate polisher vessels.
- 5) Resin transfer headers and pipe lines 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. Rinse water outlet headers from condensate-polymer vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser.
- 7) All necessary valves, and fittings for the installations with actuators necessary for their remote operation from CP System Control Panel of each 660 MW Unit. 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 Condensate Polisher Mixed Beds / Condensate Polisher Service vessels.
- 8) A drain header for the condensate polisher service vessels. All necessary drains, vents and sampling points, with valves as required.
- 9) Gland sealing water piping for the Gland sealing valves in the rinse water line & other lines.
- 10) Sample cooling line piping for sample cooling for all analysers.
- 11) Two nos. (1W + 1S) per unit 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. **Each Condensate polisher service unit shall be provided with an automatic bypass for the condensate polisher on the condensate inlet and outlet headers of the unit with a globe type control valve and globe type isolation valves (resilient material seated, to ensure bubble-tight shut off) on the upstream and downstream sides of the control valve.** Either 2X50% capacity valves or 1X100% capacity control valve shall be provided to achieve proper control under all operating conditions. Isolation valve shall be provided with geared operators for manual operation. Complete instrumentation and controls for this emergency by-pass system. Further all tubing, wiring air sets and other fittings required to complete the system shall be provided.
- 14) Total resin charges shall be supplied for the project is twelve (12) numbers. One resin charge shall be considered as resin required for one service vessel i.e. cation resin, anion resin and inert resin (if any) used for the project. Further one Year's topping requirements or 10 % of first fill quantity, whichever is more shall be supplied by bidder.
- 15) One no. specific Conductivity analyser at condensate inlet header, One no. specific Conductivity Analyzer at condensate outlet header of each TG unit & One no. specific Conductivity Analyzer at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels.
- 16) One no. cation Conductivity analyser at condensate inlet header, One no. cation Conductivity Analyzer at condensate outlet header of each TG unit & One no. cation Conductivity Analyzer at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels.
- 17) One no. pH analyser at condensate inlet header for Each TG unit & one no. pH analyser at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels. Hence total 8 nos. of PH analysers shall be supplied for both TG units service vessel area.
- 18) One no. multichannel sodium analyser to measure process value of each service vessel outlet for



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each TG unit and 1 no. single channel sodium analyser to measure the process value of common inlet for each TG unit. Hence total number of multichannel sodium analysers shall be two & single channel sodium analysers shall be two numbers for both the TG units. However Sodium analysers shall be multi-channel and subject to max 3 channel/stream only.

- 19) One no. multichannel Silica analyser to measure process value of each service vessel outlet for each TG unit and 1 no. single channel silica analyser to measure the process value of common inlet for each TG unit. Hence total number of multichannel silica analyser shall be two & single channel silica analyser shall be two numbers for both the TG units. However silica analysers shall be multi-channel and subject to max 3 channel/stream only.
- 20) One no. chloride analyser at condensate inlet header for Each TG unit & one no. chloride analyser at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels. Hence total 8 nos. of chloride analyser shall be supplied for both TG units service vessel area.
- 21) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system.
- 22) All the piping, valves, fitting, accessories etc. used in service vessel area shall be 300# class minimum and this area shall be considered as high pressure side.
- 23) Minimum instrumentation required as per P & ID included in this tender specification.
- 24) All butterfly valves MOC used in service vessel area in condensate inline line shall be (body: WCB Disc:CF8M/SS316) and condensate outlet line will be (Body & Disc both: CF8M/SS316).

B. REGENERATION SYSTEM

The regeneration system shall be common to polisher of both the units and shall be external. The CPU regeneration system will be located near DM plant area. Regeneration area shall be considered as low pressure area. Complete regeneration facility as mentioned below shall be in Bidder's scope:

- 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) All internals, fittings and appurtenances for these vessels.
 - 5) Common waste effluent header with one resin trap designed for in place manual backwashing.
 - 6) 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.
 - 7) The type of vessels indicated above (s.no 1, 2 and 3) shall be as per supplier process requirement.
 - 8) Resin Make up/injection hopper complete with water ejector system for resin make up. Resin make Up /injection hopper 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

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snubber, acoustic hood, relief valve etc.as required and shall be mounted on a single base.

- 10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps each with electric drive motor drives, one normally operating and the other standby, for water supply for chemical preparation / dosing and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from DM water storage tanks (DM water storage tanks not in bidder's scope).
- 11) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels.
- 12) Two (2) sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by bidder. Two numbers personnel water drench shower/safety shower and eye bath in regeneration area shall be provided by the bidder.

II. BULK ACID AND ALKALI UNLOADING AND DOSING FACILITY

The Acid and alkali unloading equipment for regeneration of condensate polishing resins shall preferably be mounted on skid.

- a. One (1) no. hose Station for Transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- b. One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- c. Two (2) nos. Bulk Acid storage tanks complete with integral pipe works, valves, level transmitter, level gauges, fume absorber cum overflow seal pot and all other accessories required. Further each of these bulk acid storage tanks have One spare nozzles of min 65NB size along with one isolation valve for chemical supply up to RO-DM plant by gravity.
- d. Two (2) nos. Bulk Alkali storage tanks complete with integral pipe works, valves, level transmitter, level gauges, CO2 absorber, over flow seal pot and all other accessories required. Further each of these bulk alkali storage tanks have One spare nozzles of min 65NB size along with one isolation valve for chemical supply up to RO-DM plant by gravity.
- e. Two nos. (2X100%) Acid unloading pumps each complete with electrical drive motor and all other accessories as required.
- f. 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 this equipment's independently instead of assembling the skids. Complete facility for preparing alkali solution from alkali lye & 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 pot, dissolving basket, integral pipe works, valves and all other required accessories. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 2) One (1) no. hot water tank for heating of alkali diluent water with (2X50%) electric heating coil, adequately insulated of stainless steel construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required 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 transmitter, temperature indicator etc. The heaters shall be sized for

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heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

- 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. Activated Carbon Filter for alkali rated flow of the filter shall not be less than the design capacity of the alkali unloading pump /alkali transfer cum recirculation pump (as applicable), and the maximum velocity through the filter for this flow shall not exceed 12 meters/hour. Depth of the filter materials shall not be less than 1 meter.
- 5) One number Carbon trap shall be provided at the outlet line of Activated carbon filter. This carbon trap shall have screen opening of 60 mesh.
- 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 equipment for regeneration of condensate polishing resins shall preferably be mounted on skid and shall be in bidder's scope. All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one alkali dosing equipment. 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 for regeneration complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. Each tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 2) One (1) no. Alkali measuring (day) tank for regeneration including slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 3) Two (02) numbers (1W+1S) Positive displacement type metering pumps for acid dosing for regeneration 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 for regeneration 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 with flow transmitter and a mixing tee where the chemicals get injected into the water stream.
- 6) **2 nos. Non-Nucleonic (Vibration) Type Density Meter/ transmitter shall be provided one (1) in acid dilution line and one (1) in alkali dilution line as per C&I specification as enclosed in sub Sub-section IIC of this technical specification. This transmitter shall be provided in addition to mechanical density indicator in each line.**
- 7) 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.
- 8) 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) One (1) no. Neutralization Pit of RCC construction (civil work not in bidder's scope) with two (2)



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compartments with acid and alkali resistant lining/tiling along with isolation gates for each compartment shall be provided in the CPU regeneration area. Each section/ compartment shall have capacity to hold 150% of waste water generated from CPU in one regeneration + 120% of waste generated from RO –DM plant in one regeneration (170 m3 considering margin). Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal.

- 2) One (1) no. Acid Measuring Tank for Neutralization- pit complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation & all other accessories as required shall be supplied by bidder.
- 3) One (1) no. Alkali Measuring Tank for neutralization-pit including slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories as required shall be supplied by bidder.
- 4) Two (2 x 100%) capacity Waste Recirculation / Disposal pumps of horizontal centrifugal type (rubber lined) single stage with priming arrangement (two priming tanks for N-pit waste recirculation / disposal pumps) each complete with electrical drive motor. These pumps shall be of horizontal centrifugal type with priming arrangement and shall be supplied for waste recirculation and disposal to CMB of ETP. The pump shall be designed to pump the total volume of one section/ compartment of the neutralization pit in 2 hours. Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.
- 5) One no pH Analyser at effluent discharge header, shall be in the scope of bidder.
- 6) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.

Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

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, counter 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 457.2 X 12.7 mm thick)
- 2) Service vessel outlet header shall be SA 106 Gr C (OD 457.2 X 12.7 mm thick)
- 3) Rinse water outlet piping shall be SA 106 Gr-C (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser hot well shall be considered as 70 meter for each unit (Total 140 m) and this piping shall be in bidder's scope.
- 4) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch 40 (minimum). One-way distance for resin Transfer Piping between farthest service vessel and regeneration area shall be 550m. In addition to that complete resin transfer piping shall be in bidder's scope which shall include the piping inside regeneration area equipments also.
- 5) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch 40 (minimum). One-way distance for DM water piping between farthest service vessel and regeneration area shall be 600 m. In addition to that complete DM Water piping shall be in bidder's scope which shall include the piping inside regeneration area equipments also.
- 6) N-Pit effluent piping from N-Pit to ETP of CMB shall be minimum 150 NB CPVC Sch. 40. The distance between N-Pit and CMB (common monitoring basin) of ETP shall be 750 m and this piping shall be in bidder's scope.
- 7) Piping used for handling alkali (concentrated) and alkali solution shall be CPVC Sch. 40 minimum for complete CPU regeneration area.
- 8) Piping handling acid service shall be CPVC Sch. 40 for complete CPU regeneration area.

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- 9) Piping for air service shall be hot dip galvanized (heavy grade) steel as per IS 1239.
- 10) All piping within each of the above skids/equipment shall be in bidder's scope.
- 11) Similarly DM water piping from each DM water storage tanks inlet nozzle to CPU REGENERATION CUM RESIN TRANSFER PUMPS suction lines along with their isolation valves, piping and flanges shall be in bidder's scope.
- 12) Similarly DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS discharge recirculation line to both DM water storage tanks recirculation nozzles along with their isolation valves, piping and flanges shall be in bidder's scope.
- 13) Further DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS to service vessel area and regeneration area all equipments shall be in bidder's scope.
- 14) Service water piping (used for cooling of condensate sample & other activities in regeneration area), piping for gland sealed valve cooling, instrument air piping and service air piping, potable water piping for eye wash & other applications 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, and acid & alkali storage 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, 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.
- 16) In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.

NOTE: There will be no price implication to BHEL/Customer from bidder's side due to addition / deletion in piping, when the piping quantity increases $\pm 10\%$ from the specified quantity in the technical specification. Layout and routing shall be finalized during detailed engineering. However system shall be designed to take care of any increase or decrease in length of piping.

E. ADDITIONAL REQUIREMENT

- 1) 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.
- 2) Initial charge of all lubricants & grease.
- 3) 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.
- 4) Start-up and commissioning spares as required.
- 5) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ shall be derived during detail engineering. Bidder to consider 10% margin over and above the BOQ requirement of all the fittings.
- 6) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buried pipes shall be in bidder's scope of work.
- 7) Bidder shall consider 12 m static head + 10% margin in addition to the losses in straight pipes and bend in pipes, tees, reducer, expander and valves etc. (in yard piping) while selection of pump head

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during detailed engineering.

- 8) The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as oils, lubricants including grease, servo fluids, gases and essential chemicals etc. Consumption of all these consumables during the initial operation or PG test of bidder's supplied equipment (whichever is later) and final filling after the initial operation OR PG test of bidder's supplied equipment (whichever is later) shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers. As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.
- 9) On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.
- 10) MCC, **DDCMIS based** control room & battery room shall be located in CPU regeneration area building. All regeneration vessels and chemical dosing facilities shall be located in CPU regeneration building. Bulk chemical storage tanks, unloading and transfer pumps shall be located open to sky. Further N-pit shall be located in open area near CPU regeneration area. CPU regeneration cum resin transfer pumps shall be located near DM water Storage tanks and shall have been provided with localised KNOPY arrangement on pump & motor and the same shall be in bidder's scope. Further Bidder to also provide the localized KNOPY arrangement on all pumps & motors which are open to sky.
- 11) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- 12) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- 13) Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- 14) Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- 15) Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- 16) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- 17) Ladder & platforms shall be provided for each tank for easy accessibility & maintenance purpose by

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- 18) All necessary valves and fittings for the installations with the actuators necessary for their remote operation.
- 19) Embedment plates with lugs shall also be provided by bidder as per system requirement.
- 20) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- 21) Start-up and commissioning spares as required.
- 22) Mandatory spares as per attached Annexure-VI of Sub-Section IA to this technical specification.
- 23) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with CPU Plant.
- 24) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.
- 25) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanized using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.
- 26) Instrument hook up material shall be in bidder's scope.
- 27) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.
- 28) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.
- 29) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.
- 30) If service air required by the bidder in the service vessel area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.
- 31) All other items are also included in scope of supply as specified in other part of the specification.
- 32) Bidder to use analysis given in Sub-Section –IA ANNEXURE –VIII of this technical specification under SALIENT DESIGN INPUTS/ CRITERIA for NORMAL RUN & START-UP OR CONDENSER LEAK CONDITION for design of condensate polishing plant.
- 33) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

5.0 ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK)

Required number of electric hoist / manual hoist of adequate capacity, to meet the erection and maintenance requirements are to be provided for the various areas.

Bidder to note that chain pulley block shall be manufactured as per class-II of IS3832 & Electric hoist

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shall be manufactured as per class-II of IS-3938.

The stipulations of all statutory codes like Indian Electricity Act, Indian Electricity Rules, Factory Acts, Local Municipality act etc. shall however prevail over the specification requirements, in case any conflict arises between this specification and the statutory codes.

Maintenance tools and tackles shall be as per attached list mentioned elsewhere in the specification.

5.1 DESIGN CRITERION FOR ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK)

For items weighing 300 kg and above, hoists and trolleys along with monorails shall be provided throughout the plant where crane cannot be utilized. For items weighing less than 1000 kg, manual hoists shall be provided. For items weighing 1000 kg and more, electric hoists (lift & travel) shall be provided. In case the lifting height is more than 10m, electric hoist (lift & travel) shall be provided irrespective of the weight. All hoists shall be provided with trolleys.

Capacity of cranes & hoists shall be selected considering a minimum margin of 25% over the maximum weight of the heaviest equipment / component to be handled by the Crane/Hoist.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical/ manual hoist with the help of floor operated pendant.

5.2 SCOPE OF SUPPLIES

Equipment and services to be furnished by the bidder for the ELECTRIC HOIST/ MANUAL HOIST with accessories as per the details given in the technical specification and data sheet A. Any equipment /accessories not specified in the specification but required to make the ELECTRIC HOIST/ MANUAL HOIST complete and efficient operation shall also be under the bidder's scope of work.

Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.

5.2.1 Electric hoist shall include but not be limited to the following: -

- Hoisting and CT drive arrangement
- All electrical equipment including cables (as per electrical scope matrix) and panels.
- PVC insulated shrouded bus bar DSL
- Earthing arrangement.
- Initial fill of lubricant.
- Painting of electric hoist and accessories.
- Maintenance Tools & Tackles (as per attached list)
- Erection & Commissioning spares
- Isolating switch in enclosure at operating floor for disconnecting supply to DSL while maintaining the electric hoist.

5.2.2 Erection and Commissioning spares (ELECTRIC HOIST)

The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.

5.2.3 Services to be provided by the bidder

Packing, forwarding and transportation to site, storage and handling at site.

5.2.4 Erection and Commissioning

5.2.5 Functional test (Overload testing, load testing at rated speed, travel and hoisting motion checks as per relevant Indian standards).



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5.2.6 Obtaining clearance and acceptance certificate from the concerned competent authority after site test as applicable. Necessary fees/expenditure as required shall be borne by the bidder.

5.3 INSPECTION AND TESTING

As per enclosed reference quality plan and as per IS 3938 (latest revision). Prime inspection agency shall be Consultant/ End Customer. Equipment supplied shall be strictly in accordance with nomenclature & technical specification. Any additional testing requirement/CHP (Customer Hold Point) at any stage of inspection deemed necessary by Consultant/ End Customer during detailed engineering shall be carried out without any commercial or technical implication.

5.4 TESTING AT VENDOR'S WORKS

Hoist along with its drives, controls and other accessories shall be demonstrated for the rated capacity against the rated speed of motions and for the service conditions specified as specified in QAP and as per IS 3938 for electric hoist and IS 3832 for manual hoist.

The bidder shall have the full responsibility for the safe and efficient operation of the hoist with associated accessories as a single unit.

If the shop performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Demonstration tests shall be carried out each time after the rectification /modification is carried out.

5.5 MAKE OF SUB - VENDOR ITEMS

Makes of bought out items will be as per list specified in the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser/ end client. (Refer annexure-II)

5.6 TESTING AT SITE

A) ELECTRIC HOIST:

As required for statutory clearance for operating at site i.e., overload test, load test and other tests as per IS 3938.

Test for Operation -After the supply has been connected, tests shall be carried out to prove the following:

- a) The satisfactory operation of each controller, switch, contactor, relay and other control devices and in particular the correct operation of all limit switches under the most unfavourable conditions;
- b) The correctness of all circuits and interlocks and sequence of operation; and
- c) The satisfactory operation of all protective devices.

Overload Test -After test but before the hoist is put into service, it shall be tested with overload relays appropriately set, to lift and sustain a test load of 125 percent of the working load. During the overload test, the hoist shall sustain the load under full control. The specified speeds need not be attained but the hoist shall show itself capable of dealing with the overload without difficulty.

B) MANUAL HOIST:

As required for statutory clearance for operating at site with following minimum test i.e., overload and load test.

5.7 MAINTENANCE TOOLS AND TACKLES

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting.

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The following shall be provided as minimum requirement:

S-No.	Description	Qty.
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set
2	Complete set of screwdrivers (Indicate the sizes)	1 Set
3.	Adjustable Spanner	1 No.
4.	Insulated plier	1 No.
5.	Grease gun	1 No.
6.	Oil gun	1 No.
7.	Line tester	1 No.

Note: -The tools shall be supplied in one tool box. Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.

5.8 ELECTRICAL REQUIREMENTS

Electrical equipment shall be adequately rated to permit simultaneous operation of any combination of motions of the crane for it duty service.

5.8.1 MOTORS

Motor ratings shall be 25% (at least) over the maximum power requirement. The hoist motors shall be rated to lift 125% of the design load at rated speed.

Motors shall suit the duty class S4, cyclic duration factor 60% and 300 starts per hour and shall be suitable for VVF operation. Motor pull out torque shall not be less than 2.75 times/ rated torque. Motor shall have class F insulation temperature rise limited to class B and enclosures shall conform to the degree of protection IP-55.

All motors shall be capable of the following:

- Operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
- Withstand 120% of rated speed for two minutes.
- Current shall not exceed 6 times full load current for creep speed motor.
- Withstanding the stresses imposed if started at 110% rated voltage.
- Start with rated load and accelerate to full speed with 80% rated voltage at motor terminals.
- The locked rotor motor withstand time under hot condition at 110% rated voltage shall be more than motor starting time at minimum permissible voltage by at least 3 seconds for motors upto 20 seconds starting time.
- Maximum torque shall not be below 200% of full load torque.

Each motor more than 30 KW rating shall be provided with space heater. All electrical equipment accessories and wiring shall have tropical protection.

The VVF drive control shall be used for control of each motion. The VVF drive shall be equipped at least with 1024 pulse in card, droop control for synchronization and crane software. The rating of VVF shall be decided considering 250% of full load current of respective drive motor based on in panel rating with derated at 50 Deg C ambient temperature.

The crane(s) shall be furnished complete with all electrical equipment, accessories, like drive motors with VVF drives, conductors, insulators, protective & operating devices, cables, current collectors, all protective devices, anti-collision limit switches, mechanical overload and protection for electrical faults etc.

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5.9 DSL

DSL shall meet the following requirements:

- Shrouded bus bar type.
- Minimum 20% allowance for wear and tear shall be considered during sizing.
- Voltage drop for all conductors and cables/ wires shall be limited to 3% of rated voltage between the main disconnect switch and motor terminals.

5.10 LIMIT SWITCHES

The limit switches shall be totally enclosed type IP-55. Each hoist shall be furnished with two (2) limit switches meeting the following requirements:

- A screw type limit switch with self-resetting features which will act in case of over hoisting.
- A gravity operated hand reset type limit switch as a backup protection against over hoisting. Track type limit switches shall be provided on the bridge and trolley to prevent over travelling in either direction.

Trailing cable shall be 1100 V grade, tinned copper, heat resistant, with EPR insulation and as per Class – 5 of IS-8130. Also should have inner PCP sheath and outer CSP sheath with nylon chord reinforcement & heat resistant, oil resistant and flame retardant heavy duty FRLS type.

5.11 CONTROL & INSTRUMENTATION REQUIREMENTS

Necessary start/stop and emergency controls shall be provided. Automatic reset type limit switches shall be provided to prevent over-travel for-

- Over hoisting and lowering motions of the hook.
- Long travel motion
- Cross travel motion

OPERATING SPEEDS FOR MISCELLANEOUS HOISTS

- Hoist : 3 m/min
- Trolley travel : 6 m/min
- Long travel : 10 m/min
- Creep speed : 10% of full speed (as applicable)
- Crane runway rails : Rails to suit

Notes:

- Area, type, capacity mentioned are minimum requirement and shall be finalized during detail engineering without any commercial implication.
- Travel and Lift are layout dependent and shall be finalized during detail engineering without any commercial implication.
- Additional electric/manual hoist required during detail engineering shall be provided as per design criteria given above without any commercial implication.

6.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Sub-Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

7.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in sub-Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

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8.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however complete grouting for equipments, fixing and any concreting inside the vessels, puddle pipe inside civil structure, nozzles, supporting plate/ structures & lining shall be in bidder's scope.

Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder.

9.0 SCOPE OF SERVICES

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

- (i) Erection and commissioning, unloading, storage and handling at site.
- (ii) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.
- (iii) Pre-commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- (iv) Arrangement of all instruments, equipments, lab facilities, reagents, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run, commissioning, PG test & till plant hand over.
- (v) Monitoring gadgets, instruments and equipments required for maintenance.
- (vi) *During Logic preparation, FAT & commissioning of DDCMIS, bidder shall arrange his concerned personnel at PEM office, BHEL –EDN office & for commissioning of DDCMIS at site, as and when required by customer / BHEL without any delay.*
- (vii) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
- (viii) All personnel required during maintenance, Commissioning, trial run and PG test.
- (ix) Trial run for requisite period.
- (x) Performance Guarantee testing.
- (xi) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- (xii) All other facilities/ services as described in section on site services in specification and related to CPU Plant scope of work.
- (xiii) Relevant requirements as per GTR, GCC, ECC & SCC.
- (xiv) 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 Sub-Section IA ANNEXURE V of this Technical Specification.



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(xv) Painting shall be as specified Sub-Section IA 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.

(xvi) Final touch up paint at site.

10.0 TERMINAL POINTS

10.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA

- (i) Service vessel inlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1 & unit -2.
- (ii) Service vessel outlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1 & unit -2.
- (iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, SA 106 Gr-B) from the service vessel outlet 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 shall be terminated by the bidder to the nearest drain trench through drain channel.
- (v) 25 NB connection of Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from service vessel area.
- (vi) If service air required is required by the bidder for hydro pneumatic transfer of resins bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement. No service air terminal point shall be provided by BHEL to bidder.
- (vii) Gland sealing valves cooling water supply & analysers rack cooling water supply piping – Service water connection (25 NB) at 5 meter distance from service vessel area for each TG unit. Piping inside service vessel area for each TG unit for mentioned services will be in bidder's scope.

10.2 EXTERNAL REGENERATION AREA

- (i) DM Water Supply –The DM water piping terminal point shall be from outlet nozzles to both DM water storage tanks (DM water storage tanks not in bidder's scope) & for recirculation line terminal point shall be up to the recirculation nozzles to both DM water storage tanks. Piping from these terminal points to the pump suctions (CPU regeneration cum resin transfer pumps) shall be in the scope of bidder.
- (ii) DM Pumps Recirculation Lines – Piping from CPU regeneration cum resin transfer pumps outlet lines to DM water storage tanks recirculation nozzle shall also be in the scope of bidder.
- (iii) Alkali (48% NaOH)- A spare connection of minimum 65 NB size shall be provided with isolation valve, blind flange along with header pipe connection in both alkali storage tanks for withdrawal of alkali for RO-DM plant .
- (iv) Acid (30-33% HCL)- A spare connection of minimum 65 NB size shall be provided with isolation valve, blind flange along with header pipe connection in both Acid storage tanks for drawing acid for RO-DM plant .
- (v) 25 NB Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from the regeneration building.

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- (vi) 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.
- (vii) Service water (50 NB) - At 5 meter distance from the CPU regeneration building. However distribution and piping inside CPU regeneration area will be in bidder's scope.
- (viii) Drinking/Potable water (25 NB) - At 5 meter distance from the CPU regeneration building. However distribution and piping inside CPU regeneration area will be in bidder's scope.
- (ix) N-Pit effluent piping (150 NB) from N Pit up to CMB OF ETP shall be in bidder's scope. The piping distance to be considered shall be 750 m.
- (x) RO-DM plant regeneration waste – RO DM plant regeneration waste shall be terminated by the RODM plant bidder near the neutralization pit inlet channel of CPU.
- (xi) In addition to that detailed terminal points shall be as per the P&ID for CPU plant (BHEL Drg. No.: PE-DG-412-155A-A001) enclosed with the technical specification.

11.0 EXCLUSIONS

- 11.1 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 Bidder's scope.
- 11.2 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 transfer piping, instrument air piping, service air piping, service water piping, potable water piping and effluent disposal piping etc.) are in bidder's scope.
- 11.3 Instrument air & service air up to terminal points.
- 11.4 All chemicals except reagents, monitoring gadgets required for pre- commissioning, commissioning, trial run and PG test.
- 11.5 Air conditioning, ventilation & firefighting facilities.
- 11.6 **Supply of ISMB monorail.**
- 11.7 Other exclusions are mentioned in the electrical & C&I parts of this specification.
- 11.8 Service water, Drinking/ potable water & DM water up to terminal points.

12.0 QP AND SUB VENDOR APPROVAL

- 12.1 Minimum QP requirements are specified as Sub-Section IA 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.
- 12.2 However any additional comments as given by BHEL/Customer on quality plan shall be adhered by the bidder without any commercial & delivery implication to BHEL.
- 12.3 Requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to



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BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

- 12.4 List of make sub vendor items is enclosed as Sub-Section IA ANNEXURE-II is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL. Any additional sub vendor shall be subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
- 12.5 Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI/LOA. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
- 12.6 Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

13.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

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

14.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Sub-Section IIB, IIC the following shall also be complied under scope of this specification.

The P&I diagram is enclosed herein in this section for bidder's 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.

15.0 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 Sub-Section IA 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 drawing /document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/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 and CUSTOMER without price & delivery implication.

For the Drawings/Documents distribution Procedure, please refer attached Sub-Section IA Annexure-IV. Bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. The numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA Annexure-IV.

After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer

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approval has been indicated in Sub-Section IA Annexure VII. 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.

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Sub-Section IA Annexure VII of this specification. 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)
- 1. Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's Internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

16.0 SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. The general requirements pertaining to the supply of these spares is given below:-

16.1 RECOMMENDED SPARES:

The bidder shall also furnish list of recommended spares parts for three (3) years normal operation with unit prices. These recommended spares shall be those considered necessary by the bidder on a stand-alone basis. The BHEL reserves the right to buy any of the recommended spare parts as considered necessary by him.

The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by the BHEL/Customer.

16.2 MANDATORY SPARES:

All Mandatory spares listed in Sub-Section IA Annexure VI of this specification are in bidder's scope of supply.

All the Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main Equipment/components supplied under the contract.

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

All mandatory spares shall be delivered at site at least two months before scheduled date of initial Operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding

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main equipments.

Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

Inspection of mandatory spares shall be in line with the approved quality plans for the respective Items/equipments. The inspection categorisation of mandatory spares shall also be in line with the approved categorisation plan for the respective items/equipment.

16.3 START-UP & COMMISSIONING SPARES

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

Notes:

- 1) The Bidder shall indicate the service expectancy period for the spares parts (mandatory) under normal operating conditions before replacement is necessary.
- 2) All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- 3) All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- 4) Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
- 5) All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.
- 6) The Bidder will provide the BHEL/Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
- 7) The Bidder shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
- 8) The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.
- 9) The bidder shall guarantee the long term availability of spares to the BHEL/Customer for the full life of the equipment covered under the contract. The Bidder shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the BHEL/Customer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-vendors. Further, in case of

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discontinuance of manufacture of any spares by the Bidder and/or his sub-vendors, bidder will provide the BHEL/Customer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by BHEL /Customer for the purpose of procurement of such items.

10) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.

11) Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished.

12) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities.

17.0 MISCELLANEOUS REQUIREMENT

- I. Bidders is advised to visit the site in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- II. The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.
- III. System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority, on behalf of the customer, related to installation of CPU plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- IV. Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.
- V. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- VI. Latest version of all codes and standards to be followed.
- VII. CPU regeneration facilities (except bulk acid & alkali storage and Neutralisation pit which area kept in open) shall be housed in RCC Building. Control room, battery room & MCC room for CPU plant shall be housed shall be located in RCC building. RCC building shall have toilet blocks for ladies and gents.

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VIII. Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL. Further during detail engineering breakup of supply prices of condensate polishing unit package in the Billing break up schedule shall be prepared as per below mentioned details:

1.0	THE BREAK UP (%) OF SUPPLY PRICES OF CONDENSATE POLISHING UNIT PACKAGE IN THE BBU SHALL BE IN LINE WITH THE BELOW PROVIDED DETAILS:	
1.1	Lump sum firm price for supply of Atmospheric tanks inclusive of all taxes, duties and other levies as applicable.	8 % of Total Supply Price.
1.2	Lump sum firm price for supply of Pressure Vessels inclusive of all taxes, duties and other levies as applicable.	20% of Total Supply Price.
1.3	Lump sum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable.	15% of Total Supply Price.
1.4	Lump sum firm price for supply of Instruments & analysers inclusive of all taxes, duties and other levies as applicable.	14% of Total Supply Price.
1.5	Lump sum firm price for supply of Pumps & Blowers with motor inclusive of all taxes, duties and other levies as applicable.	5% of Total Supply Price.
1.6	Lump sum firm price for supply of Piping & Fittings inclusive of all taxes, duties and other levies as applicable.	10% of Total Supply Price.
1.7	Lump sum firm price for supply of Resin media inclusive of all taxes, duties and other levies as applicable.	20% of Total Supply Price.
1.8	Lump sum firm price for supply of agitators, heater, strainers, resin trap, filter nozzle inclusive of all taxes, duties and other levies as applicable.	3% of Total Supply Price.
1.9	Lump sum firm price for supply of Balance items inclusive of all taxes, duties and other levies as applicable.	5% of Total Supply Price.

IX. Any statutory requirement / clearance required for the package from government / local body shall be in bidder's scope.

X. All interconnecting piping, valves, fittings including dosing piping, drain piping from tanks to nearby drain, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.

XI. All the vertical pumps shall be self-lubricating type.

XII. Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval shall be taken from BHEL. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

XIII. KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.



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- XIV. Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- XV. Buried piping shall be protected as under (as per IS-10221).
Surface cleaning by wire brush, power tool cleaning etc.
Apply one coat of coaltar/primer/enamel.
Apply one layer of tape comprising of coaltar. Application of tape shall conform to AWWA C- 203/IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%
- XVI. All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without price & delivery implication.
- XVII. Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- XVIII. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- XIX. Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by bidder, BHEL reserves the right to debit cost of such rework to bidder.
- XX. In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- XXI. Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- XXII. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections & sub - sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.



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- XXIII. The bidder shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. 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. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply and erection & commissioning of condensate polishing unit.
- XXIV. It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- XXV. The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- XXVI. The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- XXVII. Deviations along with cost of withdrawal (positive or negative), if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with tender specification & there is no deviation. (Price to be given in sealed envelope only.)
- XXVIII. In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- XXIX. Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder / vendor and Customer / Purchaser / Employer will mean BHEL and /or TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO), HYDERABAD and /or DESEIN (customer's assigned consultant).
- XXX. The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer.
- XXXI. 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.

18.0 MINIMUM IMPORTED ITEMS

- i) Resins.



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TECHNICAL DETAILS OF CONDENSATE POLISHING PLANT

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1.00.00 INTRODUCTION

For maintaining the feed water purity condensate polishing plant will be provided in the feed water cycle at the downstream of condensate extraction pumps. The function of the CPU will be to purify the condensate effluent from the condenser by removing solids and dissolved salts with the intent of reducing corrosion and depositions in the steam-water cycle. The proposed Condensate Polishing Unit (CPU) shall treat the condensate of the Turbine-Generator (TG) Units of the power station, using deep Mixed Bed Ion exchange Polisher vessels and an external regeneration system. One (1) number of Condensate Polishing Plants (CPP), for each TG (Turbine-Generator) unit, along with one complete common external regeneration system shall be provided alongwith instrumentations, valves and pipings, controls etc.

2.00.00 SYSTEM DESCRIPTION (GENERAL)

- 2.01.00 The proposed Condensate Polishing Plant (CPP) shall treat the condensate of the respective Turbine-Generator (TG) Units of the power station. The system shall be as per tender drawing titled P&ID of Condensate polishing Plant.
- 2.02.00 The proposed schematic arrangement of the Condensate Polishing Plant has been shown in the relevant Tender Drawing (P&ID). Arrangement of piping and valves shown in them are bare minimum only. The Contractor shall propose the complete system including regeneration facilities as per their standard design and as elaborated in this specifications meeting the basic functional requirements.
- 2.03.00 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. There shall be three service vessels (3X50%) for each 660 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet) & all HP heaters out of service condition.
- 2.04.00 The regeneration system shall be external and common to the CPU of all the TG units. For regeneration, resin from the exhausted exchanger vessel will be transferred hydraulically/ Hydro-pneumatically to this facility. The exhausted resin charge will be cleaned, separated, regenerated, mixed and rinsed before being stored for the next use.
- 2.05.00 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).
- 2.06.00 In the event of a tube failure in the condenser, circulating water will enter the condensate system and will contaminate it. Typical composition for the "START-UP OR CONDENSER LEAK CONDITION" is exhibited elsewhere in the technical specification and the condensate polishing plant shall be designed for such tube leakage condition as mentioned.
- 2.07.00 For arriving water analysis under condenser tube leakage condition. The analysis of the Sea water analysis is exhibited in the Sub-Section IA Annexure VIII of tender specification shall be used with 1.3 COC.
- 2.08.00 Polisher mixed bed / service vessels of each 660 MW Unit shall be located in respective TG hall unit. However the regeneration system shall be common to polisher of both the units and shall be external and in building (except bulk acid & alkali storage facility & N-pit which is in open area). The CPU regeneration system will be located near DM plant area (kindly refer plot plan for the same).
- 2.09.00 The equipments kept in open area (Pumps, blowers, motors, tanks, instruments, analysers etc.) have localized shade provisions which is in bidder's scope. All the instruments associated with condensate polishing plant shall be provided with proper enclosures by Bidder. All vessels,



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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.

3.00.00 SALIENT DESIGN DATA

3.01.00 There shall be three service vessels (3X50%) for each 660 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up & all HP heaters out of service condition (Flow through each service vessel indicated in the data sheet)

3.02.00 The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system.

The inlet and outlet quality ionic concentrations for design of CPU exchanger shall be as mentioned below:

(a) NORMAL RUN :

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	100	---
Total dissolved solids (TDS, ammonia excluded)	ppb	100	< 25
Conductivity (at 25°C)	Micro-mhos/cm	---	< 0.1 (After Cation Column)
Silica – Dissolved (as SiO ₂)	ppb	30	5 (Refer note # 1)
Iron (Dissolved) -as Fe	ppb	50	5
Sodium(as Na)	ppb	10	2
Chloride (as Cl)	ppb	10	2
pH (polisher runs at 25°C with H/OH mode)		8.5	6.8-7.5
Crud (mostly black oxide of iron)	ppb	50	5

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 720 hours (30 days) of continuous operation, while maintaining the above treated condensate quality.

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 50 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.

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.

(b) START-UP OR CONDENSER LEAK CONDITION :

The inlet and outlet quality ionic concentrations for design of CPU exchanger for startup or condenser tube leakage conditions shall be as mentioned below:



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CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	1000	---
Total dissolved solids (TDS, inclusive ammonia)	ppb	2000	---
Conductivity (at 25°C)	Micro-mhos/cm	---	---
Silica – Dissolved (as SiO ₂)	ppb	150	20
Iron (Dissolved) -as Fe	ppb	500	---
Sodium(as Na)	ppb	50	20
Chloride (as Cl)	ppb	300	--
Crud (mostly black oxide of iron)	ppb	500	150

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall be 50 hours before regeneration.

- 3.03.00 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.
- 3.04.00 The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 2 meters/min (120 M³/hr/M²) at the design flow rate. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the above mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.
- 3.05.00 At the design flow rate, the pressure drop between inlet and outlet flanges of the polisher Condensate Polisher Mixed Beds with clean resin bed shall not exceed 2.0 bar (g). 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 conditions shall be restricted to about 3.5 bar (g) including the pressure drop across effluent resin traps.
- 3.06.00 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. For calculations regeneration temperature should be taken as 25°C. In no case, the regeneration levels cannot be lower than the values indicated below:
- Cation resin: 125 kg of 100% HCl per cubic meter of resin
 - Anion resin: 160 kg of 100% NaOH per cubic meter of resin.
- 3.07.00 Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of both 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.
- 3.08.00 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: -
- Carbon Steel pipe : 100
 - CI pipe/ductile Iron : 100
 - Rubber lines steel pipe : 120

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4. Stainless steel pipe : 100

For pumps whose discharge pipes shall be running on pipe trestle/ pipe rack and traveling from one area to another area bidder to select 12 m static head while selecting the pump head.

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

4.00.00 GUARANTEES

All the design parameters at clause no 3.02.00 of this chapter, i.e. the effluent quality, the design flow, design service length and Pressure drop across the resin bed in clean and dirty condition at rated design flow shall be guaranteed by the Bidder. In addition to that Bidder to refer detail chapter of guarantees as specified in Sub-Section-IA, Annexure -III of this specification for the same.

5.00.00 SYSTEM REQUIREMENT

5.01.00 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.

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

5.03.00 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.

5.04.00 EXCHANGE RESINS

5.04.01 Bidder has to supply total twelve (12) nos. resin charges for the project. One resin charge shall be considered as resin required for one service vessel i.e. cation resin, anion resin and inert resin (if any) used for the project. Further one Year's topping requirements or 10 % of first fill quantity, whichever is more shall be supplied by bidder.

5.04.02 The resins used for the Condensate Polishing Unit 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 (if required) : 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.

5.04.03 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 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.

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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.

5.04.04 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: 0.8

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 / cation regeneration vessel of the external regeneration facility. The CPU Grade resin shall be of uniform particle size quality.

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:

- 1.0 Duolite.
- 2.0 Rohm and Hass
- 3.0 Dowex
- 4.0 Purolite.

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.

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 minimum temperature of 60 deg.C.

5.05.00 CONDENSATE POLISHING UNITS

5.05.01 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 or as specified in data sheet (A) of this technical specification, whichever is higher.

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

5.05.03 EMERGENCY BYPASS SYSTEM:



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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 **Globe type** control valve and **Globe type** isolation valves (resilient material seated, to ensure bubble-tight shut off) on the upstream and downstream sides of the control valve.

2) In the event of excessive pressure differential (0.35 MPa) 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 two vessel/one vessel/no vessel is in operation.

3) Bidder to provide either 2x50% capacity control valves or 1x100% control valve to achieve proper control under all operating conditions as per Customer/BHEL's approval of Engineering Documents.

4) The control system shall be so designed that the control valve is able to bypass 50 % of rated flow when any of the service vessel is out of service & 100% when both the service vessels are out of service.

5) 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.

6) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with position indicator shall be furnished by the bidder as part of this package. All tubing, wiring, air sets, and other fittings, required to complete the system, shall also be installed by bidder.

5.05.04 EXTERNAL REGENERATION FACILITY (REGENERATION PLANT)

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	: 100%
(iii)	Anion and cation regeneration vessels	: 100%
(iv)	Activated carbon filter	: 75%

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.

5.05.05 Design pressure of the condensate Polisher Service Vessels is indicated elsewhere. For all other Pressure vessels the design pressure shall be at least 10 kg/sq. cm (g).

5.05.06 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.

5.05.07 Mill tolerances 0.3 mm shall be considered for determining the thickness of the shells and dished ends of pressure vessels. A minimum thinning allowance of 2 mm shall be considered for the dished ends of pressure vessels.

5.05.08 HOT WATER TANK (FOR ALKALI)

One (1) no. hot water tank for heating of alkali diluent water with (2X50%) electric heating coil, adequately insulated of stainless steel construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The

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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 transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

5.05.09 **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 be as specified in DATASHEET –A of this specification.

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.

5.05.10 **DM WATER STORAGE TANKS (NOT IN BIDDER' SCOPE) FOR CONDENSATE POLISHING PLANT**

DM water required for CPU regeneration as well as resin transfer operations shall be drawn from DM Water Storage Tanks (not in bidder's scope). However, provision of suction nozzle & recirculation nozzle for CPU plant DM water requirement, shall be there in BHEL provided each DM water storage tanks (2nos.). Bidder to consider the piping from these suction nozzles to CPU regeneration cum resin transfer pumps and recirculation line piping from the outlet discharge line of these pumps to each DM water storage tanks recirculation nozzle along with pneumatic/electric actuated on –off valves, required flanges, counter flanges, fittings. Further Bidder to consider interlock (trip) of these pumps from the Level transmitter /level switch provided in both the DM water storage tanks necessary arrangement of bringing this Level interlocks from both DM water storage tanks to CPU regeneration cum resin transfer pumps shall be in bidder's scope (i.e. multiplier etc.). These signals shall be also brought by Bidder to **CPU DDCMIS (not in bidder's scope)** for tripping and auto operation of the CPU regeneration cum resin transfer pumps.

5.05.11 **RESIN INJECTION HOPPER**

The bidder 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.



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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.

5.05.12 PIPING

1) 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.

2) 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.

3) 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 6.1 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.

4) 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) 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.

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

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

8) 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.

9) All lined vessel connections and connections in unlined vessels (25 Nb and larger) shall be flanged to ANSI 150 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.

10) Bidder to also refer the detailed specification for low pressure piping for piping inside regeneration area & power cycle piping for piping inside service vessel area which is enclosed elsewhere in this specification.

5.05.13 VALVES

1) All valves shall be designed as per applicable AWWA/IS/BS or equivalent international standard / codes.



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

3) Emergency bypass control valve shall be of double flanged **Globe** type. **Globe** type Isolation valves (resilient material seated, to ensure bubble-tight shut off) shall be provided on the upstream and downstream sides of the control valve. The end connection type of isolation **Globe** valve on the upstream and downstream sides of the control valve shall be as per DATASHEET –A of condensate polishing unit.

4) Isolation Valves handling Acid, Alkali, Ammonia etc. shall be diaphragm type and MOC and pressure rating shall be as per DATASHEET –A of condensate polishing unit.

5) Isolation Valves handling DM water shall be Butterfly or gate or globe type and shall be SS construction. Isolation valves handling DM water can also be of diaphragm type MOC and pressure rating shall be as per DATASHEET –A of condensate polishing unit.

6) 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.

7) All valves in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class (**minimum**).

8) MOC of butterfly valve at inlet of service vessel Bod- CS, Disc- SS and outlet of service vessel Body – SS, disc- SS.

5.05.14 PRESSURE VESSELS, ATMOSPHERIC TANKS & MISCELLANEOUS ITEMS

1) 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 10 kg/cm² (g).

2) All pressure vessels shall be designed and constructed in strictly in accordance with the ASME code Section VIII Div.-I Ed 2010 /IS-2825 or acceptable equivalent international standard.

3) All pressure vessels shall be fabricated from carbon steel plates as per SA-516 Gr. 60/ 70 and lined internally.

4) Lining used shall be natural rubber having a shore durometer reading of 65 ± 5 Shore 'A' as per IS 4682 Part I.

5) 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.

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

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

8) 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.

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



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10) 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.

11) Spherical vessels for CPU service vessels are acceptable.

12) 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 torispherical type.

13) 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.

5.05.15 MATERIAL

1) 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 torispherical type.

2) 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 at least 6 mm thickness.

3) All pressure vessels shall be fabricated from carbon steel plates as specified in DATASHEET-A 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.

5.05.16 VESSEL INTERNALS REQUIREMENTS:

Vessel internal shall meet the following requirements:

1) 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.

2) Under drains: The under drain system shall be provided 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) /Fasteners.

All internal fasteners shall be of SS-316 and heavy duty locknuts shall be used throughout.

5.05.17 RESIN TRAP & CARBON TRAP:

1) 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 housing shall be of rubber lined steel construction for regeneration area & Housing MOC shall be SS316 provided at the outlet of each condensate polisher vessel and for internals (cord & screen) shall



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

2) Carbon Trap (for ACF): Outlet of each Activated Carbon filler on Carbon trap (media trap) shall be provided. MOC of carbon trap Housing shall be SS316 and for internals (cord & screen) MOC shall be SS-316.

6.00.00 OPERATION & CONTROL PHILOSOPHY OF CPU PLANT

The regeneration system shall be external and common to the polisher of both the units. Under normal conditions, it will hold a complete charge of freshly regenerated and mixed resin, ready for use, in its storage tank. For regeneration, resin from the exhausted exchanger vessel shall be transferred hydraulically / hydro pneumatically to this facility.

The empty exchanger vessel will then be filled up with the already regenerated resin which was stored in the regeneration facility. This exchange vessel shall come into service soon after requisite condition is satisfied or as and when desired by the operator. In the meantime, the exhausted resin shall be cleaned, separated, regenerated, mixed and rinsed before being stored for next use.

The control & operation of regeneration area shall be from OWS as well as OWES located in regeneration area. Operation of Service vessel shall be from 1 no. OWS located in each unit of service vessel area.

1 no. GIU (17" LCD/TFT) shall also be provided in regeneration area for the local operation (On/OFF) of CPU regeneration area drives (i.e. pumps, blowers & agitators).

Control of condensate polishing unit shall be DDCMIS (BHEL scope). Bidder to also note that GIU shall be provided by BHEL.

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 the regeneration plant 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 operation 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

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- 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 OWS/OWES. For all other steps it shall be possible to adjust the time setting from inside the OWS/OWES.
- 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/OWES.
- 6.01.10 A mimic shall be provided for the CPP scheme and Regeneration system scheme shall be provided. Status of various vessels, drives, valves etc. shall be indicated by on the mimic.
- 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 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.

6.02.0 CONDENSATE POLISHER CONTROL SYSTEM

- 6.02.01 Condensate polishing system shall be controlled from DDCMIS (BHEL scope). The control and monitoring of condensate polishing plant is done at two places:

Service vessel: The control & operation of the CPU service vessels shall be done from the 1 no. OWS and remote I/O cum processor panel dedicated for control and operation of CPU's service vessel for Each TG unit. These RIO panel's shall be located in TG hall area near CPU Service vessels for each TG unit and shall be air conditioned. RPU (Remote Processing unit) shall also be provided near service vessel area of each TG unit.

Regeneration system: The control & operation of CPU regeneration system shall be done from 2 nos. (1OWS & 1 OEWS) and redundant processor, Backup Control desk with colored Mimic, Indicators, Ammeters, H.W. Annunciator, P.B. and indication Lamps shall also be provided.

1 no. GIU (BHEL SCOPE) shall also be provided in regeneration area for the local operation (On/OFF) of CPU regeneration area drives (i.e. pumps, blowers & agitators).

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- 6.02.02 Facility to monitor the Condensate Polishing System from the Main control room is not envisaged. However, the status of major parameter shall be sent to the control room for indication purpose only.
- 6.02.03 This CPU DDCMIS shall have interface module for redundant and bi-directional OPC connectivity with main plant DDCMIS. Taking the equipment into service and regeneration of mixed-bed units shall be initiated manually from the OWS of control system or local panel and balance operation shall be carried out sequentially by the control system. Manual override facility is also provided for all operations.
- 6.02.04 CPU DDCMIS shall be provided with necessary redundant ports & complete hardwares for Auto time synchronization from Master clock time.
- 6.02.05 Open and Close limit switch feed backs of valves are to be connected to DDCMIS for remote viewing and for interlocks and protection.
- 6.02.06 Remote and local indications of various important parameters to the process requirement shall be provided.
- 6.02.07 The instruments shall be offered as per the process requirement for complete auto operation. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI.
- 6.02.08 Necessary instruments pressure gauges, Temperature gauges, DP instruments, Pressure transmitters, Radar Level transmitters, Differential pressure transmitters, Temperature Elements Various analysers, Magnetic type level indicators, shall be provided. The junction boxes and instruments / electronics housing used shall be Non – corrosive material.
- 6.02.09 Flow transmitters at each CPU service vessel inlet shall be provided for monitoring the performance and accountability.
- 6.02.10 Annunciations for abnormal conditions (as per system requirement) shall be provided in the Control Panel.
- 6.02.11 Pneumatic actuators with all accessories shall be controlled using solenoid valves, which shall be energized from OWS / Control Panel. The opening and closing of these valves is based on system requirement, which is programmed in the Control system. Feed backs to the control system regarding the valve open / close position are set through the limit switches.
- 6.02.12 Each of the solenoid valves in CPU plant shall be provided with 'close-Auto-open control switches. In 'Auto' position of the control switch the solenoid valve shall receive close/open command from the Automatic sequence logic.
- 6.02.13 Time synchronization of CPU DDCMIS with master clock system is to be carried out. Necessary hardware/software for the same shall be provided.
- 6.02.16 2 x 100% parallel redundant UPS (with ACDB), 1 x 100% Bypass stabilizer & 1 set of Battery Bank (For 1-hour back-up) in case of UPS rating less than 15 KVA. 2 sets (For 1-hour back-up) in case of UPS rating more than 15 KVA shall be provided.
- 6.02.17 Smart positioners shall be provided for pneumatically controlled valves.
- 6.03.00 CONTROL & OPERATION OF THE CONDENSATE POLISHING UNIT**
- 6.03.01 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.
- 6.03.02 *Each condensate polishing system shall be provided with RIO panel (with processor) that will*



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clearly show the status of each service vessel. It shall be possible to select each of the CPU vessel for any of the following operations or mode:

- Standby (Applicable for where spare service vessel (s) are provided.
- Service.
- Isolation from service.
- Exhausted Resin Transfer from CPU vessel to Regeneration plant.
- Regenerated Resin Transfer from Regeneration Plant to CPU vessel.
- Rinse recycle mode.

6.03.03 A mimic diagram shall be provided for the CPU scheme on the OWS and as well as front of the CPU control panel. Status of various valves shall be indicated by LED's on the mimic diagram.

Each condensate polishing system shall be provided with a RIO panel (with processor) that will clearly show the status of each service vessel. From this panel it shall be possible to initiate any of the following operating modes. This panel shall be located near the respective condensate polishing vessels. The following requirements of the control system shall be included:

Each mode or operation is described as below:

6.03.04 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.

6.03.05 SERVICE MODE:

- (1) Service flow rate for each polishing vessel shall be monitored by panel mounted flow indicators. 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 annunciator 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) Panel mounted 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 annunciator 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 annunciator 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

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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.

6.03.06 ISOLATION FROM SERVICE:

(1) Normally “Service Vessel” once exhausted shall be isolated from service till the “Resin Transfer” operation is complete. In addition, provision to be kept for isolation of one or all the vessels from service if required by operator from the panel.

(2) The sequence ‘Resin Transfer from CPU Vessel to Regeneration plant’ and Resin Transfer from Regeneration plant to CPU Vessel’ shall be initiated from the condensate polishing unit control panel but shall be controlled by the **CPU DDCMIS** in the Regeneration Control Panel.

6.03.07 EXHAUSTED 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) Manually initiated automatic sequences shall be provided for transferring resin from a Service vessel to the remote common facility for physical cleaning and chemical regeneration.

(3) The transfer of resin from the service vessel shall include operations such as isolation of the service vessel, hydraulic/hydro-pneumatic transfer of the resin to the external regeneration system (resin separation vessel) and the complete drain down of the service vessel to the hotwell.

(4) The sequence of “Resin Transfer” operation from CPU service vessel to regeneration plant and from regeneration plant to CPU vessel shall be initiated from service vessel area as well as regeneration area panel.

(5) The completion of the operation shall be exhibited in the control panels.

6.03.08 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 service 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.

(3) The transfer of resin from the regeneration plant shall include operations such as hydraulic/Hydro-pneumatic 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.

6.03.09 RINSE RECYCLE MODE:

(1) After transfer of regenerated resin from the regeneration plant to the empty condensate



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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 recycle shall be manually initiated in full automatic sequence. This sequence shall include the rinse down step using condensate at the desired flow 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) Panel mounted cation conductivity indicator shall be interlocked to prevent advancing of the automatic sequence until the rinse down is complete.

(5) Cation conductivity values shall be monitored and interlocked to prevent advancing of the automatic sequence until the rinse down is complete.

(6) 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.

6.04.00 EXTERNAL REGENERATION CONTROL SYSTEM

6.04.01 One external regeneration system shall be provided to serve the condensate polishing for the unit. This system shall be designed for physical cleaning and chemical regeneration of the resin system will consist of required number of resin separation and regeneration vessels, a mixed resin storage vessel, the tank for introducing the required regeneration solutions and means for adding make-up resin. It will have acid, alkali, and ammonia (if required) dosing system and alkali preparation facilities.

6.04.02 Manually initiated automatic sequences shall be provided for transferring resin from a vessel to the remote common facility for physical cleaning, separation and chemical regeneration and for returning fresh resin to the service vessel(s). Control for chemical dosing system and alkali preparation facility shall also be provided in it.

6.04.03 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.

6.04.04 The chemical regeneration is a many step sequence. Regeneration shall include hydraulic reclassification of the resins and the transfer of the resins to the respective regeneration vessels shall be hydraulically/ hydro-pneumatically. 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, cation & anion resin shall be 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.

6.04.05 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.

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- 6.04.06 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 Main 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.
- 6.04.07 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.
- 6.04.08 Demineralized water shall be used throughout the regeneration process for backwashing, diluting the regenerant, rinsing and resin transfer.
- 6.04.09 A conical bottom hopper having a water ejector will be used for resin make-up.
- 6.04.10 The complete detail of the regeneration system shall be supplier specific and 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 shall be provided during detail engineering.
- 6.04.11 It shall be possible to operate the Regeneration Plant in Auto/Semi-Auto/Manual mode.
- 6.04.12 Following operations shall be possible from the Regeneration Control Panel.
- Complete Regeneration.
 - Resin Transfer from CPU vessel to Regeneration Plant.
 - Resin Transfer from Regeneration Plant to CPU vessel.
- Operation (a) shall be initiated from the Regeneration Control panel whereas operation (b) & (c) shall be initiated from the CPU service vessel Remote I/O panel.
- 6.04.13 In 'Auto' mode, once the sequence has been initiated, it shall proceed from step to step automatically.
- 6.04.14 In 'Semi-auto' mode each step shall be performed only after initiation by the operator.
- 6.04.15 In 'Manual' mode complete operation shall be by the operator by operation of the Control switches on the panel.
- 6.04.16 'Close-Auto-Open' control switches shall be provided on the panel for the various drives. In 'Auto' position, the drives shall receive stop/start command from the **DDCMIS**.
- 6.04.17 'Start-Auto-Start' Control switches shall be provided on the panel from the various drives. In 'Auto' position, the valves shall receive close/open command from the **DDCMIS**.
- 6.04.18 On **CPU DDCMIS** failure, it shall be possible to operate the valves by means of manual operation of solenoid valves also.
- 6.04.19 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.
- 6.04.20 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.
- 6.04.21 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 on the front of the panel.

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- 6.04.22 A mimic diagram of the Regeneration system shall be provided on the front of the panel. The status of various drives and valves shall be indicated by LED on the mimic diagram.
- 6.04.23 The system shall incorporate the necessary safety features. During automatic sequential operation, if any pre-requisite criteria is not fulfilled or missing for a pre-determined time interval, the steps should not proceed further, the Alarm shall be provided. Missing criteria, sequence which is under hold up etc. shall be displayed on the panel.
- 6.04.24 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.
- 6.04.25 wherever standby equipments are provided, it shall be possible to select each of the drive on 'standby' duty.
- 6.04.26 Start, progress and stop of each of the sequence shall be annunciated in all the control panels.
- 6.04.27 At any time only one of the sequence shall be in progress.

6.05.00 INTERLOCKS

All interlocks for safe operation of the plant shall be provided. The following interlocks as a bare minimum requirement of the system shall be provided:

- 6.05.01 Service vessels shall be taken back in service, only after they have been pressurized.
- 6.05.02 Service vessels can be taken up for resin transfer only after they have been completely isolated from the condensate system and depressurized.
- 6.05.03 Resin can be transferred to and from only one service vessel at a time.
- 6.05.04 Resin transfer between the service and the regeneration skids shall be permitted only when the receiving vessel is initially empty.
- 6.05.05 Regeneration sequence can commence, only when the level in the waste neutralization pit is low enough to receive the entire waste quantity of waste water from the regeneration operation.
- 6.05.06 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 override sequence, if required.
- 6.05.07 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.
- 6.05.08 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.
- 6.05.09 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

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annunciation should be blocked. In general, Normal and trouble free operation of the plant shall not activate any of these alarms.

- 6.05.10 adequate diluent water flow shall be established before starting of the ejectors/ dosing pumps for acid and alkali.
- 6.05.11 The immersion heater in the hot water tank can be put on only when there is adequate water level in the tank.
- 6.05.12 CPU service vessel inlet & isolation valves will close automatically in the event of tripping of condensate extraction pump.

Note: Bidder to note that for complete control & operation of the CPU plant bidder to also refer the respective Control & Instrumentation (Sub -Section IC& IIC) & Electrical (Sub-Section IB& IIB).