

**TALCHER THERMAL POWER PROJECT STAGE-III
(2 X 660 MW)**

**TECHNICAL SPECIFICATION
FOR
SEWAGE TREATMENT PLANT**

SPECIFICATION NO.: PE-TS-497-673-A001 REV 00



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

**TITLE:**

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -

SUB SECTION -

REV. NO. 00

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PROJECT INFORMATION

CLAUSE NO.	PROJECT INFORMATION 		
6.00.00 7.00.00 8.00.00	CAPACITY Talcher TPP, Stage-III : 2x660 MW - Present proposal BENEFICIARY STATES The project is being implemented as a regional project for meeting the power demand of Eastern Region Beneficiaries including Orissa – the home-state. The exact allocation of power shall be subject to the approval of Ministry of Power, Govt. of India. METEOROLOGICAL DATA The meteorological data from nearest observatory is placed at Annexure-II.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 2 OF 15

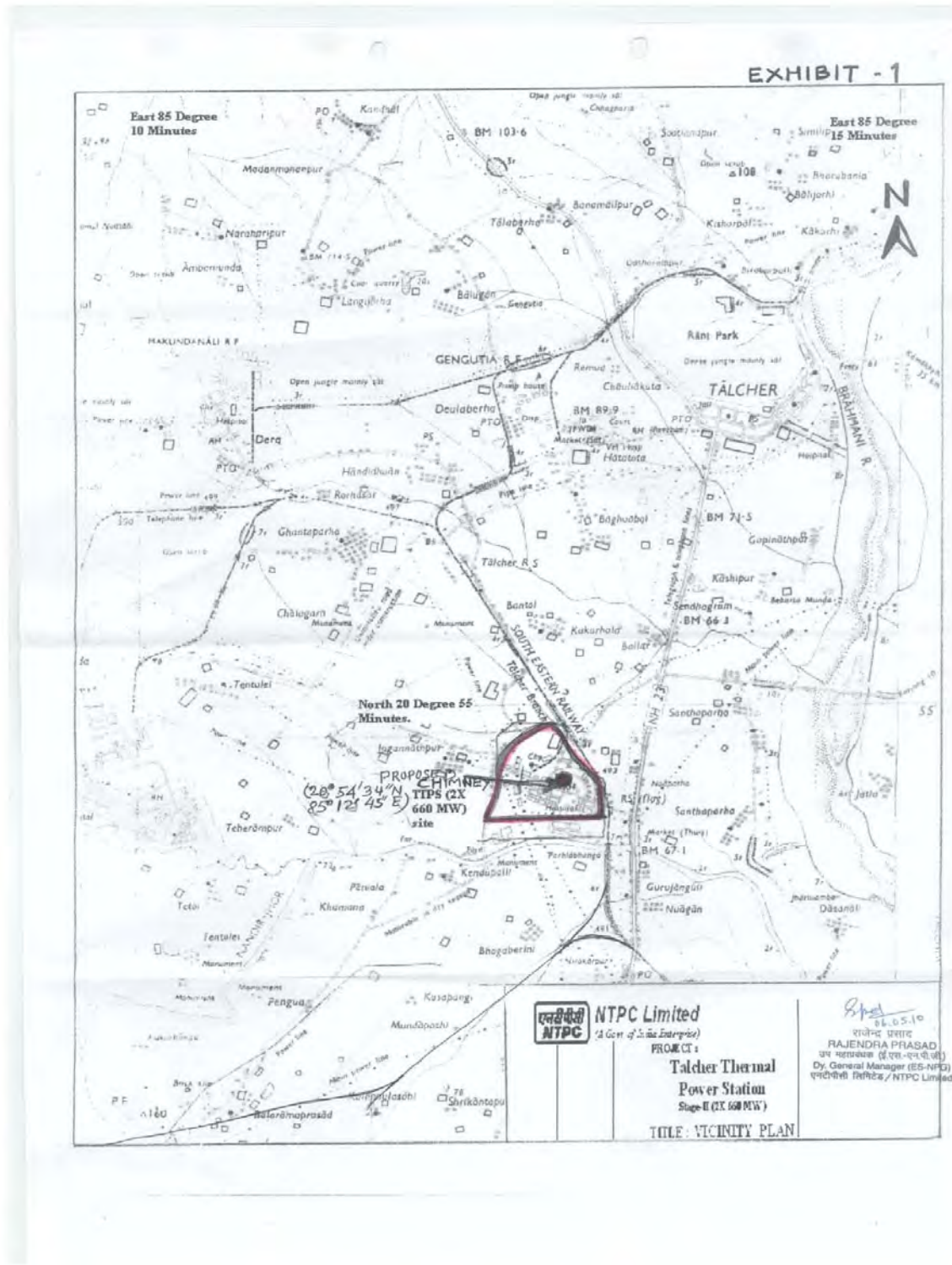
CLAUSE NO.	PROJECT INFORMATION
11.00.00 12.00.00 13.00.00	The quality of Raw water is given in this sub-section at Annexure-III Criteria for Earthquake Resistant Design of Structures and Equipment All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section. Criteria for Wind Resistant Design of Structures and Equipment All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B of this section. Vulnerability Atlas of India(VAI), prepared by Building Materials, Training and Promotion Council (BMTPC) under Ministry of Housing and Urban Affairs, is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT-wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation and construction stage. The VAI provides necessary information for risk analysis and hazard assessment and is available at website www.bmtpc.org. As per Government's directive, it is mandatory for the bidders to refer VAI for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning, designing and execution of the project in terms of following details: i) Seismic zone (II to V) for earthquakes ii) Wind velocity iii) Area liable to floods and Probable max. surge height iv) Thunderstorms history v) Number of cyclone storms/sever cyclone storms and max sustained wind specific to coastal region vi) Landslides incidences with Annual rainfall normal vii) District wise Probable Max. Precipitation Accordingly, bidder should refer VAI while planning, designing and execution of the project. However, for design of structures/facilities and equipment, the criteria for earthquake resistant design of structures and equipment, the criteria for Wind Resistant Design of Structures and Equipment and design parameters for drainage facilities, stipulated in the Technical Specification shall be followed. For other information like area liable to floods, probable max. surge height, landslide, thunderstorm, cyclone etc. agencies are required to refer the VAI.
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PROJECT INFORMATION



ANNEXURE-I



TALCHER THERMAL POWER PROJECT
STAGE-III (2X660 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION – VI, PART-A
BID DOC. NO CS-4540-001A-2

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CLAUSE NO.	PROJECT INFORMATION																																																																																		
																																																																																			
	ANNEXURE-III <u>RAW WATER ANALYSIS</u> <table border="1"> <thead> <tr> <th>SN</th> <th>Constituent</th> <th>As</th> <th>mg/l (except pH & turbidity)</th> </tr> </thead> <tbody> <tr><td>1</td><td>Calcium</td><td>CaCO₃</td><td>80</td></tr> <tr><td>2</td><td>Magnesium</td><td>CaCO₃</td><td>35</td></tr> <tr><td>3</td><td>Sodium</td><td>CaCO₃</td><td>20</td></tr> <tr><td>4</td><td>Potassium</td><td>CaCO₃</td><td>5</td></tr> <tr><td>5</td><td>Total Cation</td><td>CaCO₃</td><td>140</td></tr> <tr><td>6</td><td>HCO₃</td><td>CaCO₃</td><td>85</td></tr> <tr><td>7</td><td>p Alkalinity</td><td>CaCO₃</td><td>0</td></tr> <tr><td>8</td><td>Chlorides</td><td>CaCO₃</td><td>35</td></tr> <tr><td>9</td><td>Sulphate</td><td>CaCO₃</td><td>20</td></tr> <tr><td>10</td><td>Total Anion</td><td>CaCO₃</td><td>140</td></tr> <tr><td>11</td><td>Reactive Silica</td><td>SiO₂</td><td>25</td></tr> <tr><td>12</td><td>Silica non-Reactive</td><td>SiO₂</td><td>5</td></tr> <tr><td>13</td><td>Total Iron</td><td>Fe</td><td>0.5</td></tr> <tr><td>14</td><td>pH value</td><td>-</td><td>6.8-8.0</td></tr> <tr><td>15</td><td>Turbidity</td><td>NTU</td><td>2000</td></tr> <tr><td>16</td><td>TDS</td><td>ppm</td><td>190</td></tr> <tr><td>17</td><td>Temp</td><td>deg C</td><td>20-35</td></tr> <tr><td>18</td><td>KMnO₄</td><td>ppm</td><td>2</td></tr> <tr><td>19</td><td>TOC</td><td>ppm</td><td>5</td></tr> </tbody> </table>			SN	Constituent	As	mg/l (except pH & turbidity)	1	Calcium	CaCO ₃	80	2	Magnesium	CaCO ₃	35	3	Sodium	CaCO ₃	20	4	Potassium	CaCO ₃	5	5	Total Cation	CaCO ₃	140	6	HCO ₃	CaCO ₃	85	7	p Alkalinity	CaCO ₃	0	8	Chlorides	CaCO ₃	35	9	Sulphate	CaCO ₃	20	10	Total Anion	CaCO ₃	140	11	Reactive Silica	SiO ₂	25	12	Silica non-Reactive	SiO ₂	5	13	Total Iron	Fe	0.5	14	pH value	-	6.8-8.0	15	Turbidity	NTU	2000	16	TDS	ppm	190	17	Temp	deg C	20-35	18	KMnO ₄	ppm	2	19	TOC	ppm	5
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TREATMENT PLANT**

SECTION -I

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SECTION-I

TECHNICAL SPECIFICATION

SUB SECTION- I A TECHNICAL SPECIFICATION-MECHANICAL

SUB SECTION- I B TECHNICAL SPECIFICATION -ELECTRICAL

SUB SECTION- IC TECHNICAL SPECIFICATION -CONTROL & INSTRUMENTATION

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SUB SECTION- IA

TECHNICAL SPECIFICATION (MECHANICAL)

	TITLE: 2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III		SPECIFICATION NO. PE-TS-497-673-A001	
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SUB-SECTION IA
TECHNICAL SPECIFICATIONS (MECHANICAL)

1. SCOPE OF SUPPLY

This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub vendor's works, painting, forwarding, supply and delivery at site Mandatory spares (Annexure-IX), maintenance tools and tackles, start up and commissioning spares (as required), properly packed for transportation, preparation and submission of drawing/documents in 3D including "As Built" drawings, supervision services for trial run, conductance of performance guarantee tests at site, training of customer/ client O&M staff for complete **sewage treatment plant** with all accessories for the total scope defined as per BHEL NIT & tender technical specification no. PE-TS-497-673-A001 for Sewage treatment plant package of 2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III.

2. REFERENCE DOCUMENTS

- A. DATASHEET-A
- B. PROCESS FLOW DIAGRAM
- C. PLOT PLAN

3. SCOPE OF SUPPLY (MECHANICAL) FOR DE-CENTRALISED SEWAGE TREATMENT PLANT -1 (NEAR CHP CONTROL ROOM AREA)

- 3.1** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S1) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 3.2** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S2) (refer Plot Plan for tentative location However, location shall be finalized during detailed engineering) complete with all instrumentation, valves, piping, motor, etc.
- 3.3** One (1) no. of bar screen chamber (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories located inside STP area.
- 3.4** One (1) nos.(1W) coarse bar screen in bar screen chamber (RCC work in BHEL scope) along with, fittings, isolation gates and required accessories.
- 3.5** One (1) no. (1W) of oil & grease trap (RCC work in BHEL scope) along instruments, fittings, valves and required accessories (provide oil skimmer, if required).
- 3.6** One (1) no. (1W) De-centralised STP module is required along with valves, pipes, fittings, instruments and required accessories.
- 3.7** Two (2) nos. sludge recirculation pumps for STP Skid complete with all instrumentation, valves, piping, motor, etc., if required as per supplier recommendation.
- 3.8** Two (2) nos. (1W+1S) oil free type air blowers with piping, instrumentation, valves, fittings, air diffusers, electric motor drives for supplying air required for STP skid, if required as per supplier recommendation. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall be provided.
- 3.9** One (1) no. filter feed tank for effluent storage after treatment in STP skid along with valves, piping, fittings, instruments and required accessories.
- 3.10** Two (2) nos. filter feed pumps complete with all instrumentation, valves, piping, motor, etc. for feeding water to multi grade filter & activated carbon filter for tertiary treatment.
- 3.11** One no. (1W) (1x100%) multi grade filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 3.12** One (1) no. (1W) (1x100%) Activated Carbon filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 3.13** One (1) no. (1W) sodium hypochlorite dosing tank for dosing chemical to treated water storage tank feed line, complete with valve, fittings, instrumentation and accessories.



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- 3.14 Two (2) (1W+1S) no. Electronic type Sodium hypochlorite dosing pump with auto stroke controller complete with all instrumentation and accessories, valves, piping, motor, etc.
- 3.15 One (1) no. treated water tank for effluent storage after tertiary treatment along with valves, piping, fittings, instruments and required accessories.
- 3.16 Two (2) nos. treated water disposal pumps for treated water tank complete with all instrumentation, valves, motor, piping and required accessories etc.
- 3.17 500-meter HDPE Pipe from treated water disposal pumps for STP shall be provided by bidder upto horticulture Area.
- 3.18 20-meter Hose Pipe for treated water disposal in Horticulture Area.
- 3.19 During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, Instruments, equipment's etc.as required for smooth, safe, efficient, trouble free operation and completeness of the respective sewage treatment plant, meeting the specification requirement. Please refer the diagram for minimum requirements for scope of the system.
- 3.20 Wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per AWWA C 203. However, all auxiliary steel structure (U-clamps, nuts, bolts, channels etc.) for fixing pipes on pedestal shall also be in bidder's scope. Inputs for pipe pedestals as per requirement and layout shall be furnished.
- 3.21 Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange. All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.
- 3.22 Bidder to take care of the length of piping as included elsewhere in the technical specification. Pipe routings shall be decided during detailed engineering.
- 3.23 All puddle pipes, bolts, nuts, sleeves, gaskets shall be in bidder's scope.
- 3.24 All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- 3.25 Hangers and supports for all the piping as per the requirement shall be in bidder's scope.
- 3.26 All necessary drains, vents, breathers, CO₂ absorbers, seal pots, fume absorbers and sampling points with valves as specified and as required are in bidder's scope.
- 3.27 All necessary structural steel for pipe supporting structure, platforms, walkways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Package.
- 3.28 Finish paints for touch up painting of equipment after erection at site in sealed container.
- 3.29 Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test and plant handover).
- 3.30 Instrument hook up material shall be in bidder's scope.
- 3.31 Any item/ work either supplies 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 and will be supplied by bidder without any commercial, technical and delivery implication to BHEL and customer.
- 3.32 Any statutory requirement / clearance required from government / local body shall be in bidder's scope. Bidder to also comply local body / government norms.
- 3.33 All motorized valves (If applicable) shall be provided with integral starter.
- 3.34 Start-up and commissioning spares as required.
- 3.35 Electrical scope shall be as per 'Electrical Scope between BHEL and Vendor' enclosed elsewhere in the technical specification. Scope of cables indicated in 'Electrical Scope between BHEL and Vendor' is applicable for control and instrumentation cables also. Screen control cable is meant for electrical as well as signal/ instrumentation cables.
- 3.36 Recirculation lines for pumps shall be provided by bidder along with valves, instrumentation, fittings as per system requirement.
- 3.37 Bidder to follow latest version of all codes and standards.
- 3.38 All Valve, piping, fitting, and instrument shall be of minimum PN 10/ 150 class rating.
- 3.39 Initial charge of all lubricants & grease in bidder's scope.
- 3.40 Diaphragm seal for instruments shall be provided by bidder as per technical requirement.
- 3.41 KKS numbering for all items/ equipment including electrical and control & instrumentation to be provided by bidder during detailed engineering. KKS numbering philosophy shall be furnished during detailed engineering.
- 3.42 Grouting material required for fixing of equipment/ items.



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- 3.43** All documents, including the installation as well as the related software shall be in fluent, legible English.
- 3.44** One (1) no. Chain Pulley Block with tripod arrangement of adequate capacity, to meet the erection and maintenance requirements shall be provided by bidder.
- 3.45** All the fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids/control fluids, gases etc., which will be required to put the equipment covered under the scope of specifications, into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.
- 3.46** Two sets of all special tools and tackles required for installation, commissioning, testing, calibration, modification and maintenance of equipment(s)/ system shall be supplied. One set of these tools and tackles shall be used during the installation, commissioning, testing, calibration, modification and maintenance. Another set consists of new and unused set of tools & tackles. These tools and tackles shall be separately packed, brought to site and handed over to customer.

4. SCOPE OF SUPPLY (MECHANICAL) FOR DE-CENTRALISED SEWAGE TREATMENT PLANT -2 (NEAR CPU REGENERATION BUILDING)

- 4.1** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S3) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 4.2** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S4) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 4.3** One (1) no. of bar screen chamber (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories located inside STP area.
- 4.4** One (1) nos.(1W) coarse bar screen in bar screen chamber (RCC work in BHEL scope) along with, fittings, isolation gates and required accessories.
- 4.5** One (1) no. (1W) of oil & grease trap (RCC work in BHEL scope) along instruments, fittings, valves and required accessories (provide oil skimmer, if required).
- 4.6** One (1) no. (1W) De-centralised STP module is required along with valves, pipes, fittings, instruments and required accessories.
- 4.7** Two (2) nos. sludge recirculation pumps for STP Skid complete with all instrumentation, valves, piping, motor, etc., if required as per supplier recommendation.
- 4.8** Two (2) nos. (1W+1S) oil free type air blowers with piping, instrumentation, valves, fittings, air diffusers, electric motor drives for supplying air required for STP skid, if required as per supplier recommendation. Each blower shall be complete with motor, v-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall be provided.
- 4.9** One (1) no. filter feed tank for effluent storage after treatment in STP skid along with valves, piping, fittings, instruments and required accessories.
- 4.10** Two (2) nos. filter feed pumps complete with all instrumentation, valves, piping, motor, etc. for feeding water to multi grade filter & activated carbon filter for tertiary treatment.
- 4.11** One no. (1W) (1x100%) multi grade filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 4.12** One (1) no. (1W) (1x100%) Activated Carbon filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 4.13** One (1) no. (1W) sodium hypochlorite dosing tank for dosing chemical to treated water storage tank feed line, complete with valve, fittings, instrumentation and accessories.
- 4.14** Two (2) (1W+1S) no. Electronic type Sodium hypochlorite dosing pump with auto stroke controller complete with all instrumentation and accessories, valves, piping, motor, etc.
- 4.15** One (1) no. treated water tank for effluent storage after tertiary treatment along with valves, piping, fittings, instruments and required accessories.



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- 4.16 Two (2) nos. treated water disposal pumps for treated water tank complete with all instrumentation, valves, motor, piping and required accessories etc.
- 4.17 500-meter HDPE Pipe from treated water disposal pumps for STP shall be provided by bidder upto horticulture Area
- 4.18 20-meter Hose Pipe for treated water disposal in Horticulture Area
- 4.19 During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, Instruments, equipment's etc.as required for smooth, safe, efficient, trouble free operation and completeness of the respective sewage treatment plant, meeting the specification requirement. Please refer the diagram for minimum requirements for scope of the system.
- 4.20 Wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per AWWA C 203. However, all auxiliary steel structure (U-clamps, nuts, bolts, channels etc.) for fixing pipes on pedestal shall be in bidder's scope. Inputs for pipe pedestals as per requirement and layout shall be furnished.
- 4.21 Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange. All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.
- 4.22 Bidder to take care of the length of piping as included elsewhere in the technical specification. Pipe routings shall be decided during detailed engineering.
- 4.23 All puddle pipes, bolts, nuts, sleeves, gaskets shall be in bidder's scope.
- 4.24 All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- 4.25 Hangers and supports for all the piping as per the requirement shall be in bidder's scope.
- 4.26 All necessary drains, vents, breathers, CO2 absorbers, seal pots, fume absorbers and sampling points with valves as specified and as required are in bidder's scope.
- 4.27 All necessary structural steel for pipe supporting structure, platforms, walkways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Package.
- 4.28 Finish paints for touch up painting of equipment after erection at site in sealed container.
- 4.29 Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test and plant handover).
- 4.30 Instrument hook up material shall be in bidder's scope.
- 4.31 Any item/ work either supplies 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 and will be supplied by bidder without any commercial, technical and delivery implication to BHEL and customer.
- 4.32 Any statutory requirement / clearance required from government / local body shall be in bidder's scope. Bidder to also comply local body / government norms.
- 4.33 All motorized valves (If applicable) shall be provided with integral starter.
- 4.34 Start-up and commissioning spares as required.
- 4.35 Electrical scope shall be as per 'Electrical Scope between BHEL and Vendor' enclosed elsewhere in the technical specification. Scope of cables indicated in 'Electrical Scope between BHEL and Vendor' is applicable for control and instrumentation cables also. Screen control cable is meant for electrical as well as signal/ instrumentation cables.
- 4.36 Recirculation lines for pumps shall be provided by bidder along with valves, instrumentation, fittings as per system requirement.
- 4.37 Bidder to follow latest version of all codes and standards.
- 4.38 All Valve, piping, fitting, and instrument shall be of minimum PN 10/ 150 class rating.
- 4.39 Initial charge of all lubricants & grease in bidder's scope.
- 4.40 Diaphragm seal for instruments shall be provided by bidder as per technical requirement.
- 4.41 KKS numbering for all items/ equipment including electrical and control & instrumentation to be provided by bidder during detailed engineering. KKS numbering philosophy shall be furnished during detailed engineering.
- 4.42 Grouting material required for fixing of equipment/ items.
- 4.43 All documents, including the installation as well as the related software shall be in fluent, legible English.
- 4.44 One (1) no. Chain Pulley Block with tripod arrangement of adequate capacity, to meet the erection and maintenance requirements shall be provided by bidder.

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PROJECT STAGE-III**

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4.45 All the fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids/control fluids, gases etc., which will be required to put the equipment covered under the scope of specifications, into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.

4.46 Two sets of all special tools and tackles required for installation, commissioning, testing, calibration, modification and maintenance of equipment(s)/ system shall be supplied. One set of these tools and tackles shall be used during the installation, commissioning, testing, calibration, modification and maintenance. Another set consists of new and unused set of tools & tackles. These tools and tackles shall be separately packed, brought to site and handed over to customer.

5. SCOPE OF SUPPLY (MECHANICAL) FOR DE-CENTRALISED SEWAGE TREATMENT PLANT -3 (LOCATION INDICATED IN PLOT PLAN TO BE FINALISED DURING DETAIL ENGG.)

- 5.1** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S5) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 5.2** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S6) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 5.3** Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S7) (refer Plot Plan for location), complete with all instrumentation, valves, piping, motor, etc.
- 5.4** One (1) no. of bar screen chamber (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories located inside STP area.
- 5.5** One (1) nos.(1W) coarse bar screen in bar screen chamber (RCC work in BHEL scope) along with, fittings, isolation gates and required accessories.
- 5.6** One (1) no. (1W) of oil & grease trap (RCC work in BHEL scope) along instruments, fittings, valves and required accessories (provide oil skimmer, if required).
- 5.7** One (1) no. (1W) De-centralised STP module is required along with valves, pipes, fittings, instruments and required accessories.
- 5.8** Two (2) nos. sludge recirculation pumps for STP Skid complete with all instrumentation, valves, piping, motor, etc., if required as per supplier recommendation.
- 5.9** Two (2) nos. (1W+1S) oil free type air blowers with piping, instrumentation, valves, fittings, air diffusers, electric motor drives for supplying air required for STP skid, if required as per supplier recommendation. Each blower shall be complete with motor, v-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall be provided.
- 5.10** One (1) no. filter feed tank for effluent storage after treatment in STP skid along with valves, piping, fittings, instruments and required accessories.
- 5.11** Two (2) nos. filter feed pumps complete with all instrumentation, valves, piping, motor, etc. for feeding water to multi grade filter & activated carbon filter for tertiary treatment.
- 5.12** One no. (1W) (1x100%) multi grade filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 5.13** One (1) no. (1W) (1x100%) Activated Carbon filter along with filter media, media, trap piping, valves, electrically operated multiport valve, fittings, instrumentation and accessories associated with automatic backwash arrangement.
- 5.14** One (1) no. (1W) sodium hypochlorite dosing tank for dosing chemical to treated water storage tank feed line, complete with valve, fittings, instrumentation and accessories.
- 5.15** Two (2) (1W+1S) no. Electronic type Sodium hypochlorite dosing pump with auto stroke controller complete with all instrumentation and accessories, valves, piping, motor, etc.
- 5.16** One (1) no. treated water tank for effluent storage after tertiary treatment along with valves, piping, fittings, instruments and required accessories.
- 5.17** Two (2) nos. treated water disposal pumps for treated water tank complete with all instrumentation, valves, motor, piping and required accessories etc.



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- 5.18** 500-meter HDPE Pipe from treated water disposal pumps for STP shall be provided by bidder upto horticulture Area
- 5.19** 20-meter Hose Pipe for treated water disposal in Horticulture Area.
- 5.20** During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, Instruments, equipment's etc.as required for smooth, safe, efficient, trouble free operation and completeness of the respective sewage treatment plant, meeting the specification requirement. Please refer the diagram for minimum requirements for scope of the system.
- 5.21** Wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per AWWA C 203. However, all auxiliary steel structure (U-clamps, nuts, bolts, channels etc.) for fixing pipes on pedestal shall be in bidder's scope. Inputs for pipe pedestals as per requirement and layout shall be furnished.
- 5.22** Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange. All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.
- 5.23** Bidder to take care of the length of piping as included elsewhere in the technical specification. Pipe routings shall be decided during detailed engineering.
- 5.24** All puddle pipes, bolts, nuts, sleeves, gaskets shall be in bidder's scope.
- 5.25** All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- 5.26** Hangers and supports for all the piping as per the requirement shall be in bidder's scope.
- 5.27** All necessary drains, vents, breathers, CO2 absorbers, seal pots, fume absorbers and sampling points with valves as specified and as required are in bidder's scope.
- 5.28** All necessary structural steel for pipe supporting structure, platforms, walkways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Package.
- 5.29** Finish paints for touch up painting of equipment after erection at site in sealed container.
- 5.30** Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test and plant handover).
- 5.31** Instrument hook up material shall be in bidder's scope.
- 5.32** Any item/ work either supplies 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 and will be supplied by bidder without any commercial, technical and delivery implication to BHEL and customer.
- 5.33** Any statutory requirement / clearance required from government / local body shall be in bidder's scope. Bidder to also comply local body / government norms.
- 5.34** All motorized valves (If applicable) shall be provided with integral starter.
- 5.35** Start-up and commissioning spares as required.
- 5.36** Electrical scope shall be as per 'Electrical Scope between BHEL and Vendor' enclosed elsewhere in the technical specification. Scope of cables indicated in 'Electrical Scope between BHEL and Vendor' is applicable for control and instrumentation cables also. Screen control cable is meant for electrical as well as signal/ instrumentation cables.
- 5.37** Recirculation lines for pumps shall be provided by bidder along with valves, instrumentation, fittings as per system requirement.
- 5.38** Bidder to follow latest version of all codes and standards.
- 5.39** All Valve, piping, fitting, and instrument shall be of minimum PN 10/ 150 class rating.
- 5.40** Initial charge of all lubricants & grease in bidder's scope.
- 5.41** Diaphragm seal for instruments shall be provided by bidder as per technical requirement.
- 5.42** KKS numbering for all items/ equipment including electrical and control & instrumentation to be provided by bidder during detailed engineering. KKS numbering philosophy shall be furnished during detailed engineering.
- 5.43** Grouting material required for fixing of equipment/ items.
- 5.44** All documents, including the installation as well as the related software shall be in fluent, legible English.
- 5.45** One (1) no. Chain Pulley Block with tripod arrangement of adequate capacity, to meet the erection and maintenance requirements shall be provided by bidder.
- 5.46** All the fills of consumables and one year's topping requirements of consumables such as greases, oil, lubricants, servo fluids/control fluids, gases etc., which will be required to put the



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equipment covered under the scope of specifications, into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum. Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.

- 5.47** Two sets of all special tools and tackles required for installation, commissioning, testing, calibration, modification and maintenance of equipment(s)/ system shall be supplied. One set of these tools and tackles shall be used during the installation, commissioning, testing, calibration, modification and maintenance. Another set consists of new and unused set of tools & tackles. These tools and tackles shall be separately packed, brought to site and handed over to customer.

6. SCOPE OF SUPPLY (ELECTRICAL) (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS & SEWAGE SUMPS- S1 TO S7)

Complete electrical as per specification / details indicated in sub sections IB.

7. SCOPE OF SUPPLY (C&I) (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS & SEWAGE SUMPS- S1 TO S7)

Complete Control and Instrumentation as per specification/ details indicated in sub-sections-IC. Also refer schematic for sewage sumps. Local indication of Pressure shall be provided by bidder in each pump, blower etc. Flow measurement shall be provided by bidder at treated water pump discharge. SEWAGE TREATMENT PLANT System shall be operated from Microprocessor/ Micro PLC, shall be supplied by bidder separately for Each of the 3- De-centralised STP's.

8. INSTRUMENTS FOR DEMONSTRATION TEST AND INSTRUMENTS FOR PROCESS CONTROL

Instruments for Demonstration test and instruments for process control are in bidders' scope of supply. Instruments to be used for Demonstration test shall be additionally supplied over and above the instruments shown in tender P&IDs. **Demonstration test equipment being supplied, installed and commissioned for each unit, shall be retained by employer after completion of Demonstration test.**

9. SCOPE OF SERVICES (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS & SEWAGE SUMPS- S1 TO S7)

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

- 1) Supervision services for erection and commissioning work of complete Sewage treatment Plant.
- 2) Supervision services for 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. Vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation.
- 3) Supervision services for pre-commissioning work such as flushing, hydraulic testing etc.
- 4) Supervision services for Trial run for requisite period (**1 month**).
- 5) Conductance of Performance guarantee/ demonstration test of Sewage Treatment Plant 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 & as mutually agreed.
- 6) Arrangement of all instruments, reagents, monitoring gadgets & lab facilities to carry out trial run & conductance of Performance guarantee test will be in bidders' scope. Necessary tools, consumables and instrumentation as required for inspection and testing at works as well as at site shall be arranged by the bidder at their own cost.
- 7) Training of plant Owner's personnel, O&M operators on plant operation and maintenance is in bidders' scope.



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- 8) Bidder to comply to relevant requirements as per GTR, GCC, ECC & SCC etc.
- 9) Any other service required for making the installation complete in all respect within battery limits.
- 10) Painting as per enclosed painting schedule ANNEXURE-VI/ Sub Section IA. However, any variation in the painting schedule as finally approved by customer / BHEL, shall be taken care by bidder without any commercial and delivery implication. Colour-coding scheme shall be intimated to vendor during detailed engineering. Final touch up paint at site
- 11) Any statutory requirement / clearance required for package from government / local body shall be in bidder's scope. All Statutory Clearance and permits from concerned local bodies/ authorities, write –up on various statutory requirements and their compliance for Sewage treatment plant shall be in bidder's scope.
- 12) Bidder to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval of engineering drawings/ documents during detailed engineering to meet project's various milestones and completion schedule, without any price implication to BHEL and Customer. Meeting can be held at site also.

10. TERMINAL POINTS (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

- 1) Service water connection (50 NB connections) at 5-meter distance from each De-centralised STPs area battery limit. However, distribution and piping inside STPs area shall be in bidder's scope.
- 2) Instrument Air Connection (25NB) at 5-meter distance from each De-centralised STPs area battery limit. However, distribution and piping inside STPs area shall be in bidder's scope.

11. EXCLUSIONS (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS & SEWAGE SUMPS- S1 TO S7)

- 1) All chemicals.
- 2) Air conditioning, ventilation & firefighting facilities. However, heat dissipation data for all motors & panels as applicable shall be furnished by the bidder during detail engineering for sizing of HVAC equipment.
- 3) Civil design and construction work, lighting and illumination in STP & sewage sump areas.
- 4) MCC
- 5) Erection and Commissioning of Sewage Treatment Plant.
- 6) Unloading, Storage, handling and transportation at site.

12. PIPING (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS & SEWAGE SUMPS- S1 TO S7)

- a) Complete piping of Sewage treatment plants is in bidder's scope of supply. In addition, any additional piping required to make the system complete inside STP area shall be in bidder's scope. Pipe length inside STP area has to be considered by bidder in their scope as per layout. The below indicated pipes shall be designed & supplied by the bidder. Elbows, tees, flanges, counter flanges, Hangers and supports etc. required for the below given piping shall also be provided by the bidder.
- b) Piping distances are given below:

SL. NO.	FROM	TO	APPROX. DISTANCE
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			(In meters)
1.	De-Centralised STP-1 (Near CHP Control Room Area)	Nearest Horticulture Area	350
2.	De-Centralised STP-2 (Near CPU Regeneration Building)	Nearest Horticulture Area	300
3.	*De-Centralised STP-3 (Near CT-1/AP-6)	Nearest Horticulture Area	400
4.	From Sewage Sump-S1	De-Centralised STP-1	500
5.	*From Sewage Sump-S2	De-Centralised STP-1	300
6.	From Sewage Sump-S3	De-Centralised STP-2	250
7.	From Sewage Sump-S4	De-Centralised STP-2	500
8.	From Sewage Sump-S5	De-Centralised STP-3	300
9.	From Sewage Sump-S6	De-Centralised STP-3	100
10.	From Sewage Sump-S7	De-Centralised STP-3	550

*Location to be finalized during detailed engineering

Drain shall be located outside STP area however rest facilities of STP shall be located inside STP area provided in plot plan included in this specification.

- c) Piping from Sewage sumps (S1 to S7) to decentralised STPs (1, 2 & 3) and from treated water disposal pumps (in each decentralised STPs) to the nearest horticulture area (as per above table) are in bidder's scope. Layout and routing shall be finalized during detail engineering.
- d) In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.

13. QP AND SUBVENDOR APPROVAL (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

- 13.1 Minimum QP requirements are specified in Annexure-I/ Sub Section IA. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.
- 13.2 The sub vendor list (Annexure-II / Sub Section IA) enclosed is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
- 13.3 Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

14. FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

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

15. DESIGN/ CONSTRUCTION REQUIREMENTS (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

In addition to the requirements of Sub-Section IA & IIA, Sub-Section IB & Sub –Section IC the following shall also be complied under scope of this specification.

For inlet Sewage water characteristics, enclosed as Annexure-VII/ Sub Section IA is to be referred. The material of construction specified in Datasheet-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.

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16. PAINTING (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

Painting schedule shall be prepared in line with the details indicated in Annexure-VI/ Sub Section IA of technical specification. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.

Internal painting of the equipment shall be suitable for withstanding effect of fluid being handled. Outer painting shall be as per technical specifications. Supporting documents shall be furnished in support of suitability of the lining offered for the duty conditions by bidder during detailed engineering.

Bidder to note that painting shall be as per approved painting schedule to be finalized during detailed engineering.

17. DRAWING/ DOCUMENTS REQUIREMENT (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

17.1 For the Drawings/Documents distribution Procedure, please refer attached Annexure-IV/ Sub Section IA. 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 Annexure-IV / Sub Section IA.

17.2 After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Annexure-IV / Sub Section IA. 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.

18. CHAIN PULLEY BLOCK (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS (3 NOS) AND FOR SEWAGE SUMPS (2 NO) TOTAL 5 NOS.

18.1 Manual hoists (hand operated) shall be designed to duty class 2 as per IS 3832.

18.2 The hoist capacity shall be selected considering 25% margin over the weight of heaviest component /equipment to be handled.

19. ADDITIONAL REQUIREMENT (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

- I. 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 reviewed by BHEL.
- II. 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.
- III. 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.
- IV. 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

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- necessitated in the switch gear /MCC on account of changed loads.
- V. 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.
 - VI. 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.
 - VII. 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.
 - VIII. Bidder to adhere Format of operation and maintenance manual requirement as per Annexure-V/ Sub Section IA during detailed engineering.
 - IX. Bidder to adhere site General technical requirement of Pumps and LP Piping as per Annexure-VIII/ Sub Section IA during detailed engineering.
 - X. Bidder to refer Plot plan attached in Sub Section IA. Location of sewage collection sump outside respective area have been also located with tentative routing of sewage transfer piping for bidder's information. All sewage transfer piping from sewage lifting sump up to Sewage treatment plant shall be buried.
 - XI. Each of the 3-De-Centralised STP's are located at different places and far off from each other. Bidder to provide individual STPs at each of the 3 locations with complete items w.r.t Mechanical, Electrical, Control and Instrumentation. No common equipment/ item is envisaged among 3-De-Centralised STP's'.
 - XII. Sewage treated water shall be used for irrigation/horticulture purpose as well as terminated in nearest drain. Hence bidder to provide separate piping with isolation valve for the same.

20. GENERAL TECHNICAL INSTRUCTIONS (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANTS)

- I. The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply and erection & commissioning (E&C by BHEL) of Sewage treatment plants.
- II. 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.
- III. 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.
- IV. 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 to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

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- V. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under 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 BHEL / 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 BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.
- VI. 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.)
- VII. In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- VIII. The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer.
- IX. BHEL's/Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.

21. PLANT OPERATION AND CONTROL (APPLICABLE FOR EACH OF THE 3-DE-CENTRALISED SEWAGE TREATMENT PLANT)

The control philosophy of system is described below. Following basic process related interlocks, alarms/ prewarning signals shall be implemented in the control system as per system requirement.

- (a) Among the equipment, it shall be possible to select a specific pump or tank or sump for working/ standby/ maintenance etc. through control system.
- (b) Permissive & Interlocks:
- (1) Starting & tripping of pumps with respect to liquid level in the respective sump/ tanks or liquid pressure in the suction lines.
 - (2) Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.
 - (3) Stopping/ tripping of equipment due to abnormal parameters related to safety of equipment like high vibration, very high bearing lubrication water (and /or oil) temperature to the drive/pumps, very high bearing temperature of the of pump/drive etc. as applicable based on the recommendations of Equipment Supplier.
 - (4) Automatic starting of standby pumps upon failure of starting of selected pump or tripping of running pump as the case may be.
 - (5) Various annunciations related to low level of the chemical tanks & sumps shall be provided.
 - (6) Alarms/ signals.
 - (7) Abnormal parameters such as low & high level in tanks/sumps, high pressure at pump discharge, low header pressure, low lubrication water flow to pumps (provided with forced water lubrication system) etc.
 - (8) Failure of starting of equipment such as pumps, blowers etc. upon start command.
 - (9) Tripping of equipment due to protection logic.

In addition, the control system shall facilitate the operator to know the status of various equipment (Whether equipment is running or stopped or tripped etc., whether the equipment is selected for operation/ standby duty /maintenance mode etc. as the case may be).

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ANNEXURES

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**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

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ANNEXURE-I

QAP FOR SEWAGE TREATMENT PLANT

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QUALITY ASSURANCE

Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test/ Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
Items / Components											
COMMON ITEMS:											
1. Horizontal Centrifugal Pumps				Y	Y			Y ¹	Y		LEGENDS: Applicable tests are identified by 'Y'. Y ^a : One per Heat / Heat Treatment batch / Lot. Y ^b : On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds. Y ^c : UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 25 mm or above. Y ^d : Dynamic Balancing per IS: 21940, Grade 6.3 minimum shall be conducted for rotating assy. Y ¹ : As per Pump governing standard. Tolerances as per HIS, USA. Y ² : Random 10% RT to be conducted on butt welds for Thk >10 mm. Y ³ : Seat Leakage Test for actuator operated valves shall be done by operating the valve with job actuator. Y ⁴ : Tests on Rubber Diaphragms shall be conducted per batch of Rubber mix for Tensile, Elongation, Hardness, Thickness, Bleed Resistance. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted. Y ⁶ : Blue Matching, Wear Travel for Gate Valves and reduced pressure test for check valves shall be conducted as per relevant standards. Y ⁷ : Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code. Y ⁸ : RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT. Y ⁹ : Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted. Y ¹⁰ : Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted. Y ¹¹ : One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured. Y ¹² :Dry cycle test on valve spring for 1, 00,000
1.1. Casing	Y ^a		Y ^b		Y		Y				
1.2. Impeller	Y ^a		Y ^b		Y					Y ^d	
1.3. Shaft	Y ^a		Y		Y					Y ^c	
2. Vertical Pumps				Y	Y			Y ¹	Y		
2.1. Casing	Y ^a		Y ^b		Y		Y				
2.2. Impeller	Y ^a		Y ^b		Y					Y ^d	
2.3. Shaft	Y ^a		Y		Y					Y ^c	
2.4. Fabricated Parts	Y ^a	Y	Y ^b		Y	Y ²	Y				
3. Dosing/ Metering Pumps	Y ^a				Y		Y	Y ¹	Y		
4. Gate/ Globe/ Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ³ , Y ⁶	
5. Dual Plate Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ⁶ , Y ¹²	
6. Diaphragm Valves	Y ^a				Y		Y		Y	Y ⁴ , Y ³	
7. Butterfly Valves (Low Pr.)				Y	Y		Y	Y	Y	Y ³	
7.1 Body & Disc (Cast)	Y ^a		Y ^b		Y						
7.2 Body and Disc (Fabricated)	Y ^a	Y	Y ^b		Y				Y	Y ²	
7.3 Shaft	Y ^a		Y ^b		Y					Y ^c	
8. Plug/ Ball Valves (Low Pr.)	Y ^a		Y ^b	Y	Y		Y	Y	Y	Y ³	
9. Blowers/ Compressors	Y ^a		Y ^b	Y	Y			Y	Y	Y ^c , Y ^d	
10. Tanks/ Pressure Vessels	Y ^a	Y	Y ^b	Y	Y	Y ⁸	Y		Y	Y ⁷	
11. Rubber Lining	Y ^a				Y				Y	Y ⁹	
12. Strainers	Y ^a	Y	Y ^b	Y	Y		Y		Y		
13. Pipe & Pipe Fittings	Y ^a	Y	Y		Y	Y ⁸	Y		Y		
14. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y		Y ¹⁰	
15. Ventilation/ Exhaust Fan	Y ^a		Y ^b	Y	Y			Y ¹	Y	Y ^c , Y ^d	
16. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ⁸		Y	Y		
17. Wrapping & Coatig Material	Y				Y				Y		
18. Package/ Split AC	Y							Y	Y	Y ¹⁴	



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19. Pressure / Vacuum Relief valve / Pressure Regulating Valve	Y ^a			Y	Y			Y	Y	Y	cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring. Y ¹³ :Test as per approved supplier practice. Y ¹⁴ : Electronic leak test for condenser & evaporator unit.
											Note: 1.The complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher after erection at site. 2. In case of items other than those identified above, the quality requirements shall be decided based on system design requirements.

1. Heat Treatment shall be done as per ASME code.
2. Bleeding Resistance tests shall be done by keeping the sample in 33% HCl, 48% NaOH and DM Water for 72 Hrs.
3. Hydro Test shall be conducted, before Rubber lining.
4. As per code requirements.
5. As per HIS, USA.
6. Hydro test of body before Rubber lining. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator.
7. Tests on Rubber parts such as Diaphragms shall be done per batch of Rubber mix, such as Tensile, Hardness, Adhesion, Spark Test, Bleed Resistance test and Flex test. Life Cycle test for Diaphragms for 50000 cycles etc shall also be done.
8. Hydro Test of Body, Seat & Disc Strength shall be carried out in accordance with latest edition of AWWA C-504 Standard. Proof of Design Test in accordance with latest edition of AWWA C-504 Standard shall also be carried out, if not carried out earlier. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator. Seat leakage test shall be carried out in both directions.
 - a) One per Heat/Heat Treatment batch/Lot
 - b) On machined surfaces only.
 - c) UT shall be done for shafts with Dia 50 mm or above.
9. For all other Misc. items, refer Table on LP piping.
 10. Inspection / test / check requirements for pressure vessels other than service vessel are same as for inspection / test / check requirements for service vessel as indicate in table given above.
 11. For piping, vales, fillings in service vessel area quality requirements please also refer power cycle piping quality plan.
 12. Quality requirements specified here if contradicting as specified elsewhere in this chapter, then stringent quality requirements shall be followed by the bidder for all items without any price and delivery implications to BHEL/customer.
 13. The Quality requirements mentioned here in this annexure for different mechanical, electrical & C&I items are bare minimum, if any other quality requirements required for these items as per BHEL & customer during detail engineering the same shall be accepted and provided by bidder without any price and delivery implication to BHEL & customer.

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QAP FOR LOW PRESSURE PIPING (LP PIPING)

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**PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION,
JOINTS, TANKS, FASTENERS, LINING ETC.**

1	Tests/Check Items / Components	Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operatio nal Test	Other Tests	All Tests as per relevant Std	REMARKS
1	Pipes & Pipe Fittings	Y ^a	Y ^b			Y ¹			Y			Y	
2	Diaphragm Valves	Y ^a				Y ⁵			Y		Y ⁶		
3A	Cast Butterfly Valves (Low Pressure)					Y		Y	Y	Y	Y ⁷		
	Body	Y ^a	Y ^b										
	Disc	Y ^a	Y ^b										
	Shaft	Y ^a	Y	Y ^c									
3B	Fabricated Butterfly Valves	REFER NOTE 14											
4	Gate/ Globe/Swing Check / Ball Valves	Y ^a	Y ^b	Y ^c		Y ⁵	Y	Y	Y	Y	Y ⁸		
5	Dual Plate Check Valves	Y ^a	Y ^b	Y ^c		Y	Y	Y	Y	Y	Y ⁴		
6	Rolled & Welded Pipes and Mitre Bends	Y ^a	Y ³		Y	Y ³			Y		Y ^{3&15}	Y	
7	Coating & Wrapping of Pipes	Y ²									Y ²		
8	Tanks & Vessels	Y ^a	Y ^b		Y	Y			Y		Y ¹⁶		
9	Strainers	Y ^a	Y ^b		Y #	Y					Y ¹¹		#For Fabricated Strainer
10	Rubber Expansion Joints	Y ^a				Y ¹²		Y	Y		Y ¹³		
11	Internal Lining of Pipes	Y ^a							Y		Y ⁹		
12	Site Welding		Y ¹⁰		Y	Y							

NOTES (MEANING OF SUPERSSCRIPTS)

a One per heat/heat treatment batch/lot.

b On machined surfaces only for castings and on butt welds.

c For shaft/spindles > or = 40 mm

1 100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.

2 Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221 & IS 15337 as applicable.

3 Followings are the testing requirements for fabrication of pipes at site

TESTS**QUANTUM OF CHECKS**

WPS, PQR, Welder Qualification Test

100% Welders and WPS shall be qualified as per ASME- section IX

DPT on root run

100% for pipes up to 1200 mm diameter

DPT after back gauging

100% for pipes above 1200 mm diameter

RT / UT by (TOFD/PAUT) Technique

5% (100% of T Joints)

DPT on finished butt weld joints

10%

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	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed.	
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.	
6	Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.	
7	Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner / owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification.	
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. Valves shall be offered for hydro test in unpainted condition.	
9	Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application.	
10	10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.).	
11	Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives.	
12	During hydraulic and vacuum tests at 25mm Hg abs in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.	
13	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149/IS 3400 Part 20 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.	
14	In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: - UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. - Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. - Welders and WPS shall be qualified as per ASME- section IX	
15	Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress relieved as per norms of ASME Section VIII after welding.	
16	For pressure vessel welds RT shall be done as per design code requirements.	

All Valves shall be offered for inspection in unpainted condition.

No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.

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ANNEXURE-II

SUB-VENDOR LIST

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LIST OF MAKES OF SUB-VENDOR ITEMS

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	PRESSURE VESSELS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSICON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
2.	ATMOSPHERIC/ STORAGE TANKS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSICON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
3.	RUBBER LINING (AT SHOP)	TEMSEC	KOLKATA	
		RISHI INDUSTRIES	SONEPAT	
		CORI ENGINEERS	CHENNAI	
		POLY RUBBER	MUMBAI	
		INDUSTRIAL LINING	VADODARA	
		ARUL RUBBERS	CHENNAI	
		JASMINO POLYMERTECH	TALOJA	
		WESTERN RUBBER	NAVI MUMBAI	
		ELASTOMER LINING	AMBERNATH	
		EMKAY RUBBER	MUMBAI	
4.	AIR BLOWERS (TWIN	SWAN PNEUMATIC	NOIDA	

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	LOBE TYPE)	EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
5.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
6.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
7.	HORIZONTAL CENTRIFUGAL PUMPS	BEST AND CROMPTON ENGG LTD.	CHENNAI	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		KIRLOSKAR BROTHERS LTD	PUNE	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
		VARAT PUMP AND MACHINERY PVT. LTD.	HOWRAH	
		SINTECH PRECISION PRODUCT LTD.	GHAZIABAD	
		MAXFLOW PUMPS INDIA PVT. LTD.	GURUGRAM	
8.	VERTICAL CENTRIFUGAL PUMPS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		SULZER PUMPS INDIA LTD.	THANE	
		WPIL LIMITED	KOLKATA	
9.	SCREW PUMP	UT PUMP		
		ROTO PUMPS		
		TUSHACO		
10.	NON-METALLIC (PP/FRP) HORIZONTAL CENTRIFUGAL	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	
		LEAK PROOF PUMPS PVT. LTD.	-	

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	PUMPS	(RAJEDIA)		
11.	MISC. PUMP VERTICAL TURBINE TYPE	KBL	PUNE	
		M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
12.	COATING & WRAPPING MATERIAL TAPE	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
13.	CAST IRON GATE/GLV/NRV/SRV	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		H. SARKER AND COMPANY	HOWRAH	
		LEADER VALVES LTD.	JALANDHAR	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
14.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
15.	ELECTRIC MOTOR	VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
		CROMPTON GREAVES	AHMEDNAGAR	
		LAXMI HYDRAULICS PVT. LTD	BANGALORE / HUBLI*	
		RAJINDRA ELECT INDUSTRIES	FARIDABAD* / BANGALORE	
		GE-POWER		
		BHARAT BIJLEE	MUMBAI	

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PROJECT STAGE-III

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TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		SIEMENS	MUMBAI	
		NGEF	BANGALORE	
		KIRLOSKAR ELECTRIC CO LTD.		
		ASEA BROWN BOVERI		
		MARATHON	KOLKATA	
16.	BUTTER-FLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
17.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
18.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI ,CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
19.	Y-TYPE STRAINER	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTRATION ENGINEERS (I) PVT. LTD	MUMBAI	

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		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
20.	RUBBER FLAP TYPE CHECK VALVES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
21.	SOLENOID VALVES	ROTEX	-	
		AVCON	-	
22.	PRESSURE GAUGE/ DIFFERENTIAL PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKATA	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
23.	CHAIN PULLEY BLOCK	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	

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		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
24.	CONTROL VALVE	SPX CORPORATION, USA	AHMEDABAD	
		CONTROL COMPONENT INC.	CALIFORNIA	
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI	
		WEIR VALVES & CONTROLS UK LTD.	U.K	
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY	
		INSTRUMENTATION LTD.	KERALA	
		KOSO INDIA PRIVATE LIMITED,	NASHIK	
		LESLIE CONTROLS, INC	USA	
		MIL CONTROLS LTD.	KERALA	
		METSO SINGAPORE PTE. LTD.,	SINGAPORE	
		PARCOL S.P.A	ITALY	
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE	
		RINGO VALVULAS S.L,	SPAIN	
		SHENJIANG VALVE CO. LTD.	CHINA	
		VALVITALIA S.P.A. ,	ITALY	
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY	
25.	PRESSURE/DP/VACUUM SWITCH	INDFOSS	GHAZIABAD	
		SOR	USA	
		DRESSOR	USA	
		DELTA CONTROL	UK	
		TRAFAG	RANIPET	
		GIC(GAUGES BOURDON)	PANVEL	
		ASHCROFT INDIA PVT LTD.	USA/GERMANY	
		SWITZER	CHENNAI	
26.	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BUDENBERG GUAGE CO.LTD.	UK	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.	GOA	
		GOA THERMOSTATIC INSTRUMENTS PVT.LTD.		
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	

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		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
27.	LEVEL GAUGE (F&B, TUBULAR, REFLEX)	SBEM		
		CHEMTROL		
		PUNE TECHTROL		
		SIGMA		
		V AUTOMAT		
		GENERAL INSTRUMENTS		
28.	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	PUNE	
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TANSA EQUIPMENTS PVT.LTD	MUMBAI	
		BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		HI-TECH SYSTEMS & SERVICES LTD.	KOLKATA-	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM LEVELSTATE SYSTEMS LTD., UNITED KINGDOM.
29.	LEVEL SWITCH- CONDUCTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	KOLKATA	
		RAMAN INSTRUMENTS PVT.LTD.	MUMBAI	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM MOBREY MEASUREMENT, AN OPERATING UNIT OF MORBEY LTD., SLOUGH, BERKSHIRE, UNITED KINGDOM.
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SOR INC.	USA	
		SAPCON INSTRUMENT PVT LTD.	INDORE	
		V. AUTOMAT & INTRUMENTS (P) LTD.	NEW DELHI	
30.	LEVEL SWITCH (ALL TYPES)	LEVCON		
		CHEMTROLS SAMIL (INDIA) PVT LTD.		

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		SWITZER		
		WAAREE (BAUMER INSTRUMENTS)		
		V AUTOMAT		
		PUNE TECHTROL		
31.	MAGNETIC FLOW METER	ABB	-	
		WAAREE (BAUMER INSTRUMENTS)	-	
		EUREKA	-	
		EMERSON	-	
		YOKOGAWA	-	
		HACH (POTENSE)	-	
		KROHNE MARSHALL	-	
32.	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	GOA	
		INSTRUMENTATION LTD.	PALAKKAD	
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD	
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	GOA	
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE	
		SEIKO FLOW CONTROL GMBH	AUSTRIA	
33.	FLOW TRANSMITTERS (ALL TYPES)	E & H	-	
		KHRONE MARSHALL	-	
		EMERSON	-	
		ABB	-	
		HONEYWELL	-	
		YOKOGAWA	-	
34.	LEVEL TRANSMITTERS (ALL TYPES)	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		KROHNE MARSHALL	-	
35.	PRESSURE TRANSMITTERS (ALL TYPES)	EMERSON	USA/PAWANE	
		LAXONS AUTOMATION	DAMAN	
		YIL	BANGALORE	
		SIEMENS	THANE	
		FUJI	CHINA	
		YOKOGAWA	JAPAN	
		HONEYWELL	USA/PUNE	
36.	TEMPERATURE TRANSMITTERS	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	

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		YOKOGAWA	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
37.	PH TRANSMITTERS	EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		ABB	-	
		HACH	-	
		FORBES MARSHALL	-	
38.	ANALYSERS (ALL TYPES)	ABB	-	
		EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		HACH POLYMETRON	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
39.	PROGRAMMABLE LOGIC CONTROLLER	GE INTELLIGENT PLATFORMS PRIVATE LIMITED	BANGALORE	
		HONEYWELL AUTOMATION INDIA LIMITED ,	PUNE	
		ROCKWELL AUTOMATION INDIA LTD	SAHIBABAD	
		SIEMENS LIMITED	MUMBAI	
		SCHNEIDER ELECTRIC INDIA PVT.LTD.	NEW DELHI	
40.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	GUJARAT	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
41.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	
		FLEXPRO ELECTRICALS PVT. LTD.		METAL TYPE JUNCTION BOX ONLY
			GUJARAT	
		K.S.INSTRUMENTS PVT.LTD.	BANGALORE	
		SUCHITRA INDUSTRIES	BANGALORE	
		SHRENIK & COMPANY,	AHMEDABAD	

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42.	CABLE GLAND	COMET	-	
		DOWELL	-	
		CHETNA	-	
43.	CABLE LUGS	ELECTRO BILLETS	-	
		COMET	-	
		DOWELL	-	
		CHETNA	-	
44.	CS PIPE (ASTM A 106 GR. B)	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
45.	MS PIPES	SAIL	ROURKELA	
		JINDAL	GHAZIBAD/HISSA R	
		SURYA ROSHNI	BAHADUR GARH	
		TATA TUBE	JAMSHEDPUR	
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	
		LALIT PROFILE	THANE	
		SAMSHI PIPES INDUSTRIES	VADODARA	
		MUKUT PIPES	RAJPURA	
		INDUS TUBES	G B NAGAR	
		MANN IND	INDORE	
		SURENDRA ENGG	RAJPURA	
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	
		JCO GAS PIPE	CHINDWARA	
		NUKAT TANKS AND VESSELS	TARAPUR	
		DADU PIPES	SIKRANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	
46.	SS PIPES/ TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
47.	POWER/CONTROL/INSTRUMENT CABLE	CORDS CABLE	BHIWADI	
		RADIANT CABLES	HYDERABAD	
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		NICCO	KOLKATA	

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		RAVIN CABLES	PUNE	
		INCAB	PUNE	
		HVPL	FARIDABAD	
		TORRENT CABLE	NADIAD	
		HAVELLS	ALWAR	
		PARAMOUNT	KHUSHKHERA	
		SRI RAM CABLES	BHIWADI	
		THERMOCABLES	HYDERABAD	
		TORRENT CABLE	NADIAD	
		UNIVERSAL CABLES	SATNA	
		GEMSCAB	BHIWADI	
		DELTON	FARIDABAD	
48.	FRP TANKS & FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
49.	LOCAL CONTROL PANEL	INDUSTRIAL SWITCHGEAR & CONTROL	-	
		POSITRONICS	-	
		DELTA CONTROL	-	
		L & T	-	
		GE POWER	-	
		PYROTECH	-	
		C& S	-	
50.	TANK (FRP)	INDUSTRIAL SERVICE	KOLKATA	
		SUNRISE	BARODA	
		GANDHI & ASSOCIATES	AHMEDABAD	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
51.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
52.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	

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		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
53.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCORPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
54.	PIPE & FITTINGS (PP, HDPE, PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
55.	VALVES (GATE/GLOBE/NRV/B A LL)- (PP, HDPE, PVC & CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
56.	FILTER MEDIA	GLOBAL ABSORBENT	KOLKATA	
		BHARAT MINERALS		
57.	SIGHT FLOW INDICATORS	B.K. EQUIPMENTS PVT.LTD.	CHENNAI	
		BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TELACE EQUIPMENT PVT.LTD.	CHENNAI	
58.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
59.	PNEUMATIC	PROCON ENGINEERS	-	

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	ACTUATOR	TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
60.	MOTORISED ACTUATOR	ROTARK	-	
		AUMA	-	
		LIMITORK	-	

NOTE:

- The sub vendor list above is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI. 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.

- Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.
- End user performance certificate that the equipment/system has been operating satisfactorily for minimum two years as on the scheduled date of bid opening.
Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

- The inspection category will be intimated after award of contract by BHEL/customer. However, the same will be adhered by the bidder without any commercial and delivery implication to BHEL/customer.

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PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -I

SUB SECTION -IA

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ANNEXURE-III

FUNCTIONAL GUARANTEES

	TITLE: 2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III		SPECIFICATION NO. PE-TS-497-673-A001	
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1.0 GENERAL REQUIREMENTS FOR PERFORMANCE GUARANTEE

- Instruments for demonstration test and instruments for process control of similar applications are envisaged to be of same make and model having same accuracy level. However, instruments for demonstration test are also acceptable as per standard and proven practice of the contractor/OEM and in such case, instruments for process control shall be as per requirements specified in technical specifications. Instruments to be used for demonstration test shall be additionally supplied over and above the instruments shown in tender P&IDs. **Demonstration test equipment being supplied, installed and commissioned for each unit, shall be retained by employer after completion of demonstration test.**
- Tools and tackles, instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the contractor free of cost.
- All instruments required for performance testing shall be of the type and accuracy required by the ASME PTC code. Prior to the start of the initial operation, the contractor shall get these instruments calibrated in an independent test Institute approved by the Employer. All calibration procedures and standards shall be subjected to the approval of the Employer. Tools and tackles, instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the contractor free of cost.
- In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent.

2.0 SEWAGE TREATMENT OUTLET QUALITY TO BE DEMONSTRATED

Minimum outlet quality parameters to be demonstrated by bidder have been included below. However, in case the guaranteed parameters as per the latest MOEF, State pollution control board norms and Local authority requirement, are more stringent than the specified parameters given below, then more stringent outlet parameters must be followed and guaranteed by bidder.

OUTLET QUALITY (MINIMUM)		
S. No	Description	Value
a.	BOD ₅	Less than 10 mg/l
b.	COD	Less than 50 mg/l
c.	TSS	Less than 10 mg/l
d.	pH	7-8
e.	Coliform count	100 counts/ 100 ml
f.	NH ₄ -N	Less than 5 mg/l
g.	N Total	Less than 10 mg/l
h.	Residual chlorine	Not exceeding 0.5 mg/l
i.	Temperature	Ambient

NOTE: -

The treated sewage quality standards shall be achieved at average sewage flow rates as well as peak sewage flow rates. During the operation of the plant, the above parameters shall be demonstrated by bidder

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ANNEXURE-IV

DRAWING/ DOCUMENTS REQUIREMENT & DISTRIBUTION SCHEDULE

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After award of LOI, the drawing documents listed in MDL (which are minimum drawing/documents) shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall also be submitted by bidder without any commercial & delivery implication to BHEL.

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 number of drawing/documents to be submitted by the bidder shall be as per enclosed drawing/documents distribution schedule.

Every revised submission incorporating BHEL/Customer comments shall be resubmitted within 7 days by bidder.

BHEL shall provide observation / approval within 15 days from the date of document submission by bidder.

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

Engineering meeting shall be held fortnightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

Drawings/Documents Submission Procedure

- Bidder to note that drawings/documents submission shall be through web-based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
 - Internet explorer version – Minimum Internet Explorer 7
 - Internet speed – 2 mbps (Minimum preferred)
 - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
 - Vendor's internal proxy setting should not block DMS application's link
 - o (<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>
- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer AutoCAD and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.

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- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the AutoCAD copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However, any other AutoCAD copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.
 - P&IDs.
 - Equipment lay out of STP Plant.
 - Equipment Cable tray layout of STP Plant.
 - Civil assignment drawings.
 - Piping lay out drawing of STP Plant.

Other requirements

- Engineering for this project is to be carried out in Integrated Intelligent Engineering environment at BHEL end. The engineering platform on which BHEL is doing the project is based on Smart Plant Suite. This is being done to have automated interface checking and thereby minimising rework at site.
Hence in line with above, bidder shall provide necessary support with respect to detailed piping drawing, isometric drawing, etc. as and when required during detail engineering.
- 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.
- 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.
- 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. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

S. No.	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE FOR SEWAGE TREATMENT PLANT	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
	MECHANICAL			
1.	PE-V0-497-673-A001	P&ID FOR SEWAGE TREATMENT PLANT*	4	A0
2.	PE-V0-497-673-A002	LAYOUT OF SEWAGE TREATMENT PLANT *	4	A0
3.	PE-V0-497-673-A003	PROCESS DESIGN & SIZING CALCULATIONS, PRESSURE DROP CALCULATIONS FOR STP*	4	A4
4.	PE-V0-497-673-A006	SUB VENDOR LIST AND INSPECTION CRITERIA*	6	A4
5.	PE-V0-497-673-A007	CONTROL WRITE UP*	6	A4
6.	PE-V0-497-673-A008	TECHNICAL DATA SHEET AND GA DRG OF HORIZONTAL CENTRIFUGAL PUMPS	8	A4

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7.	PE-V0-497-673-A009	TECHNICAL DATA SHEET AND GA DRG OF SUBMERSIBLE PUMPS	8	A4
8.	PE-V0-497-673-A010	TECHNICAL DATA SHEET AND GA DRG OF BLOWERS	8	A4
9.	PE-V0-497-673-A011	CIVIL INPUT DRAWING OF FOUNDATION OF EQUIPMENT INSIDE AND OUTSIDE OF STP AREA	12	A1
10.	PE-V0-497-673-A012	MECHANICAL GA DRG OF RCC SUMPS INSIDE STP AREA	12	A1
11.	PE-V0-497-673-A013	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE STP AREA	12	A1
12.	PE-V0-497-673-A014	PIPING LAYOUT INSIDE STP AREA ALONG WITH DETAILS OF SUPPORTS	16	A1
13.	PE-V0-497-673-A015	YARD PIPING LAYOUT ALONG WITH DETAILS OF SUPPORTS	16	A0
14.	PE-V0-497-673-A017	GA DRAWING OF ATMOSPHERIC TANKS	10	A3
15.	PE-V0-497-673-A018	DATASHEET AND GA DRG OF BALL VALVE	10	A4
16.	PE-V0-497-673-A019	DATASHEET AND GA DRG OF PRV, SRV & NEEDLE VALVE	10	A4
17.	PE-V0-497-673-A020	DATASHEET AND GA DRG OF GATE VALVE	10	A4
18.	PE-V0-497-673-A021	DATASHEET AND GA DRG OF BUTTERFLY VALVE	10	A4
19.	PE-V0-497-673-A022	DATASHEET AND GA DRG OF MULTIPOINT VALVE	10	A4
20.	PE-V0-497-673-A023	DATASHEET AND GA DRG OF NRV	10	A4
21.	PE-V0-497-673-A024	VALVE SCHEDULE	10	A4
22.	PE-V0-497-673-A025	PIPING SCHEDULE	10	A4
ELECTRICAL				
23.	PE-V0-497-673-A101	ELECTRICAL LOAD LIST	8	A4
24.	PE-V0-497-673-A102	DATASHEET OF MOTORS	10	A4
25.	PE-V0-497-673-A103	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE STP	12	A0
26.	PE-V0-497-673-A104	EARTHING LAYOUT OF INSIDE AND OUTSIDE STP	12	A0
CONTROL & INSTRUMENTATION				
27.	PE-V0-497-673-A201	LIST OF DRIVES, JB GROUPING AND I/O LIST	10	A4
28.	PE-V0-497-673-A202	INSTRUMENT SCHEDULE	10	A4
29.	PE-V0-497-673-A203	DATASHEET OF LOCAL INSTRUMENTS	10	A4
30.	PE-V0-497-673-A204	DATASHEET OF SOLENOID VALVE	10	A4
31.	PE-V0-497-673-A205	DATA SHEET AND GA FOR JUNCTION BOXES	10	A4
32.	PE-V0-497-673-A206	CABLE SCHEDULE AND INTERCONNECTION DIAGRAM	12	A4
33.	PE-V0-497-673-A207	INSTRUMENT INSTALLATION DRAWINGS/ HOOK UP DIAGRAM FOR INSTRUMENTS	12	A4
34.	PE-V0-497-673-A208	DATASHEET & GA DRAWING OF MICROPROCESSOR BASED CONTROL SYSTEM	12	A4
35.	PE-V0-497-673-A210	ALARM AND ANNUNCIATION LIST	10	A4

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	QAP			
36.	PE-V0-497-673-A301	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	9	A4
37.	PE-V0-497-673-A302	QAP FOR BLOWER	9	A4
38.	PE-V0-497-673-A303	QAP FOR ATMOSPHERIC TANK	9	A4
39.	PE-V0-497-673-A304	QAP FOR PRV, SRV & NEDDLE VALVE	9	A4
40.	PE-V0-497-673-A305	QAP FOR GATE VALVE	9	A4
41.	PE-V0-497-673-A306	QAP FOR NRV	9	A4
42.	PE-V0-497-673-A307	QAP FOR MS/ CS PIPES	9	A4
43.	PE-V0-497-673-A308	QAP FOR HDPE PIPE	9	A4
44.	PE-V0-497-673-A309	QAP/ ICL OF STP (FOR BALANCE OF ITEMS)	9	A4
45.	PE-V0-497-673-A310	QAP FOR CPVC PIPES	9	A4
46.	PE-V0-497-673-A311	QAP FOR MOTOR	9	A4
47.	PE-V0-497-673-A312	QAP FOR SUBMERSIBLE PUMP	9	A4
48.	PE-V0-497-673-A313	QAP FOR BUTTERFLY VALVE	9	A4
49.	PE-V0-497-673-A314	QAP FOR BALL VALVE	9	A4
50.	PE-V0-497-673-A315	QAP FOR MULTIPOINT VALVE	9	A4

MANUAL HOIST (CHAIN PULLEY BLOCK):

S. No.	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE FOR CHAIN PULLEY BLOCK	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
1.	PE-V0-497-673-A400	MANUFACTURING QUALITY PLAN	8	A4
2.	PE-V0-497-673-A401	GA DRAWING FOR CPB WITH DETAIL BOM WITH PAINTING DETAILS	10	A4
3.	PE-V0-497-673-A402	O&M MANUAL INCLUDING ERECTION PROCEDURE	10	A4

**** Basic engineering documents.****Notes: -**

- 1.The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
- 2.Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- 3.Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
- 4.All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.: -

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

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DRAWING/DOCUMENTS DISTRIBUTION SCHEDULE

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S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	• Layout (A0&A1 sizes)	4	-
	• Other Drawings/Documents (A0 & A1 sizes)	2	-
	• P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping / structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual		
	i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book		
	i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual		
	i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
6	Performance and Functional Guarantee Test Report		
	i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2

Note:

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

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ANNEXURE-V

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

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Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

1. **CHECK LIST FOR OPERATION & MAINTENANCE MANUAL**

2. **Project name** :
3. **Project number** :
4. **Package Name** :
5. **PO reference** :
6. **Document number** :
7. **Revision number** :
- 8.

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

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

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SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -I

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

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ANNEXURE-VI

SURFACE PREPARATION & PAINTING

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CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	Specification of surface preparation & painting			
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.			
1.05.00	SURFACE PREPARATION			
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.			
1.06.00	APPLICATION OF PRIMER/PAINT			
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.			
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminum paint to IS 2339. PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC) PS13 - Rust preventive fluid by spray, dip or brush. PS14 - Weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15'. PS17 - Aliphatic Acrylic Polyurethane CDE134, %V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.) PS-20 - Epoxy based finish paint			
1.06.06	All weld edge preparation for site welding shall be applied with one coat of weldable primer.			
1.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.			
1.06.10	A)	Specification for the application of Epoxy coating for internal protection of ~~DM tank~~ & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polyimide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct		
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	hardener. Total thickness of primer and paint should not be less than 400 microns. B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns. (d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard. (b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.			
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**C) LOW PRESSURE PIPING**

1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Color shade/ coding scheme.
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											

**General Notes (Applicable for all above points A to E)**

- i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.
- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

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SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -I

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ANNEXURE-VII

SEWAGE WATER ANALYSIS

**TITLE:**

**2X660 MW TALCHER THERMAL POWER
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**TECHNICAL SPECIFICATION FOR SEWAGE
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SECTION -I

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INLET SEWAGE WATER ANALYSIS

INFLUENT QUALITY (MINIMUM)			
S. No	Description	Unit	Value
a.	BOD ₅	mg/ l	300
b.	COD	mg/ l	600
c.	TSS	mg/ l	200
d.	pH		6.5 – 8
e.	Temperature		Ambient
f.	Oil & Grease	mg/l	20

Bidder to note that above influent sewage parameters are bare minimum. In addition to the above, bidder should consider additional influent parameters while designing of complete sewage treatment plant as per proven practice and guidelines issued by MOEF/ State pollution control board/ local authorities etc.

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ANNEXURE-VIII

GENERAL TECHNICAL REQUIREMENT OF PUMPS AND LP PIPING

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Annexure-1			
	HORIZONTAL CENTRIFUGAL PUMPS			
1.00.00	SCOPE			
	General requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Horizontal Centrifugal Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:			
2.00.00	CODES AND STANDARDS			
2.01.00	Design, material, construction manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Indian standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.			
2.02.00	List of Applicable Standards			
	i) IS : 1520 - Horizontal Centrifugal Pumps for clear cold fresh water.			
	ii) IS : 5120 - Technical requirements of roto-dynamic special purpose pumps			
	iii) API - 610 - Centrifugal pumps for general refinery service.			
	iv) IS : 5639 - Pumps Handling Chemicals & corrosion liquids.			
	v) IS : 5659 - Pumps for process water			
	vi) HIS - Hydraulic Institute Standards; USA			
	vii) ASTM-I-165-65 - Standards Methods for Liquid Penetration Inspection.			
3.00.00	DESIGN REQUIREMENTS			
3.01.00	The maximum efficiency of pumps shall be preferably within + 10% of the rated design flow indicated in data sheets.			
3.02.00	Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head.			
3.03.00	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble-free operation throughout the range. Components of identical pumps shall be interchangeable.			
3.04.00	Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation.			
	Speed	Antifriction bearing	Sleeve bearing	
	1500 rpm and below	75.0-micron	75.0 micron	
	3000 rpm	50.0-micron	65.0 micron	
	The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.			
4.00.00	DESIGN CONSTRUCTION			
4.02.00	Pump casing shall have radially/axially split type construction. The casing shall be designed to withstand the maximum shut - off pressure developed by the pump at the pumping temperature. The pumps shall be capable of starting with discharge valve fully open and close condition.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.03.00	Pump casing shall be provided with a vent connection and piping with fittings & valves Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pr. Gauge as standard feature.			
4.04.00	Impeller Impeller shall be closed or semi-closed as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled			
4.05.00	Impeller/ Casing Wearing Rings Replaceable type wearing rings shall be provided at suitable locations pumps.			
4.06.00	Shaft The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.			
4.07.00	Shaft Sleeves Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening			
4.08.00	Bearings The bearings offered shall be capable of taking both the radial and axial thrust. Anti-friction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hours of continuous operation at maximum axial and a radial loads and rated speed. Bearings shall be easily accessible without disturbing the pump assembly.			
4.09.00	Stuffing Boxes / Mechanical Seals Stuffing boxes of packed ring construction type or mechanical seals shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements. If external gland sealing is required, it shall be done from the pump discharge. The Mech sealing face should be low frictional co-efficient & resistance to corrosion against the liquid being pumped.			
4.11.00	Pump Shaft Motor Shaft Coupling The Pump and motor shaft shall be connected with a adequately sized flexible coupling of proven design with a spacer			
4.12.00	Base Plate A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, suitable ribbed and reinforced.			
4.13.00	Assembly and Dismantling Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.			
4.14.00	Drive Motor (Prime Mover) The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps is specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. Cent, ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एन टी पी सी NTPC
5.00.00	Technical Data sheet of Pumps			
	No	Designation\Application	Clarified/Raw/ Treated water	DM water
	1)	Operating Speed	1500 rpm (nominal)	
	2)	Pumps and drives to be designed for	Outdoor duty & Continuous Operation	
	3)	Type of lubrication	Grease	
	4)	Suction condition	Flooded Suction	
	5)	Type of Shaft Sealing	Gland packing	Mechanical Seal
	6)	Type of coupling (motor & pump)	Flexible	
	11)	Material of Construction		
	i)	Casing, Stuffing Box, Gland	2.5% Ni CI IS210 Gr FG 260	ASTM A CF8M
	ii)	Impeller	ASTM A351 CF8M	
		Wearing rings (if applicable)	SS – 316	
	iii)	Shaft, Shaft Sleeves	SS-410	
	iv)	Bolts & nuts	SS 316 for those encountering water and for others, material shall be high tension carbon steel.	
	v)	Base plate (min 12 mm thick)	Carbon Steel (Epoxy Painted)	
	7)	Accessories	a. Required Instrumentation b. Companion flanges with nuts, bolts and gaskets, Anchor bolts, nuts, sleeves and inserts. c. Internal piping with valves, filters & Instruments for sealing/ cooling/ lubrication system up to and including isolating valve etc. d. Positioning dowels, Eye bolts, lifting etc. e. Ladders, Platforms & Other accessories	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Annexure-2			
	VERTICAL PUMPS			
1.00.00	SCOPE			
1.01.00	This specification covers general requirements in respect of design, construction features, manufacture, inspection, and performance at Vendor's / sub-vendor's works delivery to site, erection field testing and commissioning of Makeup Water & Raw Water Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:			
2.00.00	CODES AND STANDARDS			
2.01.00	The design, material, construction, manufacture, inspection, testing and performance of Vertical Pumps shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Standards listed below. Other national standards are acceptable, if they are established to be equal or superior to the listed standards.			
2.02.00	List of Applicable Standards			
	IS: 1710	:	Vertical Turbine Pumps for clear cold fresh water.	
	IS: 5120	:	Technical requirement of rotor dynamic special purpose pumps.	
	HIS	:	Hydraulic Institute Standards U.S.A.	
	PTC 82	:	Centrifugal pumps-power test code	
	API 610	:	Centrifugal pumps for general refinery purposes.	
3.00.00	DESIGN AND PERFORMANCE REQUIREMENTS			
3.01.00	The maximum efficiency point of the pumps shall preferably lie within 10% of the rated design flow.			
3.02.00	Pumps of a particular category shall be identical, suitable for parallel operation and provided with interchangeable components. Head vs. capacity and BHP vs. Capacity characteristic should match to ensure even load sharing and trouble-free operation throughout the range.			
3.03.00	The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 15% or more than the design head for radial flow pumps and 50% more than the design head for mixed flow/ turbine type pumps.			
3.04.00	The operating range of operation of pumps shall generally be 40% to 120% of rated flow for sustained period of operation.			
3.05.00	The power requirement of the pump shall be non-over loading type for mixed flow/ turbine type pumps.			
3.06.00	The critical speed of the pump shall be less than 80% of the rated speed or more than 130% of the rated speed. Also, the critical speed of the pump-motor assembly shall be more than the maximum reverse run-away speed.			
3.07.00	Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor end shall not exceed the limit specified in Hydraulic Institute Standards. The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.			
3.08.00	The base plate, foundation bolts, motor stool and other components shall be designed to take the full force coming on the discharge elbow under shut-off condition.			
3.09.00	Water for motor cooling and thrust bearing cooling, if required, shall be tapped from the discharge of the pumps and/or fed from an over-head tank. All piping, valves, strainer,			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.12.00	instruments etc. required for this purpose and line shaft bearing lubrication (if required) shall be provided by the Contractor. Reverse Rotation a) The pump shall be provided with an approved mechanical device to protect reverse rotation on loss of drive motor power and failure of discharge valve to close. b) a reverse rotation detection switch shall be provided to prevent starting of motor while rotating in reverse direction.			
3.13.00	Motor Rating The pumps shall be capable of starting with discharge valve fully closed as well as fully open conditions. Motors shall be selected to suit to the above requirements. Continuous motor rating (at 50°C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation. Drive motors shall be connected directly to the line shaft of the pump.			
4.00.00	DESIGN AND CONSTRUCTION			
4.01.00	Pump Type Pumps shall be of vertical shaft, single stage/multi-stage, submerged suction, complete with bowl, column & head assembly, and drive assembly. The pump design shall be of pullout/non-pull-out type as specified			
4.02.00	Discharge head The pump discharge shall be of above-floor type/sub-floor type. In certain cases of pump installation where expansion joint is located immediately at the pump discharge, the pump assembly will be subjected to the unbalanced hydraulic thrust. A thrust pad will be built in with the discharge head for transmitting the hydraulic thrust to external structures such that this hydraulic thrust is not transmitted to the foundation bolts for which they may not be designed.			
4.03.00	Column Pipe Column pipes shall be flanged and bolted and shall be complete with gaskets, nuts, and bolts.			
4.04.00	Impeller The impeller shall be closed, or semi-open or open as specified elsewhere.			
4.05.00	Wearing Rings Replaceable type wearing rings shall be provided for both casing and the impeller. For open impellers replaceable casing liners shall also be provided. The difference in hardness of the casing & impeller wearing rings shall be minimum 50 BHN.			
4.06.00	Impeller & Line Shaft Shaft size selected based on maximum combined shear stress must take into consideration the critical speed as per API - 610.			
4.07.00	Pump & Shaft Bearings - lubrication			
4.07.01	Adequate number of properly designed bearings shall be furnished. The type of lubrication i.e., self-water lubrication or forced water lubrication shall be provided.			
4.07.02	Self water Lubrication System The line shaft bearings shall be lubricated by the water being pumped. The main pump and line shaft bearings which are above minimum water level shall be of 'Thordon' type/			
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4.07.03	equivalent. For other line shaft bearings located below minimum water level, cutless rubber bearings can be used. Forced water lubrication system The line shaft shall be provided with shaft enclosing tube to exclude pumped water from shaft and bearings. Lubricating water pumps shall be provided to supply lubricating water for bearings. These lubricating water pumps shall get supply from the overhead water storage tank.																												
4.08.00	Thrust Bearings Single thrust bearing at motor top or separate thrust bearings at pump and motor shall be provided to take care of hydraulic thrust and weight of the rotating assembly. Thrust bearing shall be spherical roller type or superior, capable of absorbing axial thrust in both directions of rotation. Water required for cooling of thrust bearing shall be taken from pump discharge, wherever applicable. The thrust bearing shall be rated for continuous operation with thrust as developed in shut-off condition with clearance between the wearing rings in worn out condition to be at least four (4) times the clearance between the wearing rings in new condition.																												
4.09.00	Pump Motor Supports, Base plate etc. The pump and motor shall have a common support. The necessary supporting frame, base plates, mounting plates etc. as required shall be supplied under this specification.																												
4.10.00	Stuffing Box Gland packing shall be provided at the top-of-the-line shaft. Shaft sleeves shall be provided at the stuffing box.																												
4.11.00	Assembly and Dismantling Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouted base/sole plate or alignment.																												
9.00.00	Technical Data Sheet (if not mentioned specifically elsewhere in the CW System technical specifications) of Pumps <table><tr><th>SN</th><th>Description</th><th>Parameters</th></tr><tr><td>1</td><td>Designation</td><td>As applicable</td></tr><tr><td>2</td><td>Total No. of Pumps</td><td>As applicable</td></tr><tr><td>3</td><td>No. of Working Pumps</td><td rowspan="3">As applicable</td></tr><tr><td>4</td><td>No. of Standby Pumps</td></tr><tr><td>5</td><td>Guaranteed Flow & Total Head (Guaranteed)</td></tr><tr><td>6</td><td>Operating Speed (Max.)</td><td>1500 rpm</td></tr><tr><td>7</td><td>Pumps and drives to be designed for</td><td>Outdoor duty & Continuous Operation</td></tr><tr><td>10</td><td>Type of Pump</td><td>Vertical Wet Pit & Non-Pull out type</td></tr></table>				SN	Description	Parameters	1	Designation	As applicable	2	Total No. of Pumps	As applicable	3	No. of Working Pumps	As applicable	4	No. of Standby Pumps	5	Guaranteed Flow & Total Head (Guaranteed)	6	Operating Speed (Max.)	1500 rpm	7	Pumps and drives to be designed for	Outdoor duty & Continuous Operation	10	Type of Pump	Vertical Wet Pit & Non-Pull out type
SN	Description	Parameters																											
1	Designation	As applicable																											
2	Total No. of Pumps	As applicable																											
3	No. of Working Pumps	As applicable																											
4	No. of Standby Pumps																												
5	Guaranteed Flow & Total Head (Guaranteed)																												
6	Operating Speed (Max.)	1500 rpm																											
7	Pumps and drives to be designed for	Outdoor duty & Continuous Operation																											
10	Type of Pump	Vertical Wet Pit & Non-Pull out type																											
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
	13	Type of Discharge	Above Floor		
	14	Type of Impeller	Closed / Semi-open		
	16	Type of Lubrication	Forced water/ Self lubrication (as specified)		
	18	Minimum Water Level in sump	Min submergence level of pump plus 0.5.m		
	19	Maximum Water Level in sump	As per system requirement (Min 0.2 m below FGL)		
	21	Sump Invert Level	As per HIS		
	22	Operating Floor Level	Min. 0.5 M above FGL		
	23	Other dimensions of sump, Fore-bay etc	As per HIS & system requirement		
	25	Accessories to be provided with each pump	a. Required Instrumentation b. Companion flanges with nuts, bolts and gaskets, Anchor bolts, nuts, sleeves and inserts. c. Internal piping with valves, filters & Instruments for sealing/ cooling/ lubrication system up to and including isolating valve etc. d. Positioning dowels, Eye bolts, lifting etc. e. Ladders, Platforms & Other accessories		
	26	MOC			
	i	Suction Bell, Casing / Bowl	2.5% Nickel Cast Iron, IS: 210 Grade FG 260; S-0.1% max. P-0.15% max.		
	ii	Casing Liner	Stainless steel (SS)		
	iii	Impeller	Austenitic SS ASTM A743/ CF8M Grade		
	iv	Wearing rings	SS-316		
v	Impeller Shaft, Pump & line shaft, Pump & Shaft Coupling, Pump & Shaft Sleeves	SS - ASTM A 276 Gr. 410.			
vi	Shaft bearings	Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE			TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB SECTION A-15 CW SYSTEM	PAGE 28 OF 31

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																														
	<table><tr><td>vii</td><td>Column pipe</td><td>Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.</td></tr><tr><td>viii</td><td>Shaft Enclosing Tubes</td><td>Fabricated steel as per IS: 2062 (minimum thickness - 6 mm) with 2 coats of epoxy coating inside & outside.</td></tr><tr><td>ix</td><td>Discharge Head</td><td>Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.</td></tr><tr><td>x</td><td>Distance Piece (if applicable)</td><td>Fabricated steel as per IS: 2062 (min thickness 10 mm) with 2 coats of epoxy coating inside.</td></tr><tr><td>xii</td><td>Stuffing Box, Gland</td><td>2.5 % NI-CI to IS-210 FG-260</td></tr><tr><td>xiii</td><td>Gland Packing</td><td>Impregnated Teflon</td></tr><tr><td>xiv</td><td>Gaskets</td><td>Wire reinforced rubber gasket / Neoprene Rubber / Compressed Asbestos Fibre</td></tr><tr><td>xv</td><td>Ladders, Platforms & Other Accessories</td><td>Fabricated steel as per IS: 2062</td></tr><tr><td>xvi</td><td>Bolts & Nuts</td><td>Stainless Still AISI Type 316 for those coming in contact with water and for others material shall be High Tension Carbon Steel</td></tr><tr><td>xvii</td><td>Baseplate & Soleplate (min 12 mm thick), Matching flange</td><td>Fabricated steel as per IS: 2062</td></tr></table>	vii	Column pipe	Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.	viii	Shaft Enclosing Tubes	Fabricated steel as per IS: 2062 (minimum thickness - 6 mm) with 2 coats of epoxy coating inside & outside.	ix	Discharge Head	Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.	x	Distance Piece (if applicable)	Fabricated steel as per IS: 2062 (min thickness 10 mm) with 2 coats of epoxy coating inside.	xii	Stuffing Box, Gland	2.5 % NI-CI to IS-210 FG-260	xiii	Gland Packing	Impregnated Teflon	xiv	Gaskets	Wire reinforced rubber gasket / Neoprene Rubber / Compressed Asbestos Fibre	xv	Ladders, Platforms & Other Accessories	Fabricated steel as per IS: 2062	xvi	Bolts & Nuts	Stainless Still AISI Type 316 for those coming in contact with water and for others material shall be High Tension Carbon Steel	xvii	Baseplate & Soleplate (min 12 mm thick), Matching flange	Fabricated steel as per IS: 2062		
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB SECTION A-15 CW SYSTEM																														
			PAGE 29 OF 31																														

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Annexure-3			
	SUBMERSIBLE PUMPS			
1.00.00	SCOPE			
1.01.00	This specification covers general requirements in respect of design, material, manufacture, construction, testing & inspection at Vendor's / sub-vendor's delivery to side, of submersible pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:			
2.00.00	CODES AND STANDARD			
	The design manufacture and performance of submersible pumps shall be complied with all currently applicable statues, regulation, and safely codes in the locality where the Equipment will be installed. The Equipment shall also conform to the latest applicable Indian standards listed below/equivalent standards.			
2.01.00	List of Applicable Indian Standards			
	IS: 8034	-	Submersible pumps for clear cold fresh water	
	IS: 5120	-	Technical requirement of Rotodynamic Special Purpose pumps.	
3.00.00	DESIGN AND PERFORMANCE REQUIREMENTS			
	a) The pump shall be of single stage mono - block type with non-clog design.			
	b) Components of Identical pumps shall be interchangeable.			
	c) Pumps shall have continuously rising head characteristics.			
4.00.00	MOTOR RATING			
	Continuous motor rating (at 50 deg. C ambient) for pumps shall be at least ten percent (10%) above the maximum load demand of the driven equipment in the complete operating range to take care of the system frequency variations.			
5.00.00	FEATURES OF CONSTRUCTION			
	a) Pumps shall be of Submersible, wet pit type.			
	b) Pumps shall be able to pass through solids up to 100 mm and capable of handling wastewater which may contain, sludge, plastic solids etc.			
	c) Coupling device shall ensure leak proof joint between the pump and discharge elbow. This shall also enable pump to be removed from the sumps without the necessity of dismantling any nuts, bolts etc.			
	d) Pumps shall be portable type and capable of using in any sump as and when required. Pump shall be provided with required stool, flexible, hose chain connection etc. for easy installation, removal, and maintenance. Adequate length of chain required for lowering the pump into the sump and flexible type discharge pipe shall be provided.			
	e) Impeller			
	Enclosed impellers shall be equipped with seal rings on their hubs. In case of open impeller, the pump shall be designed to take care of the additional thrust produced.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2		SUB SECTION A-15 CW SYSTEM
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CLAUSE NO.		SCOPE OF SUPPLY & SERVICES		एनटीपीसी NTPC	
1.00.00_		LOW PRESSURE PIPING			
1.01.00		The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & the sub section pertaining to "Terminal points and exclusions" and shall include the following systems: a) Circulating water piping b) DM water normal make-up piping (condenser makeup, ECW makeup for both Steam Generator and Turbo Generator Auxiliaries & CPU regeneration plant, etc.). DM for Aux Boiler filling, FGD area, etc. c) Condenser emergency make up and ECW tank emergency make-up for SG & TG / condensate storage and transfer system. d) Boiler (Steam Generator) and Deaerator fill piping. e) Equipment Cooling Water (ECW) piping including its chemical dosing for primary circuit for Steam generator and Turbo generator and their auxiliaries. f) Auxiliary cooling water piping. g) Complete service water piping, APH /ESP wash water piping, Drinking (potable) water piping (plant distribution, CHP area, for Colony, etc.), CW Blowdown piping (including FGD & CHP area), clarified water & HVAC piping, Raw water piping (PT plant, ash handling, Make up to Fire water Tank), R.O. reject to CHP piping, Sludge & Effluent transfer piping system. h) Compressed air (Instrument & service air) piping system. i) Sludge (PT Plant to Ash slurry sump) & Effluent (DM Plant to Ash slurry sump) transfer systems. j) CPU Regeneration waste to CW Channel, Condenser Pit Clear water to CW Channel, ADV discharge to CW Channel, etc. k) Drain & vent piping system for the piping\equipment etc. under the bidder's scope. l) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks, etc.). m) Re-circulation pipes along with valves, breakdown orifices etc., wherever required/specified elsewhere in Technical Specification. n) Any other piping system required making the Low Pressure (LP) piping systems in the bidder's scope complete. o) Other applicable piping systems as mentioned in Plant Water Scheme and elsewhere in Technical Specification.			
1.02.00		The scope covers the following for the complete LP piping mentioned above: a) Design, engineering, manufacturing, supply, fabrication, testing packaging, transportation to site, storage, taking delivery of Employer supplied equipment from site stores, in plant transportation, erection, cleaning, testing and commissioning of all items i.e., pipes, fittings, supports/ hangers, valves, actuators, motors, specialties,			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2		SUB SECTION- IIA-08 LOW PRESSURE PIPING	
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23/2023001		This page is part of tech. spec. PE TS 497 673 A001	
CLAUSE NO.		SCOPE OF SUPPLY & SERVICES	
		एनटीपीसी NTPC	
		expansion joints, strainers, moisture traps, tanks, chemical dosing system for Equipment Cooling Water System (Primary circuit), instruments, drains, vent including drain/ vent valves ,air release valves etc.	
		The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded.	
1.03.00		Bidder's scope of supply & works shall include but not be limited to the following:	
		a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc. actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings.	
		b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc.	
		c) Weather hoods for pipes crossing ceilings and walls.	
		d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.	
		e) Drain funnels, drip pans, moisture traps etc. wherever required shall be provided.	
		f) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer.	
		g) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification.	
		Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc.	
		Reinforced concrete valve chambers wherever required for underground piping.	
		h) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces, stainless steel piping & surfaces, and gun metal surfaces.	
		Paints and varnishes, primers, thinners etc. as required for anti-corrosive protection of piping & equipment above ground.	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION- IIA-08 LOW PRESSURE PIPING
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CLAUSE NO.		SCOPE OF SUPPLY & SERVICES	
		एनटीपीसी NTPC i) Bidder shall provide anti-corrosive protection anticorrosive tape or coating wrapping on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping. j) On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied. k) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried. l) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck feet, channels, angles, etc. It is Bidder's responsibility to estimate these requirements and include them in their offer price. Whenever, straight run of the yard pipes are more than 300 meters, flexibility analysis shall be conducted by the contractor to identify the requirement of loops, type of supports etc. m) In covered concrete trenches bidder shall supply necessary supporting materials such as stools, saddles, base plates, clamps, U-bolts, angles, clips etc. n) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems based on the approved flow scheme / single line diagram. It is bidder's responsibility to identify the requirements of drains, vents, and supply the necessary pipe work, fittings, hangers and supports etc. for the same. o) Bidder shall supply and install necessary matching pieces as may be needed for connection of piping systems with equipment terminals, valves and specialties. p) Bidder shall erect all instrument impulse piping and fittings from the tap-off point of the last root valve including the root valve and instruments. q) Bidder shall perform necessary internal machining of pipe for installing orifices, flow nozzles, straightening vanes etc. r) The Bidder shall prepare the flow diagrams, detailed dimensional piping layout/ Isometric/ fabrication/ as built drawings of all the systems along with Cross sectional drawings, showing all supports and equipment as required. s) In addition to submission of drawings as stipulated above bidder shall also furnish the data/ documents with respect to following: 1) Thickness calculation of large diameter buried pipes as per AWWA-M-11. 2) System design calculation of Primary closed circuit ECW and secondary circuit ACW system for flow & pressure balancing. 3) Design calculations for condensate storage tank and Drinking water tank. 4) Static Analysis for Long (more than 300 meter straight run) above ground piping wherever required.	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION- IIA-08 LOW PRESSURE PIPING
		PAGE 3 OF 4	

CLAUSE NO.	SCOPE OF SUPPLY & SERVICES 		
1.04.00	t) Bidder's scope of supply for fabrication, erection, cleaning, testing and commissioning of the piping systems installed by him shall include the following: - All welding consumables like welding electrodes, filler rods and wires; gases like oxygen, acetylenes, argon, carbon-dioxide, propane, backing rings etc. Films for radiographic examination of welds. X-ray and Gamma -ray equipment including isotopes, dye penetrants, and other required non-destructive testing materials and equipment (all to be taken back by the Bidder after completion of work). All heating and stress relieving equipment, thermocouples asbestos blankets, cables, temperature recorders, charts heat sensitive chalks and crayons etc. (All to be taken back by bidder after completion of work). All machinery, equipment tools and tackles as required for transportation handling, fabrication and erection (All to be taken back by Bidder after completion of work). All equipment/ materials as required for cleaning, flushing, blowing out and hydro testing of the piping systems; these shall include but not be limited to pumps and compressors with prime movers, instruments, pipe work with supports, valves, strainers and other specialties, blanks, plugs, spool pieces, dummy plates, electrical accessories, etc. (All to be taken back by Bidder after completion of work). All scaffolding materials and false work (To be taken back by Bidder after completion of work). The Bidder shall provide Services of erection superintendent and foremen, fitters and riggers, welders, transport and crane operators and other skilled and unskilled labour. The design engineering and providing all temporary pipe work as required for erection, cleaning, flushing, blowing out, testing and commissioning of the piping system is the responsibility of the Bidder. The Bidder's scope shall include design, supply of required structural steel (except those which are specifically excluded), their fabrication and erection where ever required.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-4540-001A-2	SUB SECTION- IIA-08 LOW PRESSURE PIPING	PAGE 4 OF 4



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CLAUSE NO.	TECHNICAL REQUIREMENTS																																					
	एनटीपीसी NTPC LOW PRESSURE PIPING EQUIPMENT SIZING CRITERIA All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period. For all Low Pressure piping systems covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration. Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following: a) Water Application <table><tr><th colspan="2"></th><th colspan="3">Water Velocity in m/sec</th></tr><tr><th></th><th>Pipe Size</th><th>Below 50 mm</th><th>50-150 mm</th><th>200 mm & above</th></tr><tr><td>(a)</td><td>Pump suction</td><td>-----</td><td>1.2-1.5</td><td>1.2-1.8</td></tr><tr><td>(b)</td><td>Pump discharge and recirculation</td><td>1.2-1.8</td><td>1.8-2.4</td><td>2.1-2.5</td></tr><tr><td>(c)</td><td>Header</td><td>-----</td><td>1.5-2.4</td><td>2.1-2.4</td></tr></table> Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec. WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value: <table><tr><td>(i)</td><td>Carbon steel pipe</td><td>100</td></tr><tr><td>(ii)</td><td>Ductile Iron.</td><td>140</td></tr><tr><td>(iii)</td><td>Rubber lined steel pipe</td><td>120</td></tr><tr><td>(iv)</td><td>Stainless steel pipe</td><td>100</td></tr></table> For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water. b) Compressed Air Application Compressed air 15.0 m/sec. The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.			Water Velocity in m/sec				Pipe Size	Below 50 mm	50-150 mm	200 mm & above	(a)	Pump suction	-----	1.2-1.5	1.2-1.8	(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5	(c)	Header	-----	1.5-2.4	2.1-2.4	(i)	Carbon steel pipe	100	(ii)	Ductile Iron.	140	(iii)	Rubber lined steel pipe	120	(iv)	Stainless steel pipe	100
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB-SECTION- A-9 (LOW PRESSURE PIPING)	PAGE 1 OF 19
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CLAUSE NO.	TECHNICAL REQUIREMENTS																																											
1.05.00	Based on the inside diameter so established, minimum thickness calculation shall be made as per ANSI B 31.1 OD. Manufacturing allowance shall be added to minimum calculated thickness and next higher standard thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B36.19 as the case may be. Alternatively, manufacturers standard thickness can also be accepted subject to that such thickness shall be equal to or more than the minimum calculated thickness after considering manufacturing allowance. Selected thickness then shall be checked for vacuum loading criterion as per the guidelines given in AWWA-M-11.																																											
1.06.00	Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).																																											
1.07.00	Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.																																											
1.08.00	Material of construction for pipes carrying various fluids shall be as specified elsewhere.																																											
1.09.00	Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.																																											
1.10.00	Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.																																											
1.11.00	Threaded joints shall be provided with Teflon sealant tapes.																																											
1.12.00	Following types of valves shall be used for the system/service indicated. <table><tr><th>SYSTEM</th><th colspan="6">TYPES OF VALVES</th></tr><tr><th></th><th>Butterfly</th><th>Gate</th><th>Globe</th><th>Check</th><th>Ball</th><th>Plug</th></tr><tr><td>Water</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Air</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr><tr><td>Drains & vents</td><td></td><td>x</td><td>x</td><td>x</td><td></td><td></td></tr><tr><td>Fuel oil (if any)</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr></table>	SYSTEM	TYPES OF VALVES							Butterfly	Gate	Globe	Check	Ball	Plug	Water	x	x	x	x	x		Air		x	x	x	x		Drains & vents		x	x	x			Fuel oil (if any)		x	x	x	x	x	
SYSTEM	TYPES OF VALVES																																											
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Fuel oil (if any)		x	x	x	x	x																																						
1.13.00	Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30% design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.																																											
2.00.00	TECHNICAL SPECIFICATION																																											
2.01.00	GENERAL Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also																																											

TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB-SECTION- A-9 (LOW PRESSURE PIPING)	PAGE 2 OF 19
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
		includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.			
2.02.00		Pipes and fittings			
2.02.01		All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.			
2.02.02		Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.			
2.02.03		Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.			
2.02.04		Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).			
2.02.05		Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.			
2.02.06		The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.			
2.02.07		Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.			
2.02.08		For rubber lined ERW pipes, beads shall be removed for pipe size 80 NB and above.			
2.02.09		Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.			
2.02.10		At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.			
2.02.11		For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.			
		Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.			
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2.03.00 2.03.01	Material Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified. The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.																		
2.03.02	No extra credit would be given to offers containing materials superior to those specified. Likewise, no extra credit would be given to offers containing pipe thickness more than specified.																		
2.03.03	All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.																		
2.03.04	All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.																		
2.03.05	Material of construction for pipes carrying various fluids shall be as follows: <table><tr><th>SI N</th><th>Type of Fluid</th><th>Material</th></tr><tr><td>1.</td><td>i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)</td><td>IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr. 410 /IS-1239 Heavy.</td></tr><tr><td>2.</td><td>i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)</td><td>Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below</td></tr><tr><td>3.</td><td>i) Drinking (potable) water ii)Compressed air (Instrument & service air)</td><td>ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.</td></tr><tr><td>4.</td><td>(Condensate) spill water</td><td>ASTM A 106 Gr. B</td></tr><tr><td>5.</td><td>Effluents from Neutralization pit</td><td>MSRL</td></tr></table>	SI N	Type of Fluid	Material	1.	i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr. 410 /IS-1239 Heavy.	2.	i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below	3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.	4.	(Condensate) spill water	ASTM A 106 Gr. B	5.	Effluents from Neutralization pit	MSRL
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5.	Effluents from Neutralization pit	MSRL																	
2.03.06	In water lines, pipes up to 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.																		
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).																		
2.03.08	In demineralised water service, the pipes up to 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB up to and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.																		

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		Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.			
2.03.09		Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).			
2.03.10		Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.			
2.03.11		Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.			
2.03.12		If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.			
2.04.00		Field routed pipes:			
2.04.01		Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.			
2.05.00		Slope/Drains and Vents			
2.05.01		Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes. Material for drain and vent lines shall be compatible with that of the parent pipe material.			
2.05.02		Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.			
2.06.00		Pipe Joints In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.			
2.06.01		Screwed Joints (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT / ANSI B1.20.1 (taper) NPT / IS: 554 unless specified otherwise. (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating.			
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		Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & outside) after welding, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively, flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test. (c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately. (d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. All the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges will be permitted only when any flange is leak-prone during hydro testing. (e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.			
2.06.02		Welded Joints (a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.			
2.06.03		Flanged Joints (a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only. (b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification. (c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.			
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2.07.00 2.07.01		Bends / elbows / mitre bends / Tees / Reducers & other fittings For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11. Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1). However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.			
2.07.02		For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. However, mitre bends are also acceptable for rubber lined pipes above 1200 NB. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.			
2.07.03		For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.			
2.07.04		Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes up to and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.			
2.07.07		In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.			
2.08.00		Flanges			
2.08.01		Flanges shall be slip on type or weld neck type. Welding of flanges in tension is not permitted.			
2.08.02		All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 / AWWA C-207 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.			
2.09.00		Specific technical requirement of laying buried pipe with anti-corrosive treatment			
		The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.			
2.09.01		Trenching			
		(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.			
2.09.02		Preparation and cleaning of piping			
		(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.			
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2.09.03		(b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied. Coating and wrapping/ Anti corrosive Protection Coal tar tape a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are: (1) Coating primer (coal tar primer) (2) Coating enamel (coal tar enamel) (3) Wrapping materials. All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable. Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat. Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity / resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available. Total thickness of completed coating and wrapping shall not be less than 4.0 mm. b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total nominal thickness of the finished protective coating shall be 4.0 mm.			
2.09.04		Trench bed preparation and back filling Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.			
2.09.05		laying of galvanized steel (GI) pipes All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste. All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti-corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.			
2.10.00		Cleaning and flushing			
2.10.01		All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.			
2.10.02		Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. However, for pipe sizes below 100nb the pipes			
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		may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.			
2.10.03		After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.			
2.10.04		All compressed air pipe work shall be cleaned by blowing compressed air.			
2.11.00		Specification for hangers and supports			
2.11.01		All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.			
2.11.02		The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.			
2.11.03		At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.			
2.12.00		Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.			
2.12.01		GENERAL			
		(a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.			
		(b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required.			
		(c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.			
		(d) The actuator-operated valves shall be designed on the basis of the following:			
		(1) The internal parts shall be suitable to support the pressure caused by the actuators;			
		(2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.			
		(3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.			
		(4) All actuators operated valves shall open/ close fully within time required by the process.			
		(e) Valves coming under the purview of IBR shall meet IBR requirements.			
		(f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.			
		(g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety			
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2.12.02		purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer VALVE BODY MATERIAL Valve body material for various services shall be as follows: Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below. For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below. DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable. Condensate: Cast Carbon Steel / Forged Carbon Steel.																													
2.12.03		The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards. Standards and Codes <table><tr><td>AWWA-C-504</td><td>Rubber seated butterfly valves.</td></tr><tr><td>BS-5155/EN-593</td><td>Cast iron and steel body butterfly valves for general purpose.</td></tr><tr><td>IS-778</td><td>Gun-metal gate, globe and check valves for general purpose.</td></tr><tr><td>BS-5154</td><td>Copper alloy globe/globe stop and check and gate valves for general purpose.</td></tr><tr><td>IS-780</td><td>Sluice valves for water works purpose (50-300 mm size)</td></tr><tr><td>IS-2906</td><td>Sluice valves for water works purpose (350-1200 mm size)</td></tr><tr><td>IS-5150</td><td>Cast iron wedge and double disc gate for general purpose.</td></tr><tr><td>BS-5152</td><td>Specification for cast iron globe valves.</td></tr><tr><td>BS-5153</td><td>Cast iron check valves for general purpose.</td></tr><tr><td>IS-5312</td><td>Swing check type reflux (non-return) valves.</td></tr><tr><td>ANSI B 16.34</td><td>Standard for valves.</td></tr><tr><td>API-594</td><td>Standard for Dual-check valves.</td></tr><tr><td>API-600</td><td>Steel gate valves.</td></tr></table>				AWWA-C-504	Rubber seated butterfly valves.	BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.	IS-778	Gun-metal gate, globe and check valves for general purpose.	BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.	IS-780	Sluice valves for water works purpose (50-300 mm size)	IS-2906	Sluice valves for water works purpose (350-1200 mm size)	IS-5150	Cast iron wedge and double disc gate for general purpose.	BS-5152	Specification for cast iron globe valves.	BS-5153	Cast iron check valves for general purpose.	IS-5312	Swing check type reflux (non-return) valves.	ANSI B 16.34	Standard for valves.	API-594	Standard for Dual-check valves.	API-600	Steel gate valves.
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2		SUB-SECTION- A-9 (LOW PRESSURE PIPING)																											
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2.12.04		ANSI-B-16.10 Valves face to face and other relevant dimension. API-598 Valves inspection test. End Connections The end connections, shall comply with the following: Socket welding (SW) - ANSI B 16.11 Butt Welding (BW) - ANSI B 16.25. Threaded (SC) - ANSI B 2.1 Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).			
2.13.00		Gate/Globe/Check Valves (a) All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable). (b) All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints. (c) All gun metal body valves shall have screwed ends. (d) All flanged end valves / specialties shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints. (e) Gate/sluice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position, the bore of the valve shall not be constricted by any part of the gate. Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items: (1) Hand wheel (2) Position indicator (for above 50 mm NB valve size) (3) Draining arrangement wherever required. (f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have reduced or spherical seating and discs shall be free to revolve on the spindle. The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.			
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2		SUB-SECTION- A-9 (LOW PRESSURE PIPING)	
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2.13.01	(g) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB. (h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal); (i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position. (j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type. (k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable. (l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore. (m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable. MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE) (a) The materials shall generally comply with the following: (1) Cast Steel Valves <table> <tr> <td>Body & bonnet</td><td>ASTM A 216 Gr. WCB/ ASTM A 105</td></tr> <tr> <td>Disc for non-return Valves</td><td>ASTM A 216 Gr. WCB/ ASTM A 105</td></tr> <tr> <td>Trim.</td><td>ASTM A 182 Gr. F6 or Equivalent</td></tr> </table> (2) Stainless steel valves <table> <tr> <td>Body & Bonnet</td><td>SS 304</td></tr> <tr> <td>Disc</td><td>-do-</td></tr> <tr> <td>Trim.</td><td>SS 316</td></tr> </table> (3) Cast iron valves <table> <tr> <td>Body & bonnet</td><td>BS 1452 Gr. 14/ IS-210 Gr. FG 260</td></tr> <tr> <td>Seating surfaces and rings</td><td>13% chromium steel/ 13% Chrome overlay</td></tr> <tr> <td>Disc for non-return valves</td><td>BS 1452 Gr. 14/IS-210 Gr FG 260</td></tr> </table>	Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105	Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105	Trim.	ASTM A 182 Gr. F6 or Equivalent	Body & Bonnet	SS 304	Disc	-do-	Trim.	SS 316	Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260	Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay	Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260
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2.14.00		Hinge pin for non-return valves AISI 316				
		Stem for gate globe valves 13% chromium steel or Equivalent				
		Back seat 13 % chromium steel / 13% Chrome overlay				
		(4) Gun Metal valves				
		Body and bonnet IS 318 Gr. 2/ Equivalent Standard				
		Trim. -do-				
		(b) Cast iron body valves shall have high alloy steel stem and seat.				
		(c) Material for counter flanges shall be the same as for the piping.				
		(d) Forged carbon steel & Forged stainless steel valves are also acceptable in place of Gun metal valves.				
				Air Release Valve		
2.15.00		(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.				
		(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.				
		(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.				
		(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.				
2.15.01		Butterfly valves				
		Design/Construction				
2.15.01		(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm Nb diameter.				
		(b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However, for sizes 600 NB and below the valves of Wafer construction are also acceptable				
		(c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.				
		(d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be				
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2.15.02	through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction. Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter. Material of Construction (Butterfly Valves) Materials and other design details shall be as indicated below: (a) Cast Iron Butterfly Valves <table><tr><td>Body & Disc</td><td>ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated</td></tr><tr><td>Shaft</td><td>BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.</td></tr><tr><td>Seat ring</td><td>18-8 Stainless steel</td></tr><tr><td>SEAL</td><td>NITRILE RUBBER</td></tr></table> (b) Stainless Steel Butterfly Valves <table><tr><td>Body & Disc</td><td>SS 304</td></tr><tr><td>Shaft</td><td>SS 316</td></tr><tr><td>Seat Rings</td><td>EPT/BUNA-N/Neoprene</td></tr></table> (c) Carbon steel Butterfly Valves <table><tr><td>Body & Disc</td><td>ASTM A 216, Gr. WCB</td></tr><tr><td>Shaft</td><td>SS 304</td></tr><tr><td>Disc & Seat Rings</td><td>EPT/BUNA-N/Neoprene</td></tr></table> (d) Elastomer lined Butterfly Valves <table><tr><td>Body & Disc</td><td>ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.</td></tr><tr><td>Shaft</td><td>SS 316</td></tr></table>	Body & Disc	ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated	Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.	Seat ring	18-8 Stainless steel	SEAL	NITRILE RUBBER	Body & Disc	SS 304	Shaft	SS 316	Seat Rings	EPT/BUNA-N/Neoprene	Body & Disc	ASTM A 216, Gr. WCB	Shaft	SS 304	Disc & Seat Rings	EPT/BUNA-N/Neoprene	Body & Disc	ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.	Shaft	SS 316	
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2.15.03	Proof of Design Test (Type Test) for Butterfly Valves Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.																									

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2.16.00		All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516. Float operated valves (a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level. (b) DESIGN AND CONSTRUCTION FEATURES The following design and construction feature of the valve shall be the minimum acceptable. (c) Valves shall be right-angled or globe pattern. (d) Valves shall be balance piston type with float ball. (e) Leather liner shall not be provided. (f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats. (g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec. (h) The valves shall have flanged connections.			
2.17.00		Tanks and Accessories The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.			
2.17.01					
2.17.02		DESIGN AND CONSTRUCTION (a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650. (b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement. (c) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature. (f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection. (j) Tanks shall be provided with float operated level indicators / level gauges / level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be. (k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing DM water, alkaline water or power cycle water the vent to atmosphere shall be			
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2.17.03		through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals.																																										
		(l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes / inspection cover as required and also platform suitably located.																																										
		(m) Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.																																										
		(o) Tank fabrication drawing and design calculations shall be approved by the Project Manager.																																										
		Corrosion protection																																										
		(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.																																										
		(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.																																										
		(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.																																										
		----- <table><tr><th>Sl. No.</th><th>Description</th><th>Tech. Particulars</th></tr><tr><td colspan="3">-----</td></tr><tr><td>1.00</td><td colspan="2">CONDENSATE STORAGE TANKS</td></tr><tr><td>1.01</td><td>Number required</td><td>one for each unit</td></tr><tr><td>1.02</td><td>Capacity of each tank (Effective)</td><td>350 Cu. m (for 660MW units)</td></tr><tr><td>1.03</td><td>Size (Dia. & Height)/Plate Thickness</td><td>8.6mX7.2m minimum, Shell & Roof plate Thickness 8mm and Base plate thickness 10mm</td></tr><tr><td>1.04</td><td>Type and pressure class</td><td>Vertical, cylindrical, atmospheric</td></tr><tr><td>1.05</td><td>Material of construction</td><td>MS- (IS-2062 Gr. B or equivalent) as per specified code, 8mm thickness (minimum)</td></tr><tr><td>1.06</td><td>Location</td><td>Outdoor</td></tr><tr><td>1.07</td><td>Overflow, drain, vent and Sample connection (piping &valve)</td><td>required</td></tr><tr><td>1.08</td><td>Level Indicator</td><td></td></tr><tr><td></td><td>a) Number</td><td>One for each tank</td></tr><tr><td></td><td>b) Type</td><td>Mechanical float type with dial</td></tr></table>				Sl. No.	Description	Tech. Particulars	-----			1.00	CONDENSATE STORAGE TANKS		1.01	Number required	one for each unit	1.02	Capacity of each tank (Effective)	350 Cu. m (for 660MW units)	1.03	Size (Dia. & Height)/Plate Thickness	8.6mX7.2m minimum, Shell & Roof plate Thickness 8mm and Base plate thickness 10mm	1.04	Type and pressure class	Vertical, cylindrical, atmospheric	1.05	Material of construction	MS- (IS-2062 Gr. B or equivalent) as per specified code, 8mm thickness (minimum)	1.06	Location	Outdoor	1.07	Overflow, drain, vent and Sample connection (piping &valve)	required	1.08	Level Indicator			a) Number	One for each tank		b) Type	Mechanical float type with dial
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CLAUSE NO.	 TECHNICAL REQUIREMENTS		
	1.09 Manhole (minimum 500mm size) 1.10 Special Fittings a) Hydraulic Seal of Overflow/Drain b) Additional nozzle Connection c) Nozzle connection for Instrument/spare d) CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level) e) Outside stair case (spiral) f) Inside Ladder g) Draw off sump h) Root valve for level Transmitter	type indicator (Guide wire, Float and Housing of Stainless steel - 316 Gr. construction) Two (2)-one on shell and the other on roof Required number and size to be indicated to successful Bidder Three (3) nos. for each tank required required Required required Root valves for two (2) nos. level transmitter for each tank Required	
2.18.00	RUBBER EXPANSION JOINTS		
2.18.01	All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.		
2.18.02	The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.		
2.18.03	The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.		
2.18.04	The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.		
2.18.05	Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB-SECTION- A-9 (LOW PRESSURE PIPING) PAGE 17 OF 19

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2.18.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.		
2.18.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the 'duck' shall be either a superior quality braided cotton or synthetic fiber having maximum flexibility and non-set characteristic.		
2.18.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.		
2.18.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.		
2.18.10	The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.		
2.18.11	All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.		
2.18.12	Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.		
2.18.13	Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.		
2.18.14	Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.		
2.18.15	Life cycle test for RE Joints of Condenser CW Inlet Outlet lines: Life cycle test certificates shall be furnished by the bidder for each type and size of RE joints supplied by the Bidder, in the absence of which actual Life cycle test shall be conducted on one rubber expansion joint of each type and size.		
2.19.00	STRAINERS		
2.19.01	Simplex type The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows: (a) Body IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2	SUB-SECTION- A-9 (LOW PRESSURE PIPING) PAGE 18 OF 19

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CLAUSE NO.		TECHNICAL REQUIREMENTS			
2.19.02		(b) Strainer Element		Stainless steel (AISI 316)	
		(c) End connection		Screwed up to 50 mm Nb, and Flanged above 50 mm Nb	
		Duplex type			
		(a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.			
		(b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.			
		Body		IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.	
		Strainer element		Stainless steel (AISI 316)	
		End connection		Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type	
		(c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.			
		(d) The size of the strainer and the flow direction will be indicated on the strainer body casting.			
(e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.					
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-4540-001A-2		SUB-SECTION- A-9 (LOW PRESSURE PIPING)	
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PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

VOLUME II-B

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -I

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ANNEXURE-IX

MANDATORY SPARES

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TECHNICAL SPECIFICATION FOR SEWAGE
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MANDATORY SPARES LIST FOR SEWAGE TREATMENT PLANT

LIST & QUANTITY OF MANDATORY SPARES		
S.No.	DESCRIPTION	REQUIRED QUANTITY
A	MECHANICAL SPARES	
1	Valves	
1.1	Diaphragm Valves of All types	1 no of each type, size & rating for total population < 10 nos 2 nos of each type, size & rating for total population ≥ 10 nos
1.2	Diaphragms	One fourth quantity of total population
1.3	NRV (Flap type and Dual Plate Type)	Minimum 1 no. each type, size & rating
1.4	Ball Valves of all types	Minimum 2 no. each type, size & rating
1.5	Butterfly Valves of all types	Minimum 1 no. each type, size & rating
1.6	Any other type valve	Minimum 1 no. each type, size & rating
2	Agitators	
2.1	Agitator assy of each type	1 complete set
3	LOW PRESSURE PIPING	
3.1	Valves all sizes (Population= All Units)	5% of the total population of each type, size and class OR minimum 2 nos. of each type size & class whichever is more
B	C&I SPARES	
1	Electronic Transmitter	
1.1	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.
2	Temperature elements	
2.1	Temperature Transmitter	2 Nos. of each type and model.
2.2	RTD's*	1 no. of each typ
2.3	Thermo well	1 no. of each type
	* (With head assembly, terminal block and nipple)	** (to be divided into various insertion lengths in proportion to
3	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items	
3.1	Temperature gauges	1 no. of each range and type
3.2	Pressure gauges	1 no. of each range and type
3.3	Differential Pressure Gauges,	1 no. of each range and type
3.4	Level gauges	1 no. of each range and type
3.5	Flow gauges excluding Rota meters	1 no. of each range and type
3.6	All types of Rota meters	1 no. of each range

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4	Process Actuated Switch Devices -As applicable for this package, as per the following items	
4.1	Temperature switches	1 no. of each range and type
4.2	Pressure switches	1 no. of each range and type
4.3	Differential Pressure switches	1 no. of each range and type
4.4	level switches	1 no. of each range and type
4.5	Flow switches	1 no. of each range and type
5	Solenoid Valves	2 nos. of each type, model and rating.
6	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type

Note:

- I. If any item as listed above under mandatory spare list is not applicable, then bidder to supply its equivalent spares.
- II. If any item which is considered as not applicable by bidder and if the same is found to be applicable during detailed engineering, bidder to supply the same without any cost implication.

Notes:

1. Wherever quantity has been specified percentage (%) the quantity of mandatory spares to be provided by the bidder shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. In case the quantity so calculated happens to be fraction, the same should be rounded off to next higher whole number.
2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all items supplied and installed and the breakup for these shall be furnished in the bid.
3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.
4. Interchangeability and Packings:
 All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares shall include all mounted accessories like components, boards, add or items, fittings, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require additional item. All electronic modules should be preset and/or preprogrammed for ready use at site.
 Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/ROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre-setting/ re programming before putting them in to service. The spare shall be treated and properly packed for long term storage.
5. 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.
6. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.
7. 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.
8. Identification:
 Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

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TREATMENT PLANT**

SECTION -I

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PROCESS FLOW DIAGRAM & SCHEMATIC FOR SEWAGE SUMPS



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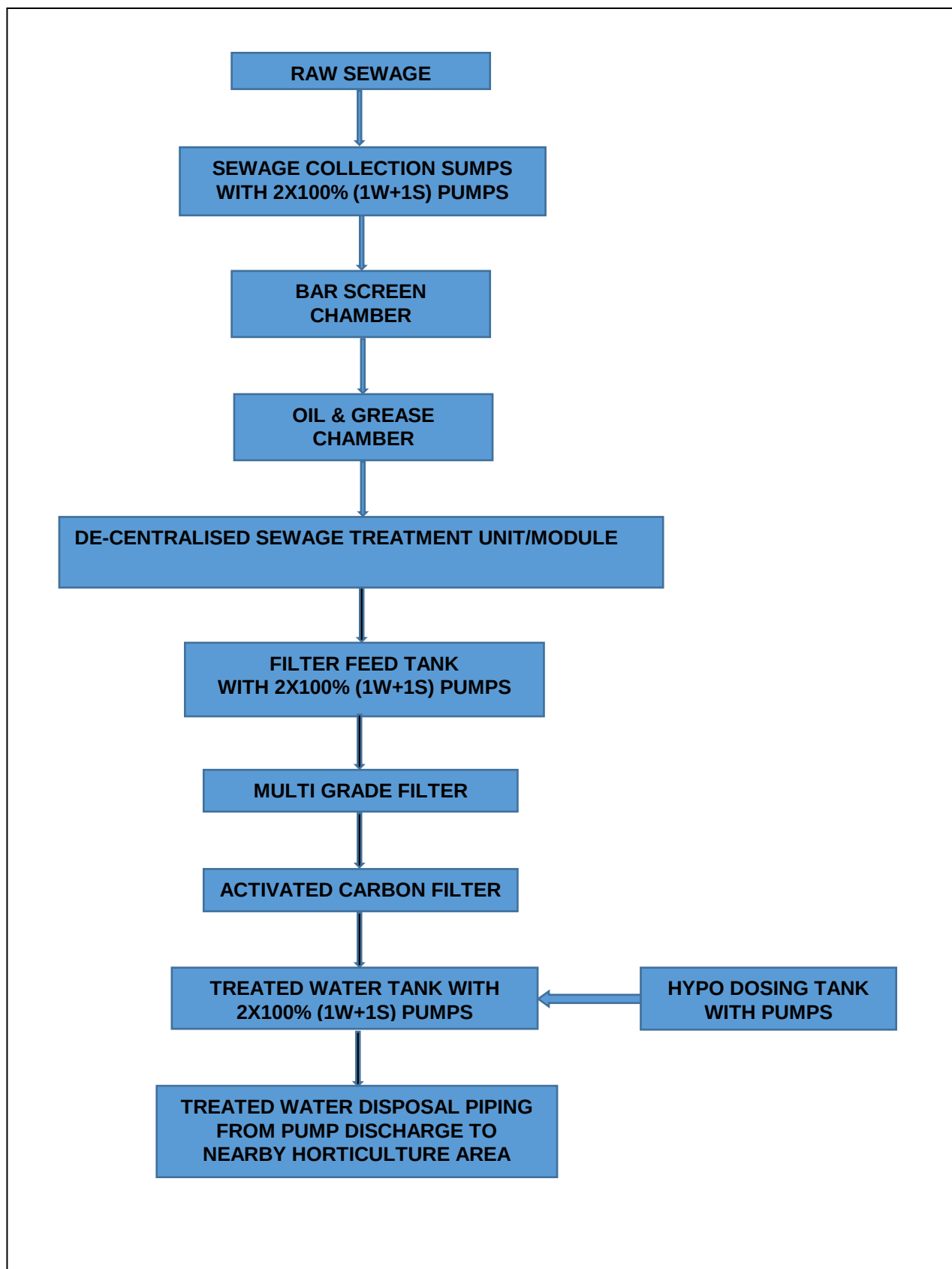
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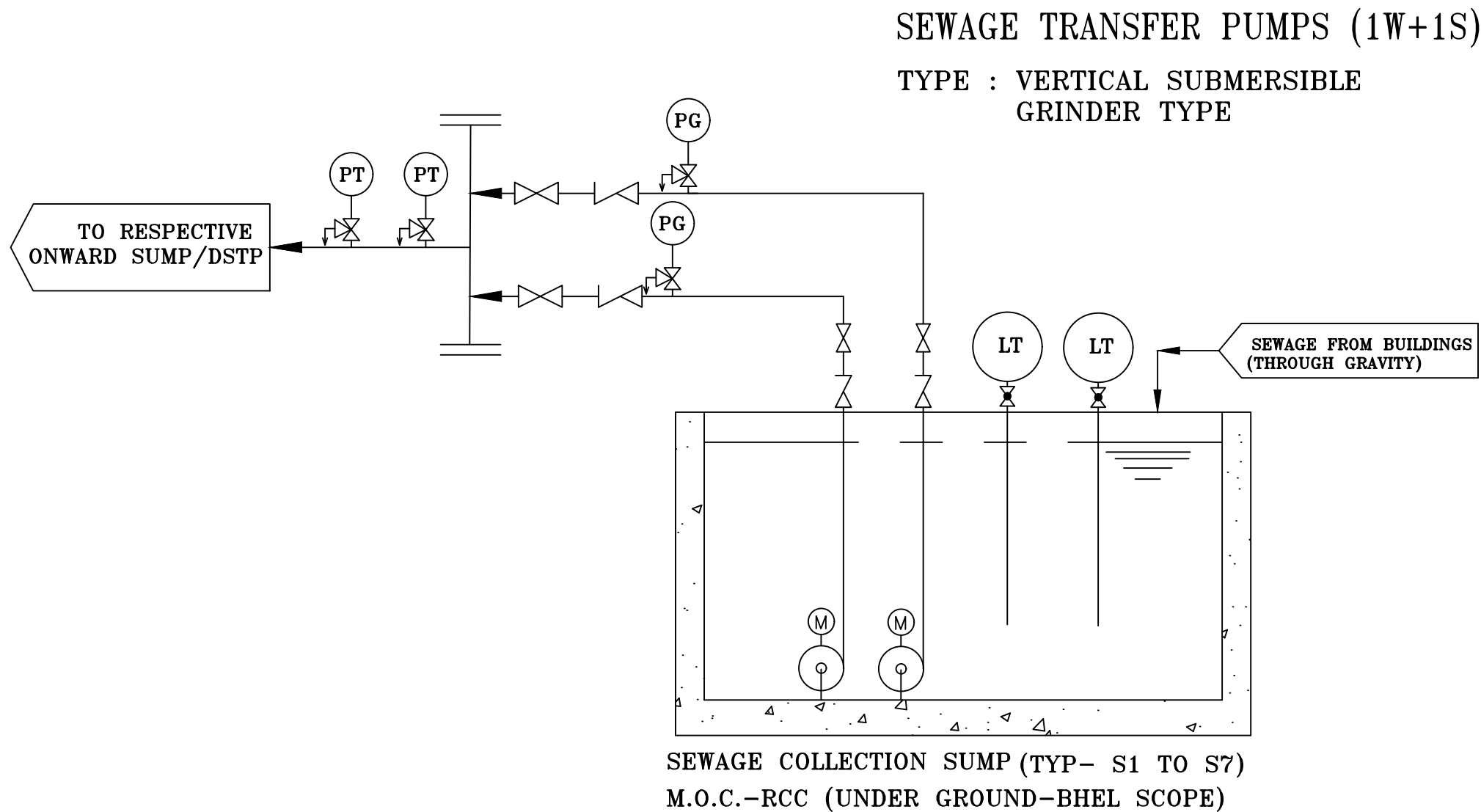
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PROCESS FLOW BLOCK DIAGRAM (FOR EACH PACKAGED TYPE DE-CENTRALISED STP)





MSCHEMATIC FOR SEWAGE SUMPS (TYPICAL)

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DATASHEET-A FOR STP

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DATASHEET-A FOR STP

S.No.	DESCRIPTION	
1.0	Total Capacity of 3-STPs	80 m ³ /day (Minimum) (Location as per PLOT PLAN)
1.1	Capacity of STP-1	15 m ³ /day (Minimum)
1.2	Capacity of STP-2	35 m ³ /day (Minimum)
1.3	Capacity of STP-3	30 m ³ /day (Minimum)
2.0	Bar Screen Chamber	
2.1	Chamber	
2.1.1	Quantity	3 Nos. (1W with each Packaged STP Module)
2.1.2	MOC	RCC (Civil by BHEL)
2.1.3	Type	Below ground /above ground
2.1.4	Capacity	As per system requirement
2.2	Bar Screen	
2.2.1	Quantity	3 Nos. (1W with each Packaged STP Module)
2.2.2	MOC	SS316
2.2.3	Type	Below ground /above ground
2.2.4	Capacity	As per system requirement
3.0	Oil & Grease chamber	
3.1	Quantity	3 Nos. ((1W with each Packaged STP Module) If required, 3-Nos.oil skimmer shall be provided (1W with each Packaged STP Module)
3.2	Oil & grease chamber MOC	RCC (Civil by BHEL)
3.3	Oil & grease chamber capacity	As per process requirement
4.0	Oil & Grease Trap	
4.1	Numbers Required	3 Nos. (1W with each Packaged STP Module)
4.2	Flow (m ³ /hr)	As per process requirement
4.3	MOC	RCC with baffle arrangements
4.4	Perforated pipe MOC	CPVC/CS
5.0	DE-CENTRALISED STP MODULES/SKIDS	
5.1	Capacity	(a) 15 m ³ /day (Minimum) For De-centralised STP-1 (b) 35 m ³ /day (Minimum) For De-centralised STP-2 (c) 30 m ³ /day (Minimum) For De-centralised STP-3
5.2	MOC	As per system requirement
6.0	Sludge recirculation pump	
6.1	Option -I	
6.1.1	Type	Submersible type
6.1.2	Quantity	6 Nos. (2 Nos.=1W+1S for each STP)
6.1.3	Suction condition	Flooded.
6.1.4	Capacity	As per process requirement
6.1.5	Head	As per process requirement
6.1.6	MOC	
	• MOC casing	Cast Iron
	• MOC impeller	Stainless Steel AISI 304
	• MOC shaft	SS 410
6.1.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
6.2	Option -II	
6.2.1	Type	Horizontal Centrifugal type
6.2.2	Quantity	6 Nos. (2 Nos.=1W+1S for each STP), all connected.
6.2.3	Suction condition	Flooded.
6.2.4	Capacity	As per process requirement
6.2.5	Head	As per process requirement
6.2.6	MOC	
	• Casing	Cast Iron IS:210 Gr FG 260
	• Impeller	Stainless steel CF 8M
	• Shaft & Shaft sleeve material	Stainless steel SS Gr. 304 & SS316

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**2X660 MW TALCHER THERMAL POWER
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VOLUME II-B

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -I

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	• Packing seal	Mechanical type
	• Common base plate	Carbon steel IS:2062
6.2.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
7.0	Air Blowers for sewage treatment skid	
7.1	Numbers Required	6 Nos. (2 Nos.=1W+1S for each STP)
7.2	Type of Blower	Twin lobe type
7.3	Flow	As per process requirement
7.4	Head	As per process requirement
7.5	MOC	CI to IS 210 Gr. FG 260
7.6	Accessories	NRV, Pressure Gauge, Safety valves, Silencer, PRV, Filter, etc
7.7	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS: 12615
7.8	Common Base plate/ mounting plate	MS as per IS 2062
8.0	Filter Feed Tank	
8.1	Numbers Required	Three (3) Nos (1W with each Packaged STP Module) and shall be in bidder's scope
8.2	Effective Capacity	6 hrs storage
8.3	MOC	As per supplier's recommendation
9.0	Hypo Dosing System	
9.1	Hypo Dosing Tank	
9.1.1	Numbers Required	Three (3) Nos (1W with each Packaged STP Module)
9.1.2	Effective Capacity	100 liters OR+ 24-hour storage requirement @ suitable dosing rate whichever is higher
9.1.3	MOC	FRP/HDPE/GRP
9.2	Hypo Dosing Pump for treated water tank	
9.2.1	Quantity	6 Nos. (2 Nos.=1W+1S for each Packaged STP Module).
9.2.2	Capacity	As per process requirement.
9.2.3	Type	Electronic dosing pump with auto stroke controller
9.2.4	MOC	PP
10.0	Filter Feed Pumps	
10.1	Option -I	
10.1.1	Type	Submersible type
10.1.2	Quantity	6 Nos. (2 Nos.=1W+1S for each Packaged STP Module)
10.1.3	Suction condition	Flooded.
10.1.4	Capacity	As per process requirement
10.1.5	Head	As per process requirement
10.1.6	MOC	
	• MOC casing	Cast Iron
	• MOC impeller	Stainless Steel AISI 304
	• MOC shaft	SS 410
10.1.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
10.2	Option -II	
10.2.1	Type	Horizontal Centrifugal type
10.2.2	Quantity	6 Nos. (2 Nos.=1W+1S for each packaged STP Module), all connected.
10.2.3	Suction condition	Flooded.
10.2.4	Capacity	As per process requirement
10.2.5	Head	As per process requirement
10.2.6	MOC	
	• Casing	Cast Iron IS:210 Gr FG 260
	• Impeller	Stainless steel CF 8M
	• Shaft & Shaft sleeve material	Stainless steel SS Gr. 304 & SS316
	• Packing seal	Mechanical type
	• Common base plate	Carbon steel IS:2062

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**TECHNICAL SPECIFICATION FOR SEWAGE
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10.2.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
11.0	Multi Grade Filter	
11.1	Quantity	Three (3) Nos (1 with each Packaged STP Module)
11.2	Capacity	As per system requirement
11.3	Design pressure	Shut off head of Filter feed pump + 5% margin
11.4	MOC	As per supplier's recommendation
11.5	Media	To suit system requirement
12.0	Activated Carbon Filter	
12.1	Quantity	Three (3) Nos (1 with each Packaged STP Module)
12.2	Capacity	As per system requirement
12.3	Design pressure	Shut off head of Filter feed pump + 5% margin
12.4	MOC	As per supplier's recommendation
12.5	Media	Activated Carbon
13.0	Treated Water Tank	
13.1	Number required	Three (3) Nos (1 with each Packaged STP Module) and shall be in bidder's scope
13.2	Capacity	6hrs storage
13.3	MOC of tank	As per supplier's recommendation
14.0	Treated Water Disposal Pumps	
14.1	Option -I	
14.1.1	Type	Submersible type
14.1.2	Quantity	6 Nos. (2 Nos.=1W+1S for each STP),
14.1.3	Suction condition	Flooded.
14.1.4	Capacity	1.5 m ³ /h (Minimum) For De-centralised STP-1 3.5 m ³ /h (Minimum) For De-centralised STP-2 3.0 m ³ /h (Minimum) For De-centralised STP-3
14.1.5	Head	25 mWC (Minimum)
14.1.6	MOC	
	• MOC casing	Cast Iron
	• MOC impeller	Stainless Steel AISI 304
	• MOC shaft	SS 410
14.1.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
14.2	Option -II	
14.2.1	Type	Horizontal Centrifugal type
14.2.2	Quantity	6 Nos. (2 Nos.=1W+1S for each STP), all connected.
14.2.3	Suction condition	Flooded.
14.2.4	Capacity	1.5 m ³ /h (Minimum) For De-centralised STP-1 3.5 m ³ /h (Minimum) For De-centralised STP-2 3.0 m ³ /h (Minimum) For De-centralised STP-3
14.2.5	Head	25 mWC (Minimum)
14.2.6	MOC	
	• Casing	Cast Iron IS:210 Gr FG 260
	• Impeller	Stainless steel CF 8M
	• Shaft & Shaft sleeve material	Stainless steel SS Gr. 304 & SS316
	• Packing seal	Mechanical type
	• Common base plate	Carbon steel IS:2062
14.2.7	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS: 12615
15.0	Sewage Sumps (Outside STP Area)	
15.1	No of Sewage sumps	7 (S1 to S7, for locations refer Plot Plan)
15.2	MOC	RCC (Civil by BHEL)
15.3	Type	Covered at top, below ground
15.4	Accessories	Coarse bar screen (MOC: SS-316) at sumps (S1 to S7)
16.0	Sewage Transfer Pumps (Outside STP Area- at Sewage Sumps- S1 to S7)	

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16.1	Type	Vertical submersible grinder type
16.2	Quantity per sump	2 Nos. (2x100% (1W+1S) for each Sewage sump
16.3	Capacity	To suit system requirement
16.4	MOC casing	Cast Iron to IS 210 FG 260 / CS ASTM A-216 Gr. WCB
16.5	MOC impeller	Stainless Steel AISI 304
16.6	MOC shaft	SS 410
16.7	Drive Motor	Induction motor, 415V, 3 Φ , 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
17.0	MATERIAL OF CONSTRUCTION OF PIPING AND FITTINGS	
17.1	MOC of Piping and fittings of handling sewage and treated sewage	HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.
17.2	MOC of Piping and fittings of Chemical dosing	CPVC as per ASTM F441 CPVC 4120 Schedule 80/equivalent.
17.3	MOC of service water piping	IS-2062 Gr.-E-250B/ ASTM A-36/ASTM A-53 type 'E' Gr. B/ IS-3589 Gr. 410 /IS-1239 Heavy.
17.4	MOC of compressed air piping (non-submerged)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent
17.5	MOC of compressed air piping (submerged)	CPVC as per ASTM F441 CPVC 4120 Schedule 80/ equivalent.
18.0	Material of Construction valves	
18.1	MOC of valves (sewage water, treated water and chemical dosing)	CPVC as per ASTM F441 CPVC 4120 Schedule 80/ equivalent.
18.2	MOC of compressed air valves	Cast iron for sizes 65NB and above; gunmetal for sizes 50 NB and below.
18.3	MOC of service water	Cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.
19.0	Chain Pulley Block	
19.1	Quantity	5 Nos. Chain Pulley Blocks of adequate capacity with tripod arrangement, to meet maintenance requirements are to be provided by bidder
19.2	Specification	Chain Pulley block shall be designed to duty class 2 as per IS 3832.

PUMPS AND PIPE SELECTION CRITERIA

Pump and Pipeline carrying water and chemicals etc. shall generally be sized on the following velocities. However wherever minimum pipe sizes are defined in the drawing/datasheets, the selected size shall not be less than the specified size.

	VELOCITY IN m/sec.		
	BELOW 50 MM.	50-150 MM	200 MM AND ABOVE
Pump Suction for water	-----	1.2-1.5	1.2-1.8
Pump discharge for water	1.2-1.8	1.8-2.4	2.1-2.5
Header for water	-----	1.5-2.4	2.1-2.4
Pump Suction for chemical solution	1.0-1.2	1.1-1.3	-----
Pump discharge for chemical solution	1.2-1.4	1.3-1.5	-----
Gravity flows	Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.		

Note 1- All piping system shall be capable of withstanding the maximum pressure in the corresponding line.

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	33559/2023/2023001 E:	This page is part of tech. spec. PE-TS-497-673-A001	SPECIFICATION NO. PE-TS-497-673-A001	
			VOLUME II-B	
	2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		
		SECTION -I	SUB SECTION -IA	
	REV. NO. 00	DATE :		

Note 2- TDH of all pumps shall be decided by the supplier assuming the following 'C' values in Hazen & Williams equation for calculation of friction loss.

- a) Carbon steel pipes – 100
- b) CI Pipes/ Ductile Iron pipes –100
- c) Rubber lined steel pipe – 120
- d) CPVC/ HDPE pipes – 140
- e) Stainless steel pipes -100

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

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TITLE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

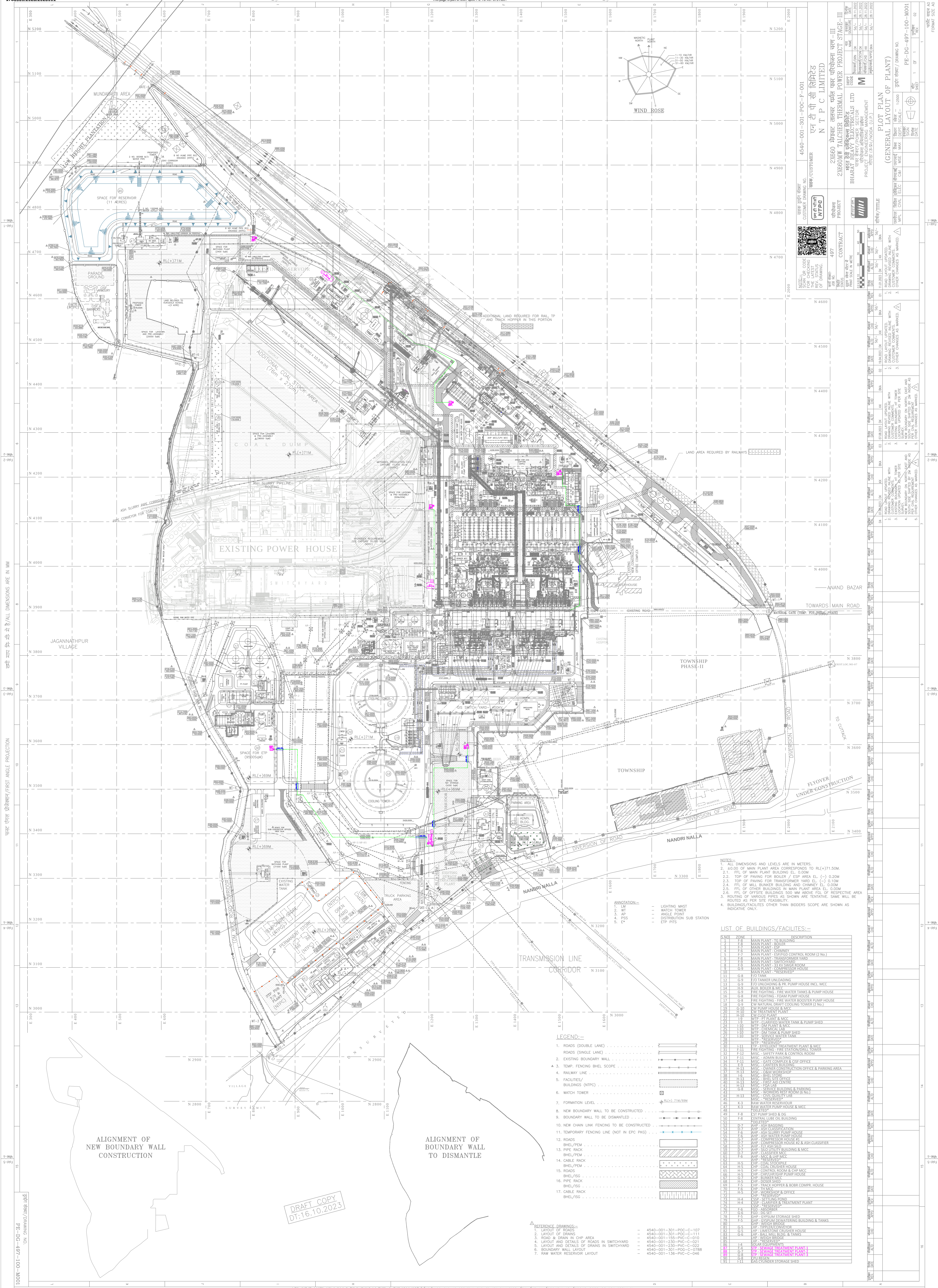
SECTION -I

SUB SECTION -IA

REV. NO. 00

DATE :

PLOT PLAN



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TITLE:

This page is part of tech. spec. PE-TS-497-673-A001



**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR
SEWAGE TREATMENT PLANT**

SECTION -I

SUB SECTION -IB

REV. NO. 00

DATE :

SUBSECTION-IB

TECHNICAL SPECIFICATIONS (ELECTRICAL PORTION)

	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT (ELECTRICAL PORTION)	SPECIFICATION NO. PE-TS-497-506-A001 VOLUME II B REV 0 DATE 17.10.2023 PAGE 1 OF 1
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SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I [Scope of Work (Electrical)].
- 1.2 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.

2.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 2.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated.
- 2.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

3.0 LIST OF ENCLOSURES

- 3.1 Electrical scope between BHEL & vendor (Annexure-I).
- 3.2 Motor Datasheet
- 3.3 Quality Plan for motors.
- 3.4 Load data format (Annexure-II).
- 3.5 Explanatory note for Cable routing & Cable schedule format.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES: STP****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 2 X 660 MW TALCHER TPP STAGE-III (EPC)**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
5	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm galvanized cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
6	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
7	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
8	Lighting	BHEL	BHEL	
9	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Any other equipment/ material/ service required for	Vendor	Vendor	

REV-00, DATE: 17.10.2023

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES: STP****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 2 X 660 MW TALCHER TPP STAGE-III (EPC)**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
	completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).			

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract without any commercial implications.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.
5. Electrical Equipment & cable tray layout drawings shall be in the scope of bidder.
6. Input cable schedules / Cable interconnection details / Cable block diagram for Control & Screened Control Cables shall be in the scope of bidder.

TECHNICAL DATASHEET

S.No.	Parameters	Requirement
1	Applicable Standards	1) Three phase induction motors : IS:325, IEC:60034, IS:12615, IS: 15999 2) Single phase AC motors : IS:996, IEC:60034 3) Energy Efficient motors : IS 12615, IEC:60034-30
2	Rated voltage	415V, 3 Phase
3	Frequency (Hz)	50Hz
4	Permissible variations for	
	a) Voltage	+/-10%
	b) Frequency	+3% & -5%
	c) Combined	10% (Sum of absolute values)
	System fault level at rated voltage	50KA for 1 sec
	Short time rating for terminal boxes	50KA for .25 sec
5	Type of motors	Continuous duty squirrel cage induction motor suitable for direct-on-line starting
6	Efficiency class	IE3 Class confirming to IS 12615 or IEC:60034-30
7	Design margin over continuous max. demand of the driven equipment (min)	10%
8	Starting requirement	
	a) Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	(a) Below 110KW : Up to 85% of rated voltage (b) From 110 KW & upto 200 KW : Up to 80% of rated voltage
	b) Maximum locked rotor current	as per IS 12615
	c) Starting duty	Two hot starts in succession, with motor initially at normal running temperature.
	d) the locked rotor withstand time under hot condition at highest voltage limit	a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting b) atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting d) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
	e)The ratio of locked rotor KVA at rated voltage to rated KW	(a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0
9	Torque (percent of full load torque)	1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
10	Noise level (max.)	85dB(A)
11	Vibration shall be limited within the limits	as per IS:12075 / IEC 60034-14
12	Construction Features	
(i)	Enclosure Details	
	a) Degree of protection	i) Indoor motors - IP 55 ii) Outdoor motors - IP 55 (Additional Canopy to be provided)
	b) Method of ventilation	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
(ii)	Insulation	Class F temperature rise limited to class -B
(iii)	Bearings	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined trust and guide bearing for Vertical motors
(iv)	Winding Type	Electrolytic grade Copper conductor, Non hygroscopic, oil resistant, flame resistant Insulation.
13	Main terminal box	
(i)	Type	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
(ii)	DOP	same as motor
(iii)	Position when viewed from the non driving end	- Left hand side
(iv)	Rotation	90 Deg.
(v)	Space heater	Motors rated 30KW and above space heater required. Separate terminal box for space heaters & RTDs shall be provided.

(vi)	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. Cable glands shall conform to BS:6121. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.
(vii)	DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS:	
	Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
	a) UP to 3 KW	As per manufacturer's practice.
	b) Above 3 KW - upto 7 KW	85
	c) Above 7 KW - upto 13 KW	115
	d) Above 13 KW - upto 24 KW	167
	e) Above 24 KW - upto 37 KW	196
	f) Above 37 KW - upto 55 KW	249
	g) Above 55 KW - upto 90 KW	277
	h) Above 90 KW - upto 125 KW	331
	i) Above 125 KW-upto 200 KW	203
	j) For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.	
(viii)	PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:	
	NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:	
	Motor MCR in KW	Clearance
	a) UP to 110 KW	10mm
	b) Above 110 KW and upto 150 KW	12.5mm
	c) Above 150 KW	19mm
14	Earthing points (2 nos. on diagonally opposite sides) suitable for connection	GS Flat- 50 x 6 OR 25 X 6 OR 25 X 3
15	Paint shade	RAL 5012 (Blue)/Light grey finish No. 631 as per IS: 5 (subject to customer approval)
16	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED	
	a) The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only	
	1. Measurement of resistance of windings of stator and wound rotor.	
	2. No load test at rated voltage to determine input current power and speed	
	3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)	
	4. Full load test to determine efficiency power factor and slip	
	5. Temperature rise test	
	6. Momentary excess torque test.	
	7. High voltage test	
	8. Test for vibration severity of motor.	
	9. Test for noise levels of motor(Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.)	
	10. Test for degree of protection and	
	11. Overspeed test.	
	12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1	
	b) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.	
	c) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.	

DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER ORDERING

1. GENERAL		
i)	Manufacturer & Country of origin.	
ii)	Equipment driven by motor)	
iii)	Motor type	
iv)	Country of origin	
v)	Quantity	
2. DESIGN AND PERFORMANCE DATA		
i)	Frame size	
ii)	Type of duty	
iii)	Type of enclosure and method of cooling	
vi)	Type of mounting	
vii)	Direction of rotation as viewed from DE END	
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	(B) Rating as specified in load list/Maximum continuous load demand of driven equipment	
xi)	Rated speed at rated voltage and frequency	
xii)	At rated Voltage and frequency	
	a) Full load current (Amps)	
	b) No load current (Amps)	
xiii)	Power Factor at	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
	e) NO load	
	f) Starting.	
xiv)	Efficiency at rated voltage and frequency	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
xv)	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
xvi)	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
xvii)	Safe stall time with 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
xviii)	Torques :	
	a. Starting torque at min. permissible voltage(kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e. Rated torque (kg.m)	
xix)	Stator winding resistance per phase (ohms at 20 Deg.C.)	
xx)	GD ² value of motors	
xxi)	Locked rotor KVA input (at rated voltage)	
xxii)	Locked rotor KVA/KW.	
xxiii)	Bearings	
	a. Type	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended Lubricants	
	e. Guaranteed Life in Hours	
	f. Whether Dial Type thermometer provided	
	g. Oil pressure Gauge/switch	
	i. Range	
	ii. Contact Nos. & ratings	
	iii. Accuracy	
xxiv)	Vibration	
	a) Velocity (mm/s)	
	b) Displacement (microns)	
xxv)	Noise level (DB)	
3. CONSTRUCTIONAL FEATURES		
i)	Stator winding insulation	
	a. Class & Type	
	b. Tropicalised (Yes/No)	
	c. Temperature rise over specified max.	

	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	d. Method of temperature measurement	
	e. Stator winding connection	
	f. Number of terminals brought out	
ii)	Type of terminal box for	
	a. stator leads	
	b. space heater	
	c. Temperature detectors	
	d. Instrument switch etc.	
iii)	For main terminal box	
	a. Location	
	b. Entry of cables	
	c. Recommended cable size	
	d. Fault level (MVA)	
	e. No. of Eathing Pads	
iv)	Temperature detector for stator winding	
	a Type	
	b. Nos. provided	
	c. Location	
	d. Make	
	e. Resistance value at 0 deg. C. (ohms)	
vi)	Paint shade	
vii)	Weight of(approx)	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
4. LIST OF CURVES		
i)	Torque speed characteristic of the motor	
ii)	Thermal withstand characteristic	
iii)	Starting. current Vs. Time	
iv)	Starting. current Vs speed	
v)	P.F. and Effi. Vs Load	

NOTE :

1. THESE DETAILS ARE IN ADDITION TO THE DETAILS MENTIONED IN SHEET- 1 & 2 OF DATASHEET. SHEET - 3 & 4 SHOULD BE READ IN CONJUNCTION TO SHEET - 1 & 2
2. DURING CONTRACT STAGE : SUCCESSFUL BIDDER TO STAMP & SIGN SHEET - 1 & 2 OF DATASHEET, AND APPEND DULY FILLED UP STAMPED & SIGNED SHEET -3 & 4 OF DATASHEET FOR BHEL/CUSTOMER'S APPROVAL.

ENDORSEMENT SHEET FOR QP
REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / ~~SQP~~/~~RFQP~~/~~SFQP~~)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION



To be filled in by NTPC

PROJECT NAME		<u>REVIEW & ENDORSEMENT BY NTPC PROJECT SPECIFIC QP NUMBER ALLOTTED</u> QP NO.: 9915-371-110-PEM-QVE-Q-160 REV. NO.: 00 DATE: 03.12.2021 ** The RQP/SQP/RFQP/SFQP once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
CONTRACT NO.:	9915	
MAIN SUPPLIER	BHARAT HEAVY ELECTRICAL LIMITED	
MANUFACTURER WORKS & ADDRESS		
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.	MOTOR FOR CONDENSATE TRANSFER PUMP – 55 KW / 4 PL HORIZONTAL (2 NOS.)	
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	000-999-QVE-P-44 REV-04 DTD 20 – 06 - 2012	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		(TICK APPLICABLE)
√I. That the item/ component is identical to that considered for QP approval. OR.		The QP is endorsed for this project without any change ✓
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. OR		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		The QP is endorsed for this project with changes as indicated. <u>DISTRIBUTION OF ENDORSEMENT OF</u> A) RQP/SQP: 1. MAIN SUPPLIER (WITH A COPY OF QP) 2. MANUFACTURER 3. RIO 4. CQA-SPL 5. CQA-O/C B) RFQP/SFQP: 1. MAIN SUPPLIER (with a copy of QP) 2. MANUFACTURER 3. NTPC FQA (with a copy of QP) 4. NTPC Erection (with a copy of QP) 5. CQA-SPL 6. CQA-O/C

Mohit
Kumar

Digitally signed by Mohit Kumar
DN: cn=Mohit Kumar, o=PEM,
ou=BHEL, email=mohitk@bhel.in
c=IN
Date: 2021.12.03.12:02:02 +05'30'

RITESH KUMAR
JAISWAL

Digitally signed by RITESH KUMAR JAISWAL
DN: c=IN, o=BHARAT HEAVY ELECTRICALS LIMITED, ou=POWER
SECTOR-PROJECT ENGINEERING MANAGEMENT (PS-PEM),
postalCode=201301, st=UTTAR PRADESH,
25.4.20-16692281523b76468e185cd0bb18977532609b5
349e8d7191a9e51174,
serialNumber=FA07E4CDDC3570BD21343A2A76385AD6F1F58E
D,
serialNumber=8CFA4DF00184875A8B03A1B000E93FF205304F
62C65E6D5F09980E099C4A8, cn=RITESH KUMAR JAISWAL
Date: 2024.12.13 12:40:16 +0530

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REFERENCE QUALITY PLAN				To be filled in by NTPC										
Item /equipment :		QP No.: NTPC-RQP 1	SIGN OF MANUFACTURER		QP No.: 0000-999- QVE-P-044									
LT INDUCTION MOTORS (50KW TO 200 KW)		Rev. No.: '4' Date:- PAGE : Page 1 of 5	MIQ		Reviewed by: V SHRIVASTAVA RAJIV GARG P K BASU									
sub-system :		Valid upto:19-06-15												
Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks	
1	2	3	4	5	M C/N	6	7	8	9	D*	M	C	N	10
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
1	COPPER WIRE dual coated enameled round copper wire	1.Dimension 2.Elongation 3.Mandrel Winding Test 4.Peel Test 5.BD Voltage Test 6.Cut Through Test 7.Heat Shock Test 8.Resistance 9.Springiness 10.Abrasion Test 11.Continuity Test 12.Tan Delta bending Point test	MA MA MA MA CR MA MA MA MA MA MI MA	Measurement Mechanical Visual Test Electrical Electrical Test Electrical Mechanical Performance Electrical Thermal	1 Sample / lot -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- Each supplier once a month	1 Sample/lot -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- -do-	MSA-091-02-R0 -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- -do-	MSA-091-02R0 -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- -do-	Inspn. Record -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- -do-		P P P P P P P P P P P V	V V V V V V V V V V V V	- - - - - - - - - - - V	
2	STEEL SHAFT Straightened steel bar in black finish	1.Dimension – OD 2.Hardness 3.Chemical comp. 4.Tensile strength 5.Yield strength 6.% Elongation 7.Ultrasonic test 8.Metallographic test 9 Normalizing	MA MA MI MA MA MA MA MA MA	Measurement Measurement Chemical Mechanical Mechanical Mechanical Mechanical Chemical Mechanical	1 Sample/lot/heat 1 Sample/lot/heat 1 Sample/lot/heat 1 Sample/lot/heat 1 Sample/lot/heat 1 Sample/lot/heat 100% 1 Sample/lot/heat 100%	-do- -do- -do- -do- -do- -do- -do- -do- -do-	MSA-072-01R0 -do- -do- -do- -do- -do- -do- -do- -do-	MSA-072-01R0 -do- -do- -do- -do- -do- -do- -do- -do-	Supp. TC -do- -do- -do- -do- -do- -do- -do- -do-	√ √ √ √ √ √ √ √ √	V V V V V V V V V	V V V V V V V V V	- - - - - - - - V	
3	AL INGOTS EC GRADE PURITY 99.5%	Chem. Comp.	MA		1 Sample/Lot	-	IS4026:1992	IS4026:1992	Supp. TC		V	-	-	
LEGENDS: * RECORDS IDENTIFIED WITH * TICK * SHOULD BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION M: MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM, W: WITNESS, V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'														
Note: # NTPC inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection														

Format No.: QS-01-QAL-P-10/F1-r1

Engg. Div./QA&I

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				REFERENCE QUALITY PLAN			To be filled in by NTPC				
				Item /equipment :	QP No.: NTPC-RQP 1	SIGN OF MANUFACTURER	QP No.: 0000-999-QVE-P-044	Reviewed by:			
				LT INDUCTION MOTORS (50KW TO 200 KW)	Rev. No.: '4'	MIQ	Rev. No.: 4	V SHRIVASTAV			
				sub-system :	Date:-		Date :-20-6-12	RAJIV GARG			
					PAGE : Page 2 of 5			P K BASU			
							Valid upto:19-06-15				
Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks	
1	2	3	4	5	M C/N	7	8	9	D* M C N	11	
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT											
4	CI CASTING (Body, End Shields, T.Box, Bearing Covers)	1.Surface defects 2.Dimn. Conformity 3.Hardness 4.Tensile strength 5.Chemical comp.	MA MA MA MA MA	Visual Measurement Mechanical Verification Verification	100% 1 Sample / heat 1 Sample / lot -do- -do-	100% - 1 Sample / lot -do- -do-	MSA-02-01 Comp. Drg. IS 210:1993 -do- -do-	No defect Comp. Drg. IS 210:1993 -do- -do-	Inspn. Rec -do- Supp. TC -do- -do-	P V - P V - V V - V V - V V -	
5	ALUMINUM FAN	1.Dimension 2.Protective paint	MA MA	Measurement Visual	1Sample/size/lot -do-	- -	Fan Drg. -do-	Fan Drg. -do-	Inspn Rec. -do-	P - P -	
6	VARNISH & THINNER	1.Viscosity 2.Shelf life	MA MA	Ford cup Verification	1 Sample/ lot -do-	- -	MFGR's Catalogue	MFGR's Catalogue	Inspn. Rec. Label	v - v -	
7	Bearing	ID / OD / WIDTH	MA	Measurement	1 Sample / lot	-	MFGR's Catalogue	MFGR's Catalogue	Inspn. Rec.	√ V -	Surveillance verification By NTPC
8	BRAZING ALLOYS	Chemical comp.	MA	Chemical	1 Sample / lot	-	MSA-203-01R0	MSA-203-01R0	-do-	V -	
9	TERMINAL BLOCK (DMC)	1.Dimension 2.Chem. Comp. 3.Comparative Tracking Index	MA MA MA	Measurement Chemical Electrical	1 Sample / lot -do- -do-	- 1 Sample / lot -	As per drg -do- MSA-086-01	As per drg -do- MSA-086-01	Supp. TC -do-	P - V - V V -	
10	PAINT	Viscosity at 32 Deg C	MA	Measurement	-do-	-	MFGR's Catalogue	MFGR's Catalogue	Inspn. Record	P -	
11	SPACE HEATER	1.IR value & HV 2.Resistance	MA MA	Electrical -do-	100% 100%	1sample/Rating/lot -do-	MSA-023-01R0 -do-	MSA-023-02R0 -do-	Inspn Report -do-	P - P -	
12	STAMPINGS	1.Thickness 2.Waviness 3.Burr height 4.Coating Thickness 5.Permeability 6.Specific core loss 7.IR	MA MA MA MA MA MA MA	Measurement Visual Measurement Mechanical Electrical Electrical Electrical	1 Sample / lot -do- -do- -do- -do- -do- -do-	-do- -do- -do- -do- -do- -do- -do-	Stamping.drg. MSA-060-01R0 -do- -do- -do- -do- -do-	Comp. drg. MSA-060-01R0 -do- -do- -do- -do- -do-	Supp.TC -do- -do- -do- -do- -do- -do-	V V V V V V V V V V V V V V V V V V V V V	
LEGENDS * RECORDS IDENTIFIED WITH "TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION						Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection					
MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC, P: PERFORM, W: WITNESS, V: VERIFICATION.											
AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'											

Format No.: QS-01-QAI-P-10/F1-r1

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				REFERENCE QUALITY PLAN			To be filled in by NTPC							
Item /equipment :				QP No.: NTPC-RQP 1	SIGN OF MANUFACTURER	QP No.: 0000-999-QVE-P-044	Reviewed by:	Approved By:						
LT INDUCTION MOTORS (50KW TO 200 KW)				Rev. No.: '4'	MIQ	Rev. No.: 4	V SHRIVASTAVA	AK GARG						
sub-system :				Date:-		Date :-20-6-12	RAJIV GARG	अनुमोदित						
						Valid upto:19-06-15								
Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check		Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks
					M	C/N				D*	M	C	N	
13	STATOR CORE PACK	1.Dimn. Conformity (core length. & Dia.) 2.Alignment of slot 3.Deburring and cleanliness	MA MA MA	Measurement Visual Visual	1 Sample / lot -do- -do-	-- -- --	MSA-060-02R0 -do- -do-	MSA-060-02R0 -do- -do-	Inspn. Report -do- -do-		P P P	-- -- --	-- -- --	
14	SLOT INSULATION (Class 'F')	1.Tensile Strength 2.Elongation at break 3.BDV as recd. & after ageing 4.IR Value	MA MA CR MA	Mechanical -do- Electrical Electrical	1 Sample/lot -do- -do- -do-	-- -- 1 Sample / lot --	MSA-088-09R0 -do- -do- -do-	MSA-088-09R0 -do- -do- -do-	Supp.TC -do- -do- -do-		V V V V	-- -- V --	-- -- -- --	
15	VARNISH FG SLEEVE (Class 'F')	1.Dimn. - Bore dia Thickness 2.BDV as recd. &after ageing 3.IR Value 4. Glass content conformity 5. Varnish compatibility 6. Bending before and after aging 7. Voltage proof test in air at room temp & at 150C 8. Stability of coating 9. Self extinguishing	MA CR MA MA MA MA MA MA MA	Measurement Electrical -do- Chemical Chemical Mechanical Electrical Chemical Chemical	1 Sample/lot -do- -do- 1 Sample/lot -do- -do- -do- -do- -do-	-- -- -- -- -- -- -- -- --	MSA-088-07R0 -do- -do- MSA-088-07R0 -do- -do- -do- -do- -do-	MSA-088-07R0 -do- -do- MSA-088-07R0 -do- -do- -do- -do- -do-	Supp.TC -do- -do- Supp. TC -do- -do- -do- -do- -do-		P P P V V V V V V	-- -- -- -- -- -- -- -- --	-- -- -- -- -- -- -- -- --	
16	GASKET	1.Shore hardness 2.Ageing test 3.Flame test 4.Neoprene conformity 5.Dimn.	MA MA MA MA MA	Mechanical Thermal Chemical Chemical Mechanical	1 Sample/lot -do- -do- -do- 1 Sample /lot	-- -- -- -do- --	MSA 162-01R0 -do- -do- -do- Gasket Drg	MSA 162-01R0 -do- -do- -do- Gasket Drg	Inspn Record Supp.TC -do- Inspn Record		P V V V P	-- -- V V --	-- -- V V --	

LEGENDS: * RECORDS IDENTIFIED WITH "TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE GHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note: # NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection

Format No.: QS-01-QAI-P-10/F1-r1

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REFERENCE QUALITY PLAN					To be filled in by NTPC						
Item /equipment :		QP No.: NTPC-RQP 1	SIGN OF MANUFACTURER	QP No.: 0000-999- QVE-P-044	Reviewed by: V SHRIVASTAVA	Approved By: AK GARG					
LT INDUCTION MOTORS (50KW TO 200 KW)		Rev. No.: '4' Date:- PAGE : Page 4 of 5	MIQ	Rev. No.: 4 Date :-20-6-12	RAJIV GARG P K BASU						
sub-system :		Valid upto:19-06-15									
Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum Of check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks	
1	2	3	4	5	M	C/N	8	9	D ² M C N	11	
1	IN PROCESS INSPN. : MACHINED CASTINGS (BODY, END SHIELDS, T.BOX, BEARING Covers	1.Dimn. 2.Concentricity/ Perpendicularity of machined surface 3.Blow holes 4 Pressure testing [4] (For Flameproof Motors only)	CR MA MA MA	Measurement Mechanical Visual Mechanical	100% 10% 100% 100%		Comp.Drg. -do- No blow hole MSA-02-02R0	Comp.Drg. -do- No blowhole MSA-02-02R0	Inspn Record -do- -do- Inspn Record	P P P P	No blow -holes on machined surface of castings & no welding on casting permitted
2	COIL FORMING	1. Conductor dia 2. No. of turns	MA MA	Measurement Visual	100% 100%	--	Winding MO. -do- -do-	Winding MO. -do- -do-	-do- -do- -do-	P P P	
3	WOUND STATOR	1.Resistance 2.HV Test 3.Interturn (Surge Test) 4.Polarity 5. Impregnation - VPI 6.Workmanship (joints, Slot Wedges, tightness & connections)	MA MA MA MA MA MA	Electrical -do- -do- -do- Mechanical Visual	100% -do- -do- -do- 100% 100%	-- -- -- -- 1/RATING/LOT --	-do- -do- -do- -do- SP05 -do-	-do- -do- -do- -do- SP05 -do-	-do- -do- -do- -do- Inspn. Record -do-	P P P P P P	
4	MACHINED SHAFT	1.Dimn.Conformity 2.Concentricity of Shaft 3.M/cing finish, radius, chamfer	CR MA MA	Mechanical -do- Visual	100% -do- -do-	-- -- --	Shaft Drg. -do- -do-	Shaft Drg. -do- -do-	Inspn. Record -do- -do-	P P P	
5	DIE CAST ROTOR	1. Core length 2.Free from blow-holes, cracks	MA MA	Measurement Visual	100% 100%	-- --	M.O. -do-	M.O. -do-	Inspn. Record -do-	P P	
6	MACHINED ROTOR	1.Dimn. - OD 2.Concentricity w.r.t Bearing seat	CR MA	Measurement Mechanical	100% 10%	1 Sample / lot -do-	-do- -do-	-do- -do-	Inspn. Record -do-	P P	
7	ROTOR	Dynamic balancing of Rotors at rated speed [4]	MA	Mechanical	100%	100 %	A18 R0 & TS A16 R1	ISO: 1940 Grade- G 2.5	Inspn. Record	√ P V V	
8	FAN	Fan Balancing	MA	Mechanical	100%	100%	TS-A19-R0	ISO: 1940 Grade -G2.5	Inspn.Record	√ P V V	
9	ASSEMBLED MOTOR	Name Plate data, T. box location, Flame path joint Gap for Flame proof motors [4]	MA MA	Visual Mechanical	100% 100%	1 Sample / lot 100%	TS: A20R5 IS2148	TS: A20 R5 IS2148	Inspn. Record Inspn. Record	P V V P V V	

LEGENDS: * RECORDS IDENTIFIED WITH * TICK * SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION

M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER N: NTPC P: PERFORM W: WITNESS V: VERIFICATION

AS APPROPRIATE CHP NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note: # NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection

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Sr. No.		ITEM	Characteristics	Class	Type of Check	Quantum of check		Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks
1		2	3	4	5	M	C/N	7	8	9	10				11
REFERENCE QUALITY PLAN Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system : QP No.: NTPC-RQP 1 Rev. No.: '4' Date:- PAGE : Page 5 of 5 SIGN OF MANUFACTURER MIQ QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 To be filled in by NTPC Reviewed by: V SHRIVASTAVA RAJIV GARG P K BASU Approved By: AK GARG Valid upto:19-06-15															
C.	FINAL INSPECTION: ROUTINE TEST	1. Marking on the Name Plate	MA	Visual	100%		100%	IS:325/ NTPC Specn/	IS:325/ NTPC Specn/	TC	√	P	W	W	
		2. a) Paint Shade	MA	Mechanical	-do-		-do-	Appd D/S,&Drg	Appd D/S,&Drg	TC	√	P	W	W	
		b) Paint Thickness (On casting surface)	MA	Mechanical	1 sample /Lot		1 sample /Lot	-do-	Min 100 microns	TC	√	P	W	W	
		c) Scratch Test	MA	Mechanical	-do-		-do-	-do-	No Peel-off						
		3.Location of T.Box.	MA	Visual	100%		100%	Appd D/S	Appd D/S	TC	√	P	W	W	
		4.IR test before & after HV on Main wdg. & Sp.Heater.	MA	Electrical	-do-		-do-	IS-325	IS-325	TC	√	P	W	W	
		5.HV on Main Wdg. & Space Heaters	MA	-do-	-do-		-do-	-do-	-do-	TC	√	P	W	W	
		6.Measurement of Wdg. Res.	MA	-do-	-do-		-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		7.No Load Test	MA	-do-	-do-		-do-	-do-	Appd D/S,&Drg	TC	√	P	W	W	
		8.Locked Rotor Test at reduced voltage	MA	-do-	-do-		-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		9.Reduced voltage running in both directions (1/3 Un)	MA	-do-	-do-		-do-	-do-	IS325	TC	√	P	W	W	
		10.Overspeed test (120% of rated speed) for 2 min.	MA	Mechanical	-do-		-do-	-do-	-do-	TC	√	P	W	W	
		11. Vibration Test at rated speed & voltage	MA	Mechanical	-do-		-do-	IS12075	IS12075	TC	√	P	W	W	
		12.Degree of Protection By insertion of 1 mm thick wire	MA	Mechanical	-do-		-do-	-do-	IS:325/IS:4029	TC	√	P	W	W	
		13.Mounting & overall dimension	MA	Measurement	-do-		1Sample/rating/Lot	-do-	As per D/S & Drg	TC	√	P	W	W	
D.	DISPATCH INSPECTIONS	Case Marking.	MA	Visual	100%		--	Manufacturing Order	Manufacturing Order	Manufacturing Order		P	-	-	

LEGENDS: * RECORDS IDENTIFIED WITH * TICK* ✓ SH/LL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION

MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC, P: PERFORM, W: WITNESS, V: VERIFICATION.

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** M: Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection

Format No.: QS-01-QAI-P-10/F1-r1

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[illegible]

NOTES:

1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V

(dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)



LOAD DATA (ELECTRICAL)

JOB NO.	497	ORIGINATING AGENCY		PEM (ELECTRICAL)	
PROJECT TITLE	2x660 MW, NTPC Talcher	NAME		DATA FILLED UP ON	
SYSTEM / S	CPU	SIGN.		DATA ENTERED ON	
DEPTT. / SECTION	128of 167	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

129 of 167

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
 (dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
 C = 3.3KV (Power cables)
 D = 1.1KV (LV & DC system power & control cables)
 E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
 T = TOUGH RUBBER SHEATH
 U = OVERALL SCREENED
 V = PAIRED OVERALL SCREENED (G-Type)
 W = PAIRED INDIVIDUAL SCREENED (F-type)
 Y = COMPENSATING CABLES
 I = PRE-FABRICATED CABLES
 Z = JELLY FILLED CABLES

6. Once a cable list has been given to PEM for routing, any subsequent changes required in the cable list (which may be in the form of addition of cables, deletion of cables, change of type or size of cable, etc.) must be informed as specific changes (as a separate file MS Excel of the same format as the original file) to the cable list given earlier if the cable list has been routed and cable schedule generated. The routing status of the cable list shall be got confirmed from PEM by the agency that has prepared the cable list before the changes are intimated. In case PEM confirms that the cable list in question has not been taken up for routing, and the revised cable list is acceptable, the same may be sent. Since cable routing through the program involves adding each cable list to the project cable schedule database, the original cable schedule shall not be furnished to PEM with revisions incorporated within.

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This page is part of tech. spec. PE-TS-497-673-A001



TITLE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR
SEWAGE TREATMENT PLANT**

SECTION -I

SUB SECTION -IC

REV. NO. 00

DATE :

SUBSECTION-IC

TECHNICAL SPECIFICATION (C&I PORTION)

1783539/2023/2023001

This page is part of tech. spec. PE-TS-497-673-A001

	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	
CONTROL AND INSTRUMENTATION FOR SEWAGE TREATMENT PLANT		

	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	
1. The overall control of Sewage Treatment Plant shall be DDCMIS based (BHEL's scope). Profibus based controls and conventional controls (hardwired 4-20mA/DI/DO) are envisaged for this package. 2. Bidder shall provide complete Instrumentation for control, monitoring and operation of entire Sewage treatment plant. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement, the more stringent requirement as per interpretation of BHEL/customer shall prevail without any commercial implication. 3. Bidder to provide Profibus PA protocol compatible PT(Pressure Transmitters),DPT(Differential Pressure Transmitters),TT(Temperature Transmitters) and Flow/Level Transmitters(DP type),as applicable, for entire Sewage Treatment Plant package. 4. All motorized valves shall be supplied with Non-intrusive Profibus based Electric Actuator(with integral starter) for Sewage Treatment Plant package along with necessary interface units for linking to corresponding Control System as applicable in line with system requirement. 5. Redundancy of instruments to be provided by bidder shall be as follows:- (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder. 6. Bidder to provide Junction Boxes(for HART compatible instruments) in field for termination of all the instruments. 7. Bidder to provide atleast 20% spare terminals in Junction boxes etc. 8. All the instruments having contact with corrosive media shall be provided with chemical/diaphragm seal.		

	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	
9. For level transmitters, electronics items etc. all weather canopy\ rack enclosures shall be provided by Bidder for protection from direct sunlight and rain for open locations. For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It should be mounted at accessible location. 10. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. 11. 230 V AC UPS Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Further, Bidder to furnish UPS load data during detailed engineering in BHEL format. 12. Bidder shall furnish Instrument Schedule, Control Scheme, I/O list, Drive list, Cable Schedule, Cable interconnection, Instrument/SOV/Analyzers Installation diagram, Instrument/Analyzer datasheets, JB grouping, SOV grouping, Annunciation list, List of Instruments/devices for Profibus/HART, configuration diagram for Profibus based actuators/instruments in BHEL approved format. Also, editable database format like MS Excel, MS Access etc. of these documents shall also be provided by Bidder.		

023/2023001		This page is part of tech. spec. PE-TS-497-673-A001	
CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.00.00	ELECTRICAL ACTUATORS		
	General Requirements	Actuators shall be designed for valve operation to ensure proper function in accordance with specifications given below and complying to EN15714-2 or equivalent. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.	
4.00.00	REQUIREMENT FOR NON-INTRUSIVE PROFIBUS ACTUATOR		
4.01.00	Type	1. The actuators shall have integral starters with built in SPP (Single Phasing Preventer). 415 V, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit. Control voltage of the motor starter shall be 110 V AC / 24 V DC, derived suitably from 415V power supply. 2. The actuators shall be Non- Intrusive electric actuator. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body	
4.02.00	Rating	1. Supply Voltage & frequency: 415V +/- 10%, 3 Phase, 3 Wire & 50HZ +/- 5%. 2. Sizing: Open/Close at rated speed against designed differential pressure at 90% of rated voltage. For ON/OFF type: Three successive open-close operations or 15 minutes, whichever is higher. For inching type: 150 starts per hour or required cycles, whichever is higher	
4.03.00	Construction	1. Enclosure: Totally enclosed weatherproof, minimum IP-68 degree of protection. 2. Manual Wheel: Shall disengage automatically during motor operation.	
4.04.00	Motor	Type: Squirrel cage induction motor suitable for Direct On-Line (DOL) starting Enclosure: Totally enclosed, self-ventilated Insulation: Class F. Temperature rise 70 Deg C. over 50 Deg C ambient. Bearings: Double shielded, grease lubricated antifriction	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-IIIC-17 ELECTRICAL ACTUATORS
			PAGE 1 OF 4

23/2023001		This page is part of tech. spec. PE-TS-497-673-A001	
CLAUSE NO.		TECHNICAL REQUIREMENTS	
		एनटीपीसी NTPC	
		Earth Terminals: Two Protection: Single Phasing Protection, Over-heating protection through Thermostat (as applicable) and wrong phase sequence protection shall be provided over and above other protection features standard to bidder's design. Suitable means shall be provided to diagnose the type of fault locally.	
4.05.00	Position / Torque Transmitter	The Position/ Limit measurement shall be done using absolute encoders which will give information of position/ limit in both the directions. Electronic measurement of torque shall be provided.	
4.06.00	Local Operation	It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.	
4.07.00	LCD Display	A local LCD display shall be provided to give information regarding actuator alarms, status and valve position indications as a minimum in local.	
4.08.00	Wiring	Suitable voltage grade copper wire.	
4.09.00	Terminal Block	For power cables, the grade of TBs shall be minimum 650V.	
4.10.00	Accessories	All required accessories for calibration / settings/ configuration of various parameters of actuator shall be provided.	
4.11.00	SIL Certification	All actuators shall be certified for SIL 2 or better.	
		contd. on next page	
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-IIIC-17 ELECTRICAL ACTUATORS
			PAGE 2 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
4.12.00	REQUIREMENT FOR NON-INTRUSIVE PROFIBUS ACTUATOR Interfaces For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. a) Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the fieldbus network along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DDCMIS through the fieldbus network. b) All actuators shall be Profibus compatible. However the exact protocol shall be based on finalized protocol of If Profibus DP protocol is envisaged then actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention. Also, for Profibus DP cable connection, suitable connector integral to the actuator, or external devices/ accessories (mounted inside minimum IP65 protection class enclosure) shall be provided so that the actuator can be isolated online from the profibus network without disturbing the Profibus communication of other actuators of the segment. c) Open/close command termination logic shall be suitably built inside actuator. d) For all actuators GSD and DTM files are to be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics.		
4.13.00	Terminal Box Suitable terminals/ connectors, integral to actuator, for terminating fieldbus cables and power cables shall be provided. Necessary glands for power cables and armored fieldbus cables shall be provided.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO.: CS-4540-001A-2	SUB-SECTION-IIIC-17 ELECTRICAL ACTUATORS PAGE 3 OF 4

CLAUSE NO.	TECHNICAL REQUIREMENTS																					
2.00.00	SPECIFICATION FOR ELECTRONIC TRANSMITTERS																					
2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS Microprocessor based 2 wire loop powered electronic transmitter with (Profibus PA complying to IEC 61158.) output signal shall be provided. <table><tr><th>Range</th><th>Accuracy (For calibrated Range)</th><th>Turndown (For span)</th><th>Stability (% of Calibrated range)</th></tr><tr><td><=400mmwc</td><td>0.1%</td><td>20:1</td><td>+/-0.2% for 1 year</td></tr><tr><td>>400mmwc</td><td>0.060%</td><td>50:1</td><td>+/-0.25 % for 10 year</td></tr><tr><td>>250 kg/cm2</td><td>0.065%</td><td>10:1</td><td>+/- 0.15 % for 5 years</td></tr></table> Above parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only. Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, Plug and socket type electrical connection for HART and ½ "NPT (F) for Profibus type Transmitter, calibration using Profibus calibrator, 2/3/5 Valve non integral manifold and rack with canopy. For HART transmitter SIL 2 certification is required. For corrosive, viscous, solid bearing, slurry type process fluids, suitable diaphragm seal shall be provided. Parts below seal shall be removable for cleaning. Entire volume shall be completely filled with inert liquid suitable for instruments. LVDT type transmitter is not acceptable.				Range	Accuracy (For calibrated Range)	Turndown (For span)	Stability (% of Calibrated range)	<=400mmwc	0.1%	20:1	+/-0.2% for 1 year	>400mmwc	0.060%	50:1	+/-0.25 % for 10 year	>250 kg/cm2	0.065%	10:1	+/- 0.15 % for 5 years		
Range	Accuracy (For calibrated Range)	Turndown (For span)	Stability (% of Calibrated range)																			
<=400mmwc	0.1%	20:1	+/-0.2% for 1 year																			
>400mmwc	0.060%	50:1	+/-0.25 % for 10 year																			
>250 kg/cm2	0.065%	10:1	+/- 0.15 % for 5 years																			
2.02.00	GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER AS APPLICABLE <table><tr><td>Type</td><td>Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.</td></tr><tr><td>Principle</td><td>TDR (Time domain reflectometry)</td></tr><tr><td>Probe Type & Material</td><td>(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.</td></tr><tr><td>Output signal</td><td>4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.</td></tr><tr><td>Accuracy</td><td>+/- 0.5% of calibrated span or minimum 5mm.</td></tr><tr><td>Power supply</td><td>24 VDC +/- 10%.</td></tr><tr><td>Housing</td><td>Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.</td></tr><tr><td>Adjustment/ calibration</td><td>Using hand held HART calibrator/ centralized PC based system (as applicable).</td></tr><tr><td>Zero & span</td><td>Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument</td></tr></table>				Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.	Principle	TDR (Time domain reflectometry)	Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.	Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.	Power supply	24 VDC +/- 10%.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.	Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).	Zero & span	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument
Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.																					
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Zero & span	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument																					
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 2 OF 34																		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.03.00	adjustment	without any level in the tank/sump etc.		
	Display	Integral digital display.		
	Load Impedance	500 ohms (minimum).		
	Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 50082-2		
	Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor. (ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. (iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.		
	Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.			
	Ultrasonic Type level Transmitter AS APPLICABLE			
	S.No.	Features	Essential/Minimum requirement	
	1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.	
	2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).	
3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.		
4.	Power supply	24 V DC +/- 10%.		
5.	Temperature compensation	To be provided within transducer.		
6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.		
7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).		
8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.		
9.	Sensor Material	Corrosion resistant material to suit individual application requirement.		
10.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 3 OF 34

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
2.04.00	11.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
	12.	Display	Integral digital display
	13.	Diagnostics	Loss of echo alarm etc.
	14.	Load Impedance	500 ohms (minimum).
	15.	Electrical Connection	Plug and socket
	16.	Accessories	• All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. • All mounting accessories required for erection and commissioning shall be provided. • For hazardous area, explosion proof enclosure as described in NEC article 500
	Note: 1) Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under "ultrasonic transmitters" category for fly ash silo level. 2) Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC. 3) For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location. HART Hand Held calibrator Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter.		
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)
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	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	
Orifice Plate Features Type Material Thickness Tappings Beta Ratio	Essential/Minimum Requirements Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1980 or BS-1042, ISO 5167 316 SS 3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm. Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tappings. However for flow elements in CPU, DM & PT plant- 2 Pairs of Tappings shall be provided as minimum. 0.34 to 0.7	

2023/20230001	This page is part of tech. spec. PE-TS-497-673-A001	
	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	
SOLENOID VALVES Solenoid valves shall fulfil the following requirements: a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.) b. Power supply : 24 V DC $\pm$ 10%. c. Plug and socket electrical connection. d. Insulation : Class 'H' e. IP Class : IP65 Electronic Flow-Meter The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner. The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments. The flow meter shall meet or exceed the following requirement : (a) Output : 4-20 mA DC Isolated output (b) Accuracy : $\pm$ 0.5% of calibrated span or better * (c) Repeatability : $\pm$ 0.2% of calibrated span or better (d) Power Supply : 240V AC $\pm$ 10%, 50 HZ $\pm$ 5%/ 24 V DC, to be arranged by the contractor. (f) Protection class : IP-55 (e) Flow tube SS304 (f) liner Hard Rubber The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser/ integrator to get the daily and monthly discharge as stated above.		

	2X660 MW Talcher STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) SEWAGE TREATMENT PLANT	

Limit switches

For offsite plant (except PT, DM, Chlorination, chemical treatment, Liquid effluent treatment) application Limit switches shall be silver plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.

For PT, DM, Chlorination system, chemical treatment, Liquid effluent treatment plant, limit switches of manual valves and solenoid operated on-off valves shall be of inductive proximity type and shall be mounted inside the enclosure: pl. refer the minimum specification requirement below.

Operating voltage Range	10-40 V DC
Sensing system	Inductive Proximity type, 2 Wire
Sensor Contact Type	NO
Reverse polarity and short circuit protection	Yes
IP Class-Sensor	IP67
IP Class-Enclosure(Switch box)	IP67
Cable entry-Enclosure(Switch box)	2no-1/2" NPT
Casing material-Sensor	Brass /SS
Enclosure(Switch box) Housing material	FRP or SS
Operating Ambient temp(sensors)	-5 to 70 deg C
Max allowed Voltage Drop across sensor	5 V
Standard applicable	EN 60947-5-2 or equivalent.

CLAUSE NO.	TECHNICAL REQUIREMENTS																																															

13.04.00	NOT USED																																															
14.00.00	NOT USED																																															
15.00.00	PROCESS ACTUATED SWITCHES																																															
	<table><tr><th>FEATURES</th><th colspan="3">ESSENTIAL / MINIMUM REQUIREMENTS</th></tr><tr><td></td><td>Pressure/ Draft Switches/ DP Switches</td><td>Temperature switches</td><td>Level switches</td></tr><tr><td>Sensing Element</td><td>Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum</td><td>Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (5 m minimum, to suit application)</td><td>Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .</td></tr><tr><td>Material</td><td>316 SS</td><td>Bulb 316 SS/ capillary 304 SS</td><td>316 SS</td></tr><tr><td>End connection</td><td>½ inch NPT (F)</td><td>½ inch NPT (F)</td><td>Manufacturer standard</td></tr><tr><td>Over range/ proof pressure</td><td>150% of maximum operating pr.</td><td>-</td><td>150% of maximum operating pr.</td></tr><tr><td>Repeatability</td><td colspan="3">+/- 0.5% of full range</td></tr><tr><td>No. of contacts</td><td colspan="3">2 No.+2NC. SPDT snap action dry contact</td></tr><tr><td>Rating of contacts</td><td colspan="3">60 V DC, 6 VA (or more if required by DDCMIS)</td></tr><tr><td>Elect. Connection</td><td colspan="3">Plug in socket.</td></tr><tr><td>Set point adjustment</td><td colspan="3">Provided over full range.</td></tr></table>				FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS				Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches	Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (5 m minimum, to suit application)	Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .	Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS	End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard	Over range/ proof pressure	150% of maximum operating pr.	-	150% of maximum operating pr.	Repeatability	+/- 0.5% of full range			No. of contacts	2 No.+2NC. SPDT snap action dry contact			Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)			Elect. Connection	Plug in socket.			Set point adjustment	Provided over full range.		
FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS																																															
	Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches																																													
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TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 24 OF 34																																												

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Dead band adjustment	Adjustable/ fixed as per requirement of application.		
	Enclosure	Weather and dust proof as per IP-55, metallic housing.		
	Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories
	Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
	Power Supply (wherever required)	As per Contractor's Standard practice.		
	Notes :- 1) Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. 2) Pressure/ Diff pressure switches for very low press/ DP measurements can have sensor material other than SS316 in case of any technical limitation and the offered product is standard product of the manufacture for very low pressure applications. 3) Repeatability can be upto +/-1% of full range in case of switches with diaphragm seals or very low pressure/DP range.			
16.00.00				
17.00.00				
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 25 OF 34

SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	SS 316	SS 316	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be 1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

12	Accessories	Blow out disc, SS Thermowell siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS

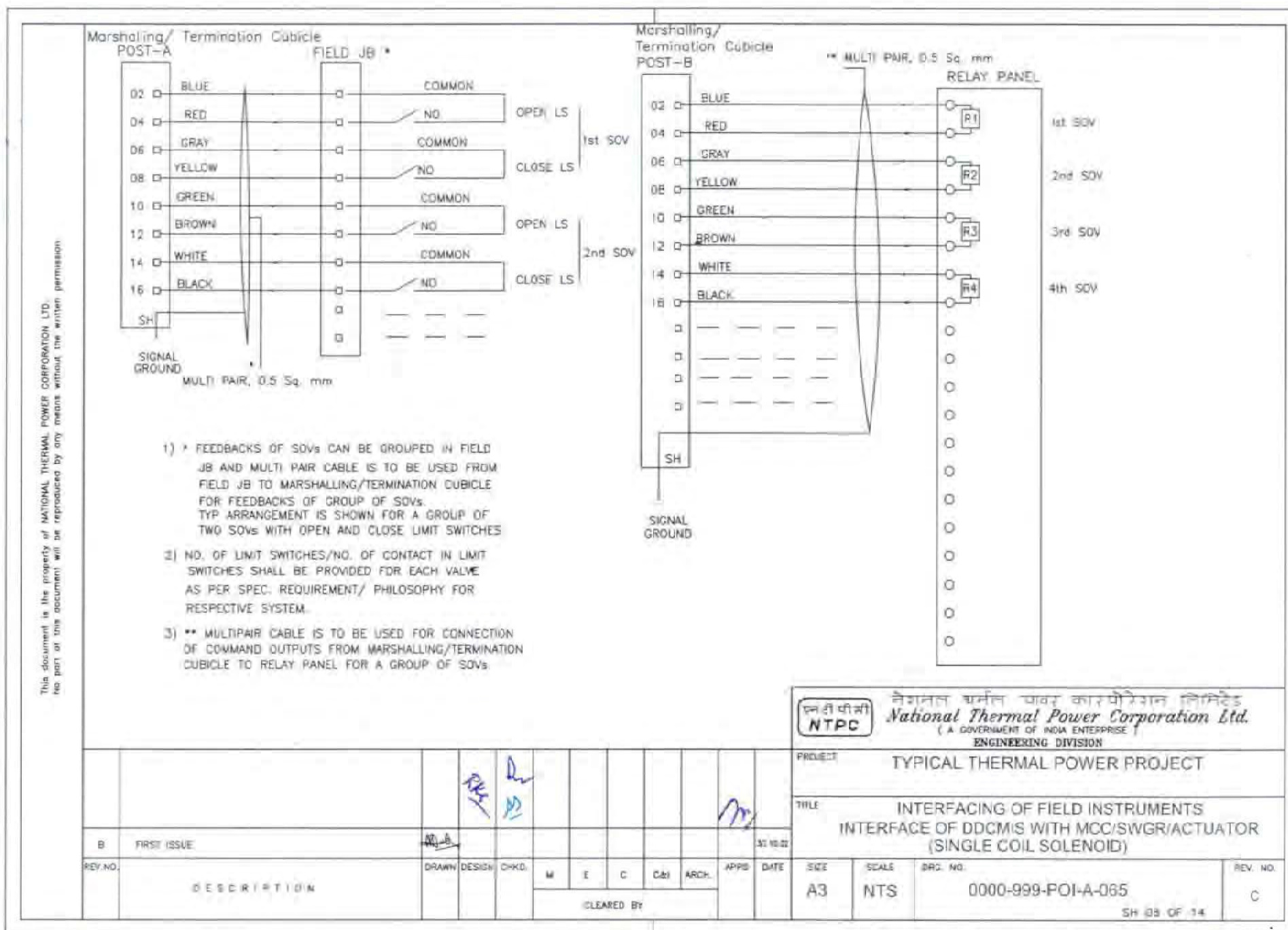
Notes:-

*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

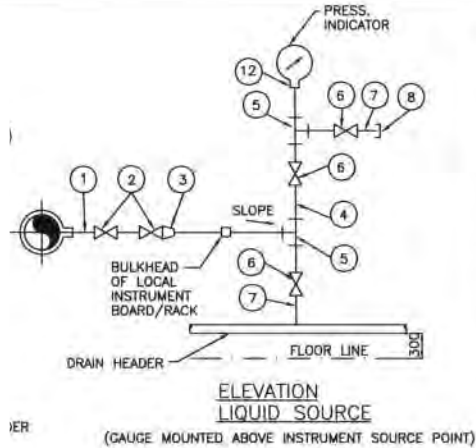
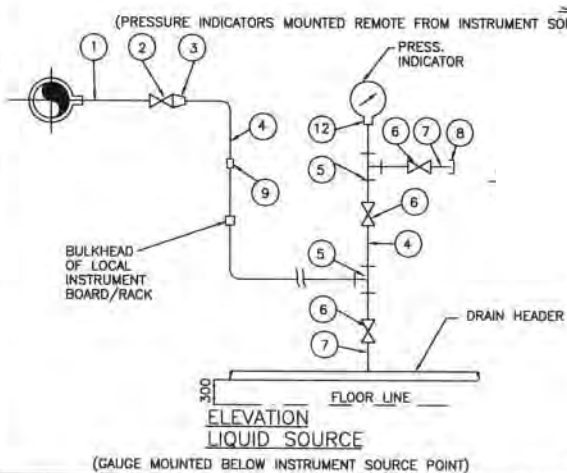
Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	PROCESS CONNECTION AND PIPING		
1.00.00	PROCESS CONNECTION PIPING Process connection & piping including all impulse piping, sample piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories required for proper installation & completeness of impulse piping system, sampling piping system and air supply system shall be provided by the Contractor on as required basis. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:		
	Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70	
	Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34	
	Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009	
	Installation Schemes	BS 6739-2009, ANSI/ISA 77.70	
	Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply.		
1.01.00	All transmitters and switches (except for fuel oil applications) shall be suitably grouped together and mounted inside (i) Local Instruments Enclosures (LIE) in case of Open Areas of the Plant like Boiler Area, Coal Handling, Chimney Area, FGD area, CW Pump House, DM Plant, PT Plant, Ash Handling Plant etc. (ii) Local Instrument Racks (LIR) in case of covered areas like Turbine Area, Generator Area etc. (iii) Local Indicators/Gauges shall also be suitably grouped in Local Instrument Racks In case grouping is not possible and these are to be installed individually, canopy with suitable mounting arrangement shall be provided. All electric actuators, pneumatic control valves, Junction Boxes, Solenoid boxes and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.		
1.02.00	Local Instrument Enclosures (LIEs) and Local Instrument Racks (LIRs) complete with all fittings, mountings & accessories, drains and Utility Lighting, Cable & Grounding cable etc. shall be provided by the Contractor on as required basis. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55. The instrument racks shall be constructed from 1.6 mm sheet plate and shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel and extended beyond the ends of the rack.		
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LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	1/2" x 3/4" x 1" NPS SCH 40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1" SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE.
7.	1/2" / 3/4" NPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1"/3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WAFER ELEMENT)
17.	ISOLATION VALVE 316 SS,1/4"SW

- NOTES:-
1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
 2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFORM TO ANSI-B.16-11.
 3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
 4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
 5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK..
 6. * SLOPE APPROX. 50 MM / METRE.

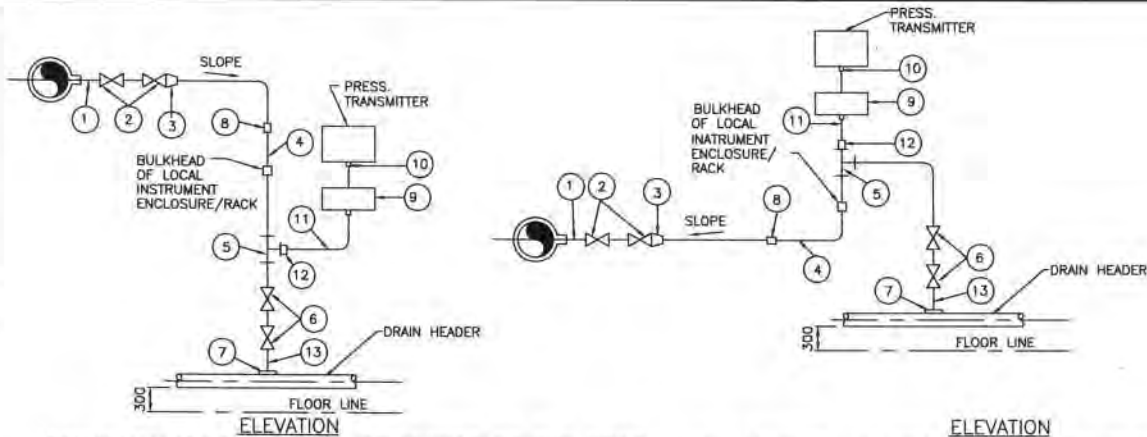
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NTPC
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)	
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-022	A

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LIST OF MATERIALS

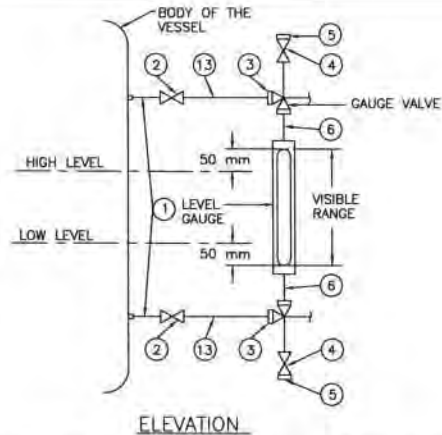
ITEM NO.	DESCRIPTION
1.	1/2" / 3/4" / 1" NPS SCH. 80/160/XXS/PB1 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4"/1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2"SW GLOBE VALVE
7.	1/2"NPS SCH. 80/160 SWx1/2"CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-POI-A-023).
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2"NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT
ELEVATION ELEVATION
SLOPE SLOPE
FLOOR LINE FLOOR LINE
DRAIN HEADER DRAIN HEADER
LIQUID PRESSURE MEASUREMENT

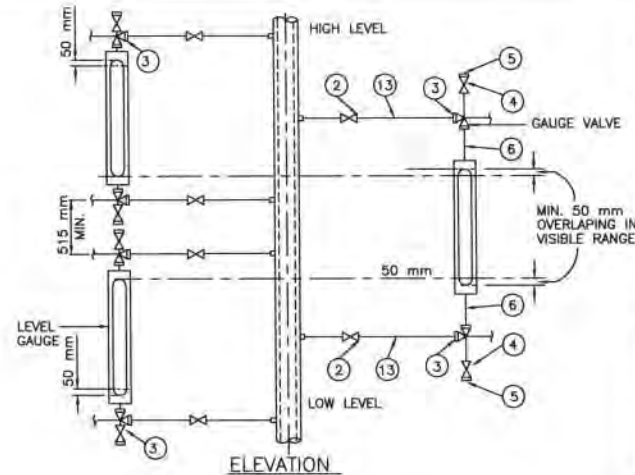
FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC		NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	
PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS /DP TRANSMITTERS STEAM/LIQUID VACUUM)	
REV. NO.	DESCRIPTION	SIZE	SCALE
A	FIRST ISSUE	A3	N.T.S.
DRAWN	DESIGN	CHKD.	DATE
			21.08.12
Cleared By		DRG. NO.	REV. NO.
		0000-999-POI-A-025	A

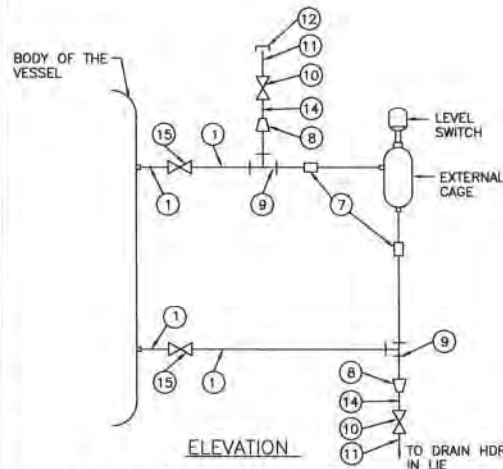
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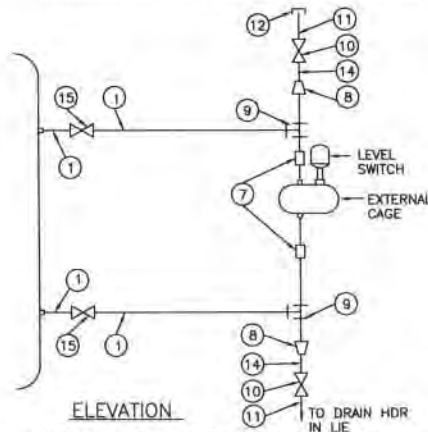
ELEVATION
LOCAL LEVEL INDICATION USING GAUGE GLASS



ELEVATION
LOCAL LEVEL INDICATION USING MULTIPLE GAUGES
FOR INCREASED RANGE NOT COVERED IN A SINGLE UNIT



ELEVATION
FLOAT OR DISPLACER OPERATED EXTERNAL CAGE TYPE LEVEL SWITCH INSTALLATION



ELEVATION
TO DRAIN HDR IN LIE

LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	3/4" / 1" NPS SCH.40/80/160/P91 (AS PER PROCESS REQUIREMENT) CARBON / ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
12.	1/2" NPT (F) CAP
13.	3/4"x1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/160 CS/AS NIPPLE.
15.	1" SW GLOBE VALVE.

NOTES:-

1. FOR LEVEL GAUGE 3/4" AND FOR LEVEL SWITCH 1" PROCESS CONNECTION SHALL BE PROVIDED.
2. NOTES UNDER DRG. NO. 0000-999-POI-A-023 (WHICHEVER ARE RELEVANT).

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NTPC

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT **TYPICAL THERMAL POWER PROJECT**

TITLE **INSTRUMENT INSTALLATION DIAGRAM
(LEVEL GAUGE & SWITCHES)**

A FIRST ISSUE

REV.NO.

DESCRIPTION

DRAWN

DESIGN

CHKD.

M

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ARCH.

APPD

DATE

21.08.12

SIZE

A3

SCALE

N.T.S.

DRG. NO.

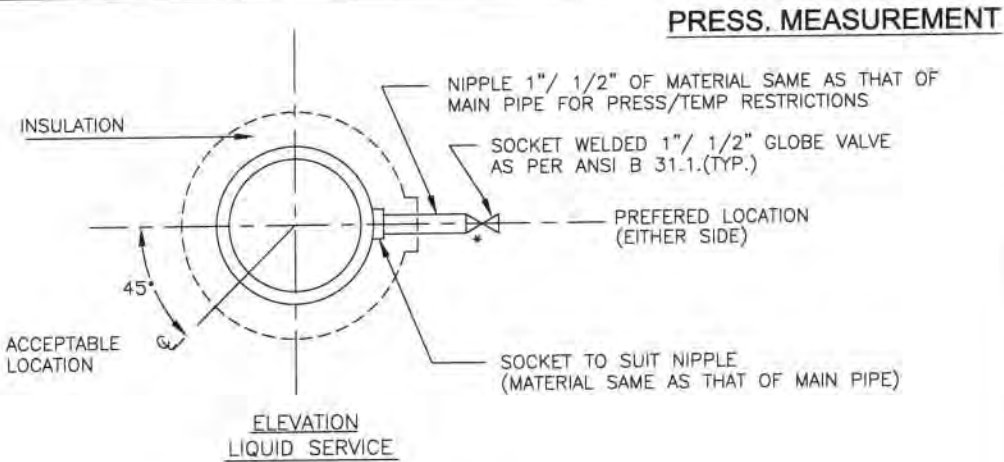
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REV. NO.

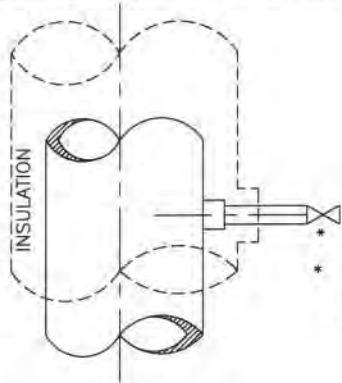
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PRESSURE CONNECTION ON HORIZONTAL PIPE



* USE DOUBLE ISOLATION VALVES FOR PRESSURE EQUAL TO OR EXCEEDING 40 Kg/Cm2.

PRESSURE CONNECTIONS ON VERTICAL PIPES

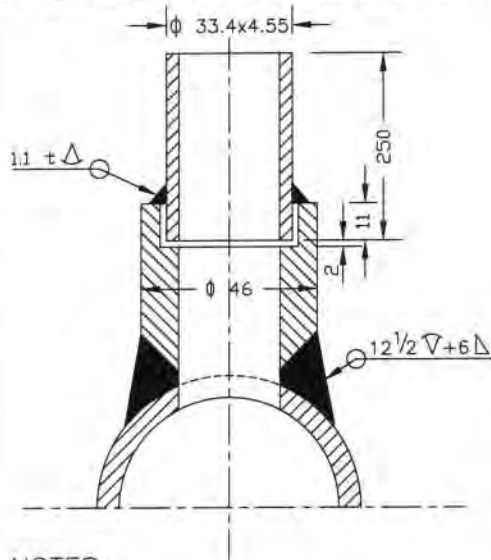
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एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION									
PROJECT TYPICAL THERMAL POWER PROJECT									
TITLE INSTRUMENT SOURCE CONNECTION DETAILS									
A	FIRST ISSUE								
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CAI	ARCH. APPD. DATE
Cleared By									
SIZE	A4	SCALE	N.T.S.	DRG. NO.	0000-999-POI-A-035				REV. NO. A
SH-1 OF 14									

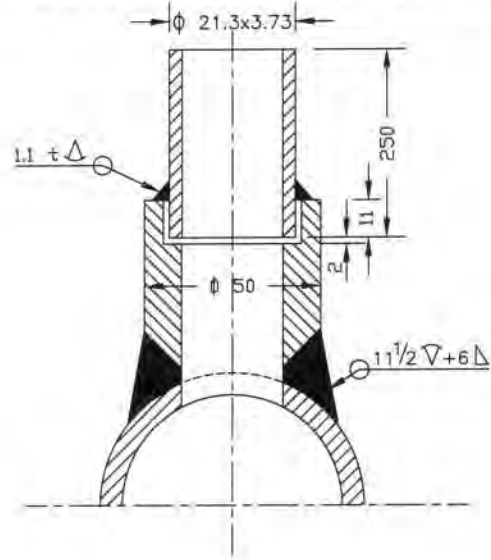
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PRESSURE MEASUREMENT

(SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000)



(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)



NOTES:-

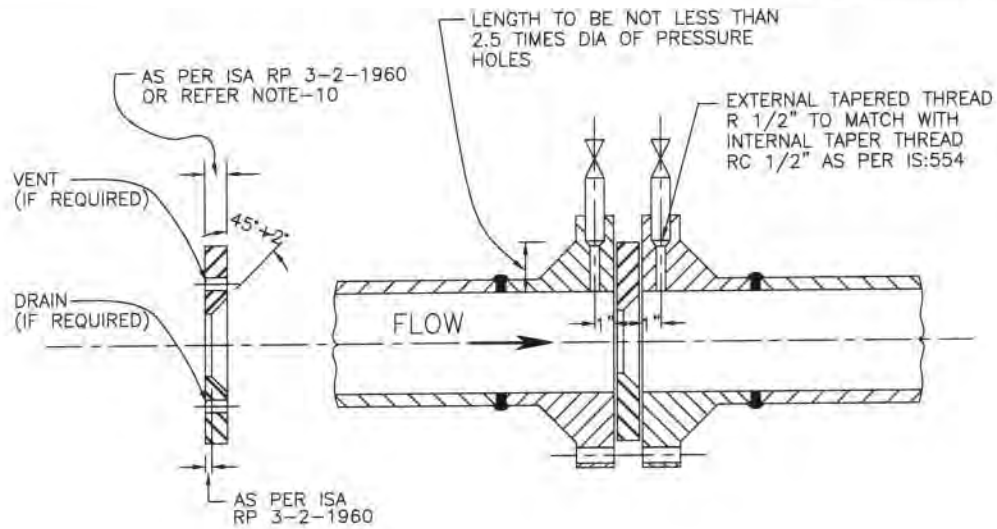
1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm².
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

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PROJECT: TYPICAL THERMAL POWER PROJECT															
TITLE: INSTRUMENT SOURCE CONNECTION DETAILS															
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CLT	ARCH.	APPR.	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE											A4	N.T.S.	0000-999-POI-A-035	A
Cleared by														Sh-2 Of 14	

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FLOW MEASUREMENT



NOTES:—

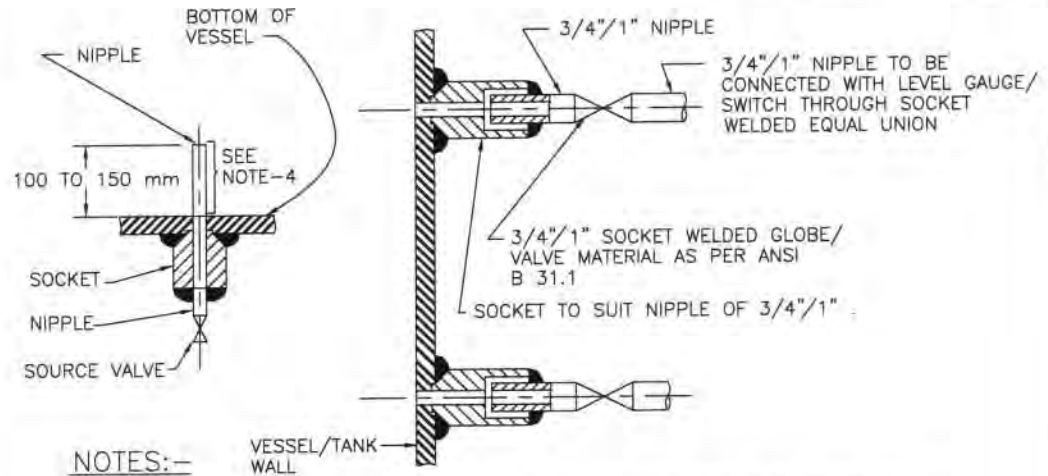
- ORIFICE PLATE MOUNTED BETWEEN FLANGES WITH FLANGE TAPPING (AS SHOWN ABOVE) SHOULD BE LIMITED TO PIPE SIZES OF 2" OR LARGER.
- ORIFICE PLATE SHALL BE MOUNTED BETWEEN PIPING FLANGES WITH THE SHARP EDGE FACING UPSTREAM SUCH THAT CENTRE OF THE CONCENTRIC ORIFICE SHOULD BE WITHIN 0.79 mm (1/32") OF THE AXIS OF THE PIPE.
- TWO GASKETS SHALL BE INSERTED BETWEEN THE PLATE AND THE FLANGES AND INSIDE DIAMETER OF THE GASKETS SHOULD BE ATLEAST 1.5 mm (1/16") GREATER THAN THE INSIDE DIAMETER OF THE PIPE SO THAT THEY DO NOT PROTRUDE INTO THE PIPE.
- PIPING FLANGES SHALL BE ANSI WELD NECK, RAISED FACE TYPE. THE FLANGE IS TO BE ALIGNED WITH THE FACE PERPENDICULAR TO THE FLOW AXIS.
- BIDDER TO SUPPLY ORIFICE PLATE SPECIAL TYPE (HAVING PRESS. CONNECTIONS) OF FLANGES ALONG WITH GASKETS, NIPPLES AND SOURCE VALVES.
- ON HORIZONTAL PIPE RUN PRESSURE CONNECTIONS ARE TO BE TAKEN FROM SIDES FOR LIQUID AND STEAM SERVICE AND FROM TOP FOR DRY GAS SERVICE. FOR PROCESS LIQUIDS INSTALLATION OF PRESSURE TAPS MAY BE ALLOWED WITHIN AN ANGLE OF 45° ELBOW THE HORIZONTAL IN SPECIAL CASES BUT NO BOTTOM CONNECTIONS ARE ALLOWED.
- THE LOCATION OF PRESSURE TAPS MUST BE WITHIN 1.5 mm (1/16") OF THE DISTANCE SPECIFIED.
- MAXIMUM DIAMETER OF PRESS. CONNECTION HOLES SHALL BE AS PER RECOMMENDATIONS OF ASME PTC 19.5. THE DIAMETER OF THE HOLE SHOULD REMAIN THE SAME FOR A DISTANCE NOT LESS THAN 2.5 TIMES OF THE DIAMETER BEFORE EXPANDING INTO THE PRESSURE PIPE.
- THERE MUST BE NO BURRS WIRE EDGES OR OTHER IRREGULARITIES ALONG THE EDGE OF THE HOLE AND IT MUST BE SQUARE AND ROUNDED SLIGHTLY (1/64" RADIUS).
- ORIFICE PLATE SHOULD BE FLAT WITHIN 0.02 mm (0.001") AND THE SURFACE ROUGHNESS SHOULD NOT EXCEED 20 MICRO INCH. THE THICKNESS OF THE ORIFICE PLATE SHOULD BE AS PER EN ISO 5167:2003.
- FOR HORIZONTAL PIPE RUN DRAIN HOLES IN ORIFICE PLATES ARE AT THE BOTTOM (APPROX. TANGENT TO INSIDE DIA OF PIPE) FOR STEAM OR GAS SERVICE. VENT HOLES SHOULD BE LOCATED ON UPPER SIDE FOR INCOMPRESSIBLE FLUID.
- ORIFICE PLATE SHOULD BE OF 316 SS (ASTM A167-54 GRADE-II).
- RECOMMENDED MINIMUM LENGTHS OF STRAIGHT PIPE PRECEDING AND FOLLOWING ORIFICES SHALL BE AS PER EN ISO 5167:2003.
- THREE PAIRS OF PRESSURE TAPS SHALL BE PROVIDED WITH NIPPLES OF REQUIRED LENGTH AND SOURCE VALVES AND THE UN-USED TAPS ARE PLUGGED.
- THE INTERNAL TAPERED CONNECTION WITHIN THE FLANGE FOR PRESSURE TAPS SHOULD BE RC 1/2" AND THE NIPPLE SHOULD ALSO OF EXTERNAL THREADED R 1/2" AS PER IS:554. THE LENGTH OF THREADED ENGAGEMENT SHALL BE AS PER ABOVE STANDARD.

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PROJECT: TYPICAL THERMAL POWER PROJECT									
TITLE: INSTRUMENT SOURCE CONNECTION DETAILS									
A FIRST ISSUE		DRAWN DESIGN CHD.		M E C		T.G. ARCH. APPD. DATE		REV. NO. A	
DESCRIPTION		Cleared By		SIZE A4		SCALE N.T.S.		DRG. NO. 0000-999-POI-A-035	
								Sh-12 Of 14	

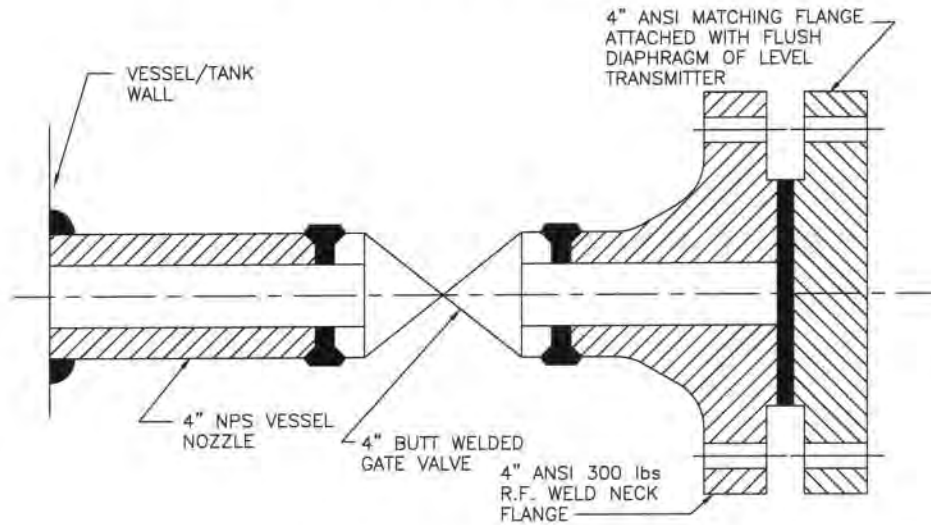
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LEVEL MEASUREMENT



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR LEVEL GAUGE AND EXTERNAL CAGE TYPE FLOAT OR DISPLACER OPERATED LEVEL SWITCH.
2. FOR GAUGES 3/4" NIPPLE ALONG WITH 3/4" SW SOURCE VALVE AND FOR SWITCHES 1" NIPPLE ALONG WITH 1" SW SOURCE VALVE SHALL BE PROVIDED AS PROCESS CONNECTION.
3. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
4. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE PROVIDED FOR TANK LEVEL MEASUREMENT OF VISCOUS OR CORROSIVE LIQUID USING FLUSH DIAPHRAGM/WAFER TYPE LEVEL TRANSMITTER.
2. WELDING OF MATCHING FLANGE TO GATE VALVE SHALL BE DONE BY BIDDER.

FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION									
PROJECT: TYPICAL THERMAL POWER PROJECT									
TITLE: INSTRUMENT SOURCE CONNECTION DETAILS									
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	DATE	BY
A	FIRST ISSUE								
SIZE: A4 SCALE: N.T.S. DRG. NO. 0000-999-POI-A-035 Sh-13 Of 14 REV. NO. A									

MEASURING INSTRUMENTS

Page- 1/2

Item Components Sub System Assembly	Attributes Characteristics								
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
7. Transducer (IS-14570)	Y	Y	Y	Y	Y	Y			
8. Thermocouples (IEC – 584 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
9. RTD(IS-2848)	Y	Y	Y	Y	Y	Y			
10. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									

MEASURING INSTRUMENTS

Page- 2/2

Item Components Sub System Assembly	Attributes Characteristics												
	GA, Dimensions, Paint Thickness (R)	Make, Model, Type, Rating ,BOM(R)	Process / Electrical connection (R)	Calibration/Functional (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	HV/ IR Test (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)	Integral Testing of complete System
11. Orifice plate(BS-1042)	Y	Y	Y	Y*	Y	Y* *	Y* *			Y	Y* *	Y	
12. Flow nozzle(BS-1042)	Y	Y	Y	Y*	Y	Y	Y			Y	Y	Y	
13. Impact head type element	Y	Y	Y					Y				Y	
14. Electronics Water Level Indicator (EWLI)	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
15. Flue Gas & Ambient Air Analysers	Y	Y	Y	Y					Y				Y
16- SWAS System with Analyser & Chiller#	Y	Y	Y	Y			Y		Y	Y	Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable													
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.													
** As applicable													
#Vaccuminasation test of chiller assembly													
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.													

CLAUSE NO.	QUALITY ASSURANCE													एन टी पी सी NTPC		
	Process, Connection & piping FOR C&I SYSTEMS															
	TESTS	ITEMS														
			Visual & Dimensions ®	GA, BOM, Layout of component & construction feature, Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessibility of TBs/Devices Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydraulic impulse and vibration test (R)	Tests as per standards & specification
			Local Instrument enclosure	Y	Y		Y	Y	Y	Y	Y	Y	Y			
			Local instruments racks	Y	Y		Y	Y	Y	Y	Y	Y	Y			
			Junction Box	Y	Y*		Y		Y	Y						
			Gauge Board	Y	Y		Y		Y		Y		Y	Y		
			Impulse pipes and tubes	Y		Y			Y					Y		
			Socket weld fittings ANSI B-16.11	Y					Y					Y		Y
			Compression fittings	Y					Y				Y	Y	Y	
			Instrument valves & Valve manifolds	Y					Y				Y	Y		
	Copper tubings ASTM B75	Y					Y							Y		
	*-applicable for painted junction boxes.															
	Note: R-Routine Test A- Acceptance Test Y – Test applicable															
	Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.															
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE				TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.: 4540-001A-2				SUB-SECTION-E-57 PROCESS CONNECTION & PIPING				PAGE 1 OF 1				

CLAUSE NO.	TECHNICAL REQUIREMENTS					एनटीपीसी NTPC
3.00.00	TYPE TEST REQUIREMENT FOR OTHER C&I SYSTEMS					
	Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
	1	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes
TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4540-001A-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 4 OF 8

1783539/2023/2023001

TITLE:

This page is part of tech. spec. PE-TS-497-673-A001



**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -II

SUB SECTION

REV. NO. 00

DATE :

SECTION – II

1783539/2023/2023001

This page is part of tech. spec. PE-TS-497-673-A001



TITLE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -II

SUB SECTION

REV. NO. 00

DATE :

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

1.0 Bidder to furnish following documents/information along with the bid

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating "No Deviation" duly Stamped & Signed.
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

1783539/2023/2023001

This page is part of tech. spec. PE-TS-497-673-A001



TYPE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -II

SUB SECTION

REV. NO. 00

DATE :

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

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This page is part of tech. spec. PE-TS-497-673-A001



TYPE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -II

SUB SECTION

REV. NO. 00

DATE :

PRE BID CLARIFICATION SCHEDULE

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

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

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

1783539/2023/2023001

This page is part of tech. spec. PE-TS-497-673-A001



TITLE:

**2X660 MW TALCHER THERMAL POWER
PROJECT STAGE-III**

SPECIFICATION NO. PE-TS-497-673-A001

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SECTION -II

SUB SECTION

REV. NO. 00

DATE :

SCHEDULE OF DECLARATION

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

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

Bidders Company Name

.....

Authorized Representative's
Signature

.....

Name

.....

Bidder's Name

.....

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

		THIS IS A PART OF TENDER TECHNICAL SPECIFICATION PE-TS-497-673-A001							
		<u>SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL</u>							
<u>2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III</u>									
<u>SEWAGE TREATMENT PLANT</u>									
<u>TENDER ENQUIRY REFERENCE:-</u>									
NAME OF VENDOR:-									
SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF withdrawal OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF withdrawal OF DEVIATION IS APPLICABLE	NATURE OF COST OF withdrawal OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
<u>TECHNICAL DEVIATIONS</u>									
<u>COMMERCIAL DEVIATIONS</u>									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME		DESIGNATIONS				SIGN & DATE			
<u>NOTES:</u>									
1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.									
3. All the bidders has to list out all their Technical and Commercial Deviations (if any) in detail in the above format.									
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.									
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. in the absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT									
6. Bidder shall furnish price copy of above format along with price bid.									
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.									
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.									
9. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VII of GCC, Rev-07 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.									
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be considered.									
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in un-priced copy of this format.									
12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.									
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									

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