

**MAHARASHTRA STATE POWER GENERATION CO. LTD.
(MAHAGENCO)**

1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6

**TECHNICAL SPECIFICATION
FOR
SEWAGE TREATMENT PLANT**

SPECIFICATION NO: PE-TS-415-673-A001



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

5176/2020/PS-DEM-MAX



TITLE:

1X660 MW BHUSAWAL THERMAL POWER
STATION UNIT -6SPECIFICATION NO. PE-TS-415-673-
A001TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT

REV. NO. 00

DATE :

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	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT	SUB-SECTION -
		REV.NO. 0 DATE:

PROJECT INFORMATION

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 2
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GENERAL PROJECT INFORMATION

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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1.0	INTRODUCTION
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3.0	LAND
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5.0	SOURCE OF WATER
6.0	ASH DISPOSAL AREA
7.0	PROJECT INFORMATION

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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1.0 <u>INTRODUCTION</u> The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Deepnagar near Bhusawal, Maharashtra, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder. 2.0 <u>APPROACH TO SITE</u> Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway. 3.0 <u>LAND</u> Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land. 4.0 <u>SOURCE OF COAL</u> Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tippers and will be either bunkered or stacked in the stock pile at site. 5.0 <u>SOURCE OF WATER</u> The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.		

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6.0

ASH DISPOSAL AREA

The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.

7.0

PROJECT INFORMATION

7.1

Client / Owner

:

Maharashtra State Power Generation Co. Ltd.

7.2

Consultant

:

Develop consultants Pvt. Ltd. Mumbai

7.3

Project Title

:

BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW

7.4

Location

:

Dipnagar, Near Bhusawal, Maharashtra, India

7.5

Nearest railway station

:

Bhusawal

7.6

Nearest Airport

:

Aurangabad

7.7

Nearest Harbour

:

Mumbai

7.8

Access Roads

:

NH 6 (Mumbai-Nagpur Highway)

7.9

Elevation above MSL

:

210 M

7.10

Longitude/latitude

:

75°51’10” East /21° 02’ 30” North

7.11

Seismic Zone

:

Zone III as per IS:1893

7.12

AMBIENT TEMPERATURE

7.12.1

Mean of daily maximum temperature

:

48.25 °C (during May)

7.12.2

Mean of daily minimum temperature

:

18 °C (during January)

7.12.3

Highest temperature recorded

:

48.7°C

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7.12.4	Lowest temperature : 13°C recorded		
7.13	Wet bulb temperature : 27°C (Maximum)		
7.14	Rainfall : 112 mm average annually		
7.15	Wind Speed : 0 to 39 Km/hr		
7.16	Wind direction : East North East to West South West		
	<u>ELECTRICAL</u>		
7.17	<u>MAIN POWER SOURCE FROM GRID</u>		
7.17.1	Rated Voltage : 400kV		
7.17.2	Voltage variation : $\pm 10\%$		
7.17.3	Frequency Variation : $\pm 5\%$		
7.17.4	Rated Short Circuit : 50 kA, Three Phase Symmetrical Level		
7.18	<u>AUXILIARY POWER SUPPLY</u>		
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:		
7.18.1	Motors above 1000 kW : 11kV, 3Ph, 3wire, 50Hz system & other Power devices		
7.18.2	Motors below 1000 kW : 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively & above 160kW earthed & other power devices		
7.18.3	Motors upto 160 kW & : 415V, 3 ph, 4 wire 50 Hz other power devices		
7.18.4	Motor Starting Methods : Direct on Line		
7.18.5	(a) Lighting fixtures : 240V, 1 phase, 50 Hz Space heaters, and Supply through suitably rated transformers to limit the short circuit level to 9kA – 1 sec. single Phase motors		

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(b) Control & : 240V, 1 Phase, 50 Hz from UPS Instrumentation 7.18.6 Short circuit levels of 11kV, 3.3 kV and 415V system equipments The equipment shall be suitable for the following short circuit levels (a) 11kV Switchgears : 44 kA/3 sec (b) 3.3kV Switchgears : 40 kA/3sec (c) 415V PCC/ : 50 kA/1sec PMCC/ MCC (d) Lighting : 9 kA/1sec Distribution Boards & 240V A.C. supply 7.18.7 Auxiliary DC supply The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc. (a) Voltage : (i) 220V DC for utility purpose (ii) 24V DC for Control and Instrumentation (b) Voltage variation : + 10 %, - 15 % 7.18.8 Emergency power supply (a) Purpose : (i) Standby power to normal incomer of emergency MCC (ii) Alternate power source to Fire water Pumps (b) Rated voltage and : 415 V, 3 phase, 3 wire, 50 Hz. frequency		

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7.18.9 UPS power supply (a) Purpose : (i) Vital process loads (ii) Critical lighting (iii) Control and Instrumentation (iv) Office for LAN power supply/Server etc. (b) Rated Voltage : 415V, 3 ph, neutral/240V single phase, 50Hz 7.19 The variation in voltage and frequency may be $\pm 10\%$ and $\pm 5\%$ respectively. The combined voltage and frequency variation may be $\pm 10\%$. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance 7.20 Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type 7.21 All electrical equipment shall be designed for the following ambient conditions (a) Maximum ambient temperature : 50°C (b) Minimum Ambient temperature : 13°C		

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	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION:	
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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA - Specific Technical Requirements (Mech.)

SUB-SECTION IB - Specific Technical Requirements (Electrical)

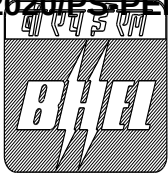
SUB-SECTION IC - Specific Technical Requirements (C & I)

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SUB-SECTION IA - Specific Technical Requirements (Mech.)

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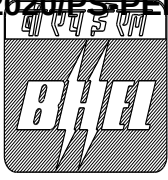
SUB-SECTION IA**1.0 GENERAL**

Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for SUPPLY PART, SERVICES PART & MANDATORY SPARES comprising of design (i.e. Preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals) engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, chemicals for MBR, mandatory spares along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, minor civil works, erection & commissioning, trial run at site and carrying out performance guarantee / Functional / Demonstration tests at site, training of customer/ client & final handing over to end customer in flawless condition for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.

2.0 SCOPE OF SUPPLY FOR SEWAGE TREATMENT PLANT (REFER P & ID OF SEWAGE TREATMENT PLANT SUBSECTION IA)**2.1 SCOPE OF SUPPLY (MECHANICAL)**

- 2.1.1** Two (2) nos. (1W+1S) Coarse Bar screens in each sewage sump i.e., S1, S2, S3, S4, S5 and S6.
- 2.1.2** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S1) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.3** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S2) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.4** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S3) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.5** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S4) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.6** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S5) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.7** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S6) complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.8** Two (2) Nos. (1W+1S) submersible grinding type sewage transfer pumps for Common sewage collection sump complete with all instrumentation, valves, piping, fittings, motor and other accessories.
- 2.1.9** All instrumentation and accessories in sewage sump S1, S2, S3, S4, S5, S6 and Common sewage collection sump (RCC work in BHEL scope).
- 2.1.10** One (1) No. of Inlet Chamber below ground (RCC work in BHEL scope) along piping, isolation gates, fittings, and required accessories.
- 2.1.11** Two (2) Nos. (1W+1S) of coarse screens for common collection sumps in below ground sump (RCC work in BHEL scope) along with, fittings, isolation gates and required accessories.
- 2.1.12** One (1) No. (1W) of oil & grease trap with oil skimmer & Oil drum (RCC work in BHEL scope) along instruments, fittings, valves and required accessories.
- 2.1.13** One (1) No. of Common sewage collection sump below ground (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories located in STP area.
- 2.1.14** Two (2) Nos. (1W+1S) fine screens along with valves, piping, fittings instruments and required accessories.
- 2.1.15** Two (2) Nos. (1W+1S) Grit chambers (RCC work in BHEL scope) along with One no. in each chamber, MS with FRP coating with washing system/ mechanism, valves, piping, fittings instruments and required accessories.
- 2.1.16** Common Belt conveyor for grit chambers to transfer collected grit from grit chamber. Conveyor shall be provided by bidder complete with all instrumentation, fittings, motor and required accessories.
- 2.1.17** One trolley for collection of grits from belt conveyor.
- 2.1.18** One (1) no. (1W) above ground anoxic tank of RCC construction (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories.
- 2.1.19** One (1) no. (1W) above ground aeration tank of RCC construction (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories.

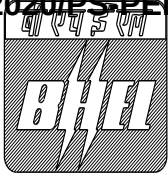
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- 2.1.20** One (1) no.(1W) above ground MBR tank of RCC construction (RCC work in BHEL scope) along with valves, piping, fittings, instruments and required accessories.
- 2.1.21** One (1) no. (1W) Membrane bio reactor including pressure tubes, membranes, associated valves, instruments, piping, fittings and required accessories.
- 2.1.22** Chemical dosing/ cleaning system including tanks and dosing pumps for membranes, associated valves, instruments, piping, fittings etc.
- 2.1.23** One number CIP dosing tank along with dissolving basket, agitator, gear box, motor, valves, fittings, instrumentation and accessories.
- 2.1.24** One number (1W) CIP dosing pumps complete with all instrumentation, cartridge filter, valves, piping, fittings, motors, recirculation line etc.
- 2.1.25** Two nos. hypo dosing tanks along with valves, fittings, instrumentation and accessories.
- 2.1.26** Two (2) nos. (1W+1S) hypo dosing pumps complete with all instrumentation, valves, piping, fittings, motors, etc.
- 2.1.27** One number PE dosing tank along with dissolving basket, agitator, gear box, motor, valves, fittings, instrumentation and accessories.
- 2.1.28** Two (2) nos. (1W+1S) PE dosing pumps complete with all instrumentation, valves, piping, fittings, motors, recirculation line etc.
- 2.1.29** One (1) no. overhead service water storage tank complete with valves, Instrumentation, fittings, piping etc. as required.
- 2.1.30** One (1) no. RCC clear water tank (RCC work in BHEL scope) complete with valves, Instrumentation, fittings, piping etc. as required.
- 2.1.31** Two (2) nos. (1W+1S) clear water disposal pumps complete with all instrumentation, valves, piping, fittings, motors, recirculation line etc.
- 2.1.32** Two (2) nos. (1W+1S) permeate pumps complete with all instrumentation, valves, piping, motors, fittings etc.
- 2.1.33** One no. (1) sludge holding tank (RCC work in BHEL scope) complete with valves, Instrumentation, fittings, piping etc. as required.
- 2.1.34** Two (2) nos. (1W+1S) anoxic tank recirculation pumps with all instrumentation, valves, piping, motors, fittings etc.
- 2.1.35** Two (2) nos. (1W+1S) thickener feed pumps with all instrumentation, valves, piping, motors, fittings etc.
- 2.1.36** One no. of thickener with associated valves, instruments, piping, fittings and required accessories.
- 2.1.37** Two (2) nos. (1W+1S) centrifuge feed pumps with all instrumentation, valves, piping, motors, fittings etc.
- 2.1.38** One (1) no. Centrifuge with one sludge trolley along with associated valves, instruments, piping, fittings and required accessories.
- 2.1.39** Two (2) nos. (1W+1S) oil free type air blowers with piping, instrumentation, valves, fittings, electric motor drives for supplying air required for aeration tank and common sewage collection sump. 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 as required. Acoustic hood for air blowers shall also be provided by the bidder.
- 2.1.40** Two (2) nos. (1W+1S) oil free type air blowers with piping, instrumentation, valves, fittings, electric motor drives for supplying air required for MBR tank. 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 as required. Acoustic hood for air blowers shall also be provided by the bidder.
- 2.1.41** Two (2) nos. (1W+1S) Hypo dosing tank along with two nos. hypo dosing pumps (1W+1S) for dosing solution to clear water tank complete with piping, valves, fittings, necessary instrumentation and accessories.
- 2.1.42** One number personnel water drench safety shower and eye bath along with piping, valves, fittings & accessories shall be provided by the bidder.
- 2.1.43** 200-meter hose pipe (50NB) from clear water disposal pumps shall be provided by bidder for horticulture purpose.
- 2.1.44** All drains of STP plant shall be connected to common sewage collection sump inside STP area.
- 2.1.45** All Chemicals for membrane cleaning of Membrane Bio Reactors for trial run, commissioning and PG test shall be in bidder's scope. In addition, chemicals required for MBR cleaning after handing over of the STP for 6 months regular operation shall also be in the scope of bidder.
- 2.1.46** One number Effluent Quality Monitoring System (EQMS) at discharge of STP. Required instrumentation is indicated in P & ID.
- 2.1.47** Ventilation system required for housing of items of inside STP area in building shall be in bidder's scope, if required during detailed engineering.

2.1.48 PIPING

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- a) Complete piping indicated in P & ID of Sewage treatment plant is in bidder's scope of supply and erection. 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.
- b) Pipe distances are given below:

SL. NO.	FROM	TO	DISTANCE (In meters)
1.	Sewage sump (S1)	Sewage sump (S5)	315
2.	Sewage sump (S2)	STP area	210
3.	Sewage sump (S3)	STP area	160
4.	Sewage sump (S4)	Sewage sump (S3)	275
5.	Sewage sump (S5)	STP area	350
6.	Sewage sump (S6)	Sewage sump (S4)	325

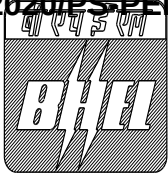
Sewage sumps S1, S2, S3, S4, S5 and S6 shall be located outside STP area however rest facilities indicated in P&ID of STP shall be located inside STP area provided in plot plan included in this specification.

Bidder to note that no commercial settlement / adjustment shall be entertained for variation up to +/- 15% of pipe lengths tabulated above during detailed engineering. Bidder to further note that above piping distances are in bidder's scope. Distances given above are from one area to other area only, however inside piping in respective area shall be in bidder's scope which is not included in above distances.

2.1.49 OTHER TECHNICAL REQUIREMENTS/ SCOPE

- Bidder to note that the equipment, valves, piping, control & instruments indicated in the P&IDs for Sewage Treatment Plant attached in the technical specification are minimum and are in bidder's scope. During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, equipment's etc. as required for smooth, safe, efficient, trouble free operation and completeness of the respective sewage treatment plant, meeting the specification requirement.
- All sewage transfer piping from sewage sumps up to Sewage treatment plant shall be routed on pedestals/ buried. 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 by bidder during detailed engineering.
- The pipe sizes indicated in the tender specification/ P&I diagrams are minimum. Wherever pipe sizes are not indicated, the same shall be selected based on the specification requirement and shall be subject to BHEL/ customer approval during detailing engineering. All pipes shall be carbon steel heavy grade unless exclusively mentioned.
- 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.
- Bidder to take care of the length of piping as included elsewhere in the technical specification. Pipe routings shall be decided during detailed engineering.
- All steel inserts plates with lugs, rungs, ladder, puddle pipes, bolts, edge angle in desired shape, nuts, sleeves, gaskets and all other embedding components etc. as required to grout in BHEL civil works and to support/hold the equipment being supplied under this specification shall be in bidder's scope. Rungs/ ladder provided by bidder in any sump shall be coated with suitable material w.r.t. water/ liquid handled.
- All pipes, fittings etc. required for hand railing, platforms, and ladders shall be in the scope of bidder. All ladders shall be non-civil work. Supply and erection of Hand railing as required for safety purpose will be in bidder's scope. All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per ASTM A 500 or equivalent international standard galvanized using 750 gm. / sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm center to center of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of

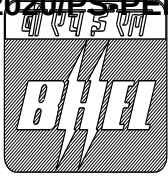
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railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminum/ Teakwood handrail shall be provided, unless specifically mentioned otherwise.

- All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- Hangers and supports for all the piping as per the requirement shall be in bidder's scope.
- 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.
- All the sumps, tanks, reservoirs and other water retaining structures shall be provided with access ladders/rungs from operating platforms/ground level as the case may be and de-watering pits one for each section (civil work by BHEL).
- 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.
- One set of all special tools & tackles of reputed make necessary for proper maintenance or adjustment of the equipment being supplied by the bidder for Package, packed in permanent box.
- One set of maintenance and repair tools including all special tools and tackles required for the installation and maintenance of equipment for package for commissioning, testing, calibration, modification and maintenance.
- Finish paints for touch up painting of equipment after erection at site in sealed container.
- All the first fill and one Year's topping requirements or 15% of first fill quantity, whichever is more, of consumable such as greases, oil, lubricants, servo fluids/ control fluids, 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 furnished by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.
- Monitoring gadgets, instruments and equipment required for maintenance (till demonstration/ PG test and plant handover).
- Instrument hook up material shall be in bidder's scope.
- 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.
- All other items are also included in scope of supply as specified in other parts of the technical specification.
- Any statutory requirement / clearance required from government / local body shall be in bidder's scope. Bidder to also comply local body / government norms.
- All motorized valves shall be provided with integral starter.
- Start-up and commissioning spares as required.
- Mandatory spares for Sewage Treatment Package as per the list attached in ANNEXURE-VI/ Sub Section IA & specified elsewhere in the technical specification.
- Electric hoist and chain pulley block along with trailing cables.
- 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.
- Recirculation lines for pumps shall be provided by bidder along with valves, instrumentation, fittings as per system requirement.
- Bidder to follow latest version of all codes and standards.
- Apart from package specific design requirement indicated in this technical specification, design of various systems/ sub-systems and all equipment/ items will also strictly meet stipulations of General Technical Requirements of Customer's Technical Specification (included in Annexure-XII/ Sub Section IA) as relevant to Package.
- All Valve, piping, fitting, and instrument shall be of minimum PN 10/ 150 class rating.
- The MOCs indicated in the Technical Specification, Datasheet and P&IDs for various items/ equipment/ piping/ valves/ fittings are minimum requirement and to be complied by the bidder.
- Initial charge of all lubricants & grease in bidder's scope.
- Diaphragm seal for instruments shall be provided by bidder as per technical requirement.
- Material handling equipment for sewage sumps.
- 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.

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- Grouting material required for fixing of equipment/ items.
- All documents, including the installation and operation and maintenance manuals as well as the related software shall be in fluent, legible English.
- MBR skids along with chemical dosing systems as indicated in P & ID included, shall be housed in industrial shed. However, shed may convert to building during detailed engineering as per BHEL/ customer requirement, then required ventilation fans shall be in bidder's scope.
- In case the bidder is not the manufacturer of the MBR (membrane bioreactor), then he has to buy the MBR from the BHEL and MahaGenco approved make of MBR. For this the bidder has to submit the full credential of the MBR supplier with supporting end user certificate for successful operation of the MBR (MBR capacity minimum 20m3/day) for at least one year from the date of operation of the MBR unit. The design of the MBR based sewage treatment calculation and operational philosophy to be vetted by the MBR supplier which shall be subject to BHEL and MahaGenco approval during detail engineering.

2.2 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Sub Sections IB and IIB.

2.3 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Sub Sections IC and IIC.

2.4 SCOPE OF SUPPLY (CIVIL)

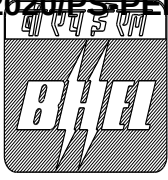
Complete architectural, structural and civil design and construction work for Sewage Treatment Plant is in BHEL Scope. However, civil input drawings shall be furnished by the bidder during detailed engineering.

3.0 SCOPE OF SERVICE

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

- Unloading, Storage, handling and transportation at site.
- Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself, excavation & filling of earth for buried pipes if and as required. Vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation.
- Pre-commissioning work such as flushing, hydraulic testing etc. Necessary tools, consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- Erection and Commissioning of Sewage Treatment Plant.
- Arrangement of all lubricants, instruments, tools, reagents for carrying out trial run, commissioning and performance guarantee/ demonstration test.
- Monitoring gadgets, instruments and equipment required for maintenance (till performance guarantee/ demonstration test & Plant Hand over).
- All personnel required during commissioning, trial run and performance guarantee/ demonstration test.
- Trial run for requisite period.
- Performance guarantee/ demonstration test of Sewage Treatment Plant.
- Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- Relevant requirements as per GTR, GCC, ECC & SCC etc.
- Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically excluded from scope of services.
- Painting as per enclosed painting schedule ANNEXURE V/ 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.
- Any statutory requirement / clearance required for package from government / local body shall be in bidder's scope.

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- o. During implementation of logic and FAT of BHEL DCS, bidder will depute his concerned representative for technical support as and when required by customer / BHEL. Bidder to refer sub sections IC and IIC also.
- p. 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.

4.0 TERMINAL POINTS

- a. Service Water pipeline (50 NB) will be provided by BHEL at 5m distance from sewage treatment plant area. Further distribution inside Sewage treatment plant area will be in bidder's scope. Bidder to note that pressure available at terminal point for service water will be approximately 1-2 kg/cm². Hence, bidder will take care for their pump lubrication/ cooling accordingly.
- b. Potable water connection (50 NB) shall be provided by BHEL 5m distance from sewage treatment plant. Further distribution inside sewage treatment plant area will be in bidder's scope.
- c. All chemical slippage drains of Sewage Treatment plant shall be led to common sewage collection sump.
- d. Instrument airline (25 NB) will be provided by BHEL at 5 m distance from Sewage Treatment Plant area. Further distribution inside Sewage treatment plant area will be in bidder's scope. Bidder to note that pressure available at terminal point for Instrument air will be approximately 3-7 kg/cm².
- e. Service airline (25 NB) will be provided by BHEL at 5 m distance from sewage treatment plant area. Further distribution inside sewage treatment plant area will be in bidder's scope. Bidder to note that pressure available at terminal point for Service air will be approximately 3-7 kg/cm².

5.0 EXCLUSIONS

- 5.1 All civil construction works including foundation of equipment, structural shed, excavation & back filling.
- 5.2 Main pipe trestles.
- 5.3 Air conditioning & firefighting facilities.
- 5.4 Other exclusions are mentioned in the Electrical & C&I parts of this specification.
- 5.5 Service water, Potable Water, Instrument air, Service air up to terminal points.
- 5.6 Monorail beams for electric hoists.

6.0 QP AND SUBVENDOR APPROVAL:

- 6.1 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.
- 6.2 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.
- 6.3 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.

7.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

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

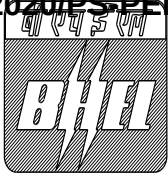
8.0 DESIGN/ CONSTRUCTION REQUIREMENTS

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

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

The material of construction specified in 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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8.1 STP's sump depth may vary from 2.5 to 4.5 meters.

8.2 Max. support length in meters for MS pipe shall be as follows: -

a)	PIPE DIAMETER (MM)	1200	1000	800
b)	SPAN (METERS)	12	10	10

For pipe sizes less than 800 NB, span shall be as per ANSI B31.1.

8.3 METERING PUMPS

- Pumps shall be simplex displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.
- The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the pumps are running or stopped. Adjustment of capacity shall be done by automatically from remote location and / or manually (micrometric adjusting type) locally for each of the pump as described elsewhere.
- Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard + 1% of capacity setting.
- Pumps shall be provided with an integral relief valve, spring operated, to release pressure when delivery line blockage occurs.
- Crank case shall be constructed of high quality cast iron which will also house the gear box and guides for cross head.
- Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge sides. Suitable gland seal be provided to prevent leakage.

9.0 PAINTING

Painting schedule shall be prepared in line with the details indicated in Annexure V/ 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.

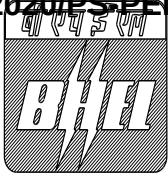
10.0 INFLUENT QUALITY AND OUTLET GUARANTEE PARAMETERS

Bidder to refer Annexure VIII/ Sub Section IA for influent qualities for designing of Sewage treatment plant. Bidder to refer Annexure III/ Sub Section IA for Performance/ outlet guarantee requirements of the package.

11.0 DRAWING/ DOCUMENTS REQUIREMENT

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

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11.3 Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure IV/ Sub Section IA of this specification. Bidder would be provided access to the DMS for drg./doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

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

12.0 ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK)

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

Manual hoists (hand operated) shall be designed to duty class 2 as per IS 3832 and electric wire rope hoist shall be designed as per IS: 3938 (latest).

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

Maintenance tools and tackles shall be as per data sheet attached.

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

Hoists shall be provided in all areas where any equipment/ component weighing above half ton is installed and needs to be handled for maintenance purposes. Number of monorail beams shall be such that the centre line of the hoist and the centre line of equipment to be handled shall be not more than half meter. The location and number of hoists is to be finalized during detailed engineering. Final arrangement is subject to approval of Customer.

The hoist capacity shall be selected considering 25% margin over the weight of heaviest component /equipment to be handled. The hoist parameters (i.e. lift & travel) are subject to change/s, to suit the final layout of the area in which it is intended to be installed.

Electric hoist shall be provided for capacity >1T.

Chain pulley block (Manual hoist) - 500kg to <=1T, wherever feasible, considering layout constraints.

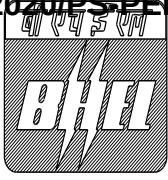
For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical/ manual hoist with the help of floor operated pendant.

12.2 SCOPE OF SUPPLIES

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

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

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

- Equipment offered shall be suitable for indoor duty conforming to Class II of IS: 3938.
- Equipment shall be designed to operate in non- hazardous area.
- Electric hoists shall be pendent operated.
- Both hoisting and trolley movement shall be motor driven.
- Hoisting motion shall be thru' VVVF drives to achieve creep speed of 10% of main speed.
- Wheels shall be single flanged type.
- Hook shall be swiveling type and fitted with a safety latch.
- Control panel shall be hoist mounted.
- Power feeding to the electric hoists shall be thru' PVC shrouded DSL.
- Brakes shall be fail to safety.
- Load/overload testing of the hoists shall be carried out as per IS: 3938.
- All material, castings and forgings will be of tested quality & certificates shall be made available for review as per approved QAP
- Lifting lug, eye bolts etc., for handling hoist parts.
- Erection hardware.

12.2.2 Erection and Commissioning spares (ELECTRIC HOIST)

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

12.2.3 Services to be provided by the bidder

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

12.2.4 Erection and Commissioning

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

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

12.3 INSPECTION AND TESTING

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

12.4 TESTING AT VENDOR'S WORKS

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

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

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

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

12.5 MAKE OF SUB - VENDOR ITEMS

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

12.6 TESTING AT SITE

A) ELECTRIC HOIST:

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

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

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

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

B) MANUAL HOIST:

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

12.7 MAINTENANCE TOOLS AND TACKLES

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

The following shall be provided as minimum requirement:

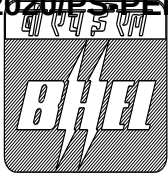
S. No.	Description	Qty.
1	Complete set of ring spanners	1 Set
2	Complete set of screwdrivers (Min. 6 nos of suitable sizes)	1 Set
3	Adjustable Spanner	1 No.
4	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6	Grease Gun	1 No.
7	Oil Gun	1 No.
8	Hand Lamp	1 No.
9	Line tester	1 No.

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

13.0 SPARES

The Bidder shall include in his scope of supply all Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. Requirements of mandatory spares are indicated in Annexure VI/ Sub Section IA for bidder's adherence.

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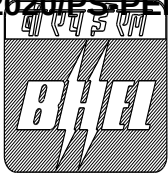
14.0 ADDITIONAL REQUIREMENT

- 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 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 X/ Sub Section IA during detailed engineering.
- IX. Bidder to adhere site storage and preservation requirement as per Annexure XI/ Sub Section IA during detailed engineering.
- X. Bidder to adhere site General technical requirement as per Annexure XII/ Sub Section IA during detailed engineering.
- XI. Bidder to adhere Annexure IX PID and Plot Plan of Sub Section IA.
- XII. Bidder to refer Plot plan attached in Annexure XII/ Sub Section IA. Location of sewage collection sumps located 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 sumps up to Sewage treatment plant shall be buried.

15.0 GENERAL TECHNICAL INSTRUCTIONS

- 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 of Sewage treatment plant.
- 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.

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	TITLE :		SPECIFICATION NO. PE-TS-415-673-A001	
	1 X 660 MW BHUSAWAL THERMAL POWER PROJECT		SECTION: I	
	TECHNICAL SPECIFICATION FOR WATER SEWAGE TREATMENT PLANT		SUB-SECTION: IA	
			REV. No. 00	DATE :

- 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.
- 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.

16.0 PLANT OPERATION AND CONTROL

Sewage Treatment Plant shall be controlled from DDCMIS (BHEL Scope) based control system.

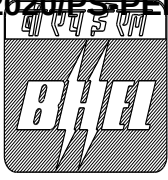
In addition, operation shall be from local control panel also. In view of this, bidder shall provide total eight nos. (8) local control panel for the following areas:

- One local control panel at each sewage lifting sump location (S1 to S6) i.e. total six numbers
- Two nos. control panels for inside STP area for all drives.

The control philosophy of system is described below. Following basic process related interlocks, alarms/ pre-warning 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:
 - (i) Starting & tripping of pumps with respect to liquid level in the respective sump/ tanks or liquid pressure in the suction lines.
 - (ii) Starting & tripping of agitators with respect to liquid level in the respective sump/tanks.
 - (iii) Starting & tripping of pumps (which are provided with forced water lubrication) with respect to lubricating water flow (through low pressure/ low flow signal as the case may be).
 - (iv) Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.

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- (v) 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.
- (vi) Automatic opening of the re-circulation valve to pre-set percentage, in case of failure of opening of pump(s) discharge valve to ensure minimum flow through the pump, as per the recommendation of manufacturer.
- (vii) Automatic starting of standby pumps upon failure of starting of selected pump or tripping of running pump as the case may be.
- (viii) Capacity of the metering pump shall be controllable from 10-100% continuously by adjusting the stroke length manually by a micro meter dial calibrated for 0–100% of pump capacity integral with the pump.
- (ix) Various annunciations related to low level of the chemical tanks & sumps shall be provided.
- (x) Alarms/ signals
- (xi) 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.
- (xii) Failure of starting of equipment such as pumps, blowers etc. upon start command.
- (xiii) 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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	TITLE :		SPECIFICATION NO. PE-TS-415-673-A001	
	1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION: I A	
			REV. NO. 00	DATE :

ANNEXURE I QUALITY PLAN

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QUALITY ASSURANCE REQUIREMENTS

CONSULTANT : PROCON ENGINEERS

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ENCLOSURES

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| ANNEXURE–A | FORMAT OF QUALITY ASSURANCE PROGRAMME |
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1.0 QUALITY ASSURANCE PROGRAMME

1.1 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following:

1.1.1 His organisation structure for the management and implementation of the proposed quality assurance programme.

1.1.2 Documentation control system.

1.1.3 Qualification data for Bidder's key personnel.

1.1.4 The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

1.1.5 System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

1.1.6 Control of non-conforming items and system for corrective actions.

1.1.7 Inspection and test procedure both for manufacture and all site related works.

1.1.8 Control of calibration and testing of measuring and testing equipments.

1.1.9 System for quality audit.

1.1.10 System for indication and appraisal of inspection status.

1.1.11 System for authorising of release of manufactured product to the Owner.

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1.1.12	System for handling storage and delivery.	
1.1.13	System for maintenance of records.	
1.1.14	Furnishing of quality plans for manufacturing and field activities, detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.	
2.0	<u>GENERAL REQUIREMENTS - QUALITY ASSURANCE</u>	
2.1	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection /tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder, separately in the format attached at Annexures and shall be submitted to Owner/ Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.	
2.2	Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc, during all stages of materials procurement, manufacture, assembly and final testing/performance testing.	
2.3	Field Quality Plans shall detail out for all the equipment, the quality practices and procedures etc to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.	
2.4	The Bidder shall also furnish copies of the reference documents / plant standards / acceptance norms/tests and inspection procedure etc as referred	

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

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

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2.14	For quality assurance of all civil works refer to the specifications for civil works.	
3.0	<u>QUALITY ASSURANCE DOCUMENTS</u>	
3.1	The Contractor shall be required to submit two (2) copies and two (2) sets of softcopies in the form of CD of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :	
3.1.1	Material mill test reports on components as specified by the specification.	
3.1.2	The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.	
3.1.3	Non-destructive examination results/reports including radiography interpretation reports.	
3.1.4	Factory tests results for testing required as per applicable codes and standards referred in the specification.	
3.1.5	Welder identification list incorporating welder's and welding operator's qualification procedure and welding identification symbols.	
3.1.6	Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.	
3.1.7	Stress relief time temperature charts.	
3.1.8	Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following shall also be recorded :	
	(a) When some important repair work is involved to make the job acceptable.	
	(b) The repair work remains part of the accepted product quality.	

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3.2	Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.	
4.0	<u>INSPECTION, TESTING AND INSPECTION CERTIFICATES</u>	
4.1	The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.	
4.2	The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, shall attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified Six (6) copies of test reports.	
4.3	The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, on any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.	
4.4	When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/ Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/ Inspector to issue such a	

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certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract. 4.5 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/ Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing. 4.6 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans shall be made for each three consecutive months and shall be furnished before beginning of each calendar month.		

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FORMAT OF QUALITY ASSURANCE PROGRAMME

ANNEXURE – A

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

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FIELD WELDING SCHEDULE

ANNEXURE – B

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

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

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The Field Welding schedule shall be submitted for:

- (a) Pressure Parts
- (b) Tanks/Vessels
- (c) Piping
- (d) Heavy/Important Structural Steel
- (e) Heat Exchangers
- (f) Bus Ducts

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ANNEXURE A

MINIMUM TESTING AND INSPECTION REQUIREMENTS

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~~to ensure required contact area and joint tightness shall be carried out.~~

2.1.2 Low Pressure Enclosure (Fabricated)

(a) Where welds are made by chipping and grinding back to the first side weld before completing the weld from second side, a magnetic particle or dye penetrant examination of the chipped area shall be carried out.

(b) Bidder to furnish their practice regarding stress relieving of the fabricated enclosures for Owner's approval.

(c) Bidder to furnish their standard practice regarding NDT on welds for Owner's approval, however following are minimum NDT requirements:

(i) Butt welds	10% RT or UT
(ii) Fillet welds	10% MPE/DPT
(iii) Nozzle welds	10% MPE/DPT
(iv) Lifting lug & other load bearing fillet welds	100% MPE/DPT
(v) Site weld edge preparations	10% MPE/DPT

(d) Bidder to furnish his proven practice for hydraulic pressure tests. If it is not their practice, the justification for not carrying out hydraulic test shall be furnished for Owner's approval.

(e) Feeler gauge tightness check from inside and outside to ensure required joint tightness shall be carried out.

2.1.3 Rotors

2.1.3.1 Forging

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(c) Refer relevant clauses of the specification for other items such as piping, heat exchangers, valves, filters, blowers / exhausters etc in this system. 2.3 <u>PIPING, BELLOWS AND THERMAL INSULATION FOR TURBINE & AUXILIARY SYSTEMS</u> 2.3.1 Piping and Fittings 2.3.1.1 All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification. 2.3.1.2 All pipe lengths shall be subjected to 100% ultrasonic examination or hydraulic tests and UT/RT on longitudinal welds at the tube mill. 2.3.1.3 All mother pipes used for fittings shall be subjected to a hydraulic test or an ultrasonic test at the tube mill. Raw material of all forged fittings shall be ultrasonically tested. Forged fittings shall be ultrasonically tested. 2.3.1.4 Welded and cast fittings, if any, shall be subjected to suitable NDT as per applicable standards. However, as a minimum 100% RT shall be carried out on all alloy steel fittings and on carbon steel fittings for use above 71 bar design conditions. 2.3.1.5 The edge preparation for shop and site welds shall be checked by MPI/LPI however edge preparation in stainless steel alloy/ steel shall be subjected to a Dye penetrant check. 2.3.1.6 Thickness of pipe bends shall be checked by ultrasonic or other acceptable methods on sample basis for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination / LPI. 2.3.1.7 Non-destructive examination of welds shall be carried out after post weld heat treatment, if any. For P91, material NDT (UT or RT) shall be carried out after PW HT. For carbon steel and low alloy steel (P-22, P-12, P-11), RT or UT shall be carried out before PWHT and MPI will be carried out after PWHT.		

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2.3.1.8 Non-Destructive Examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met (except for oil piping). Further statutory requirement, wherever applicable shall also be complied with. (a) Temperature > 400 deg. C and/or pressure exceeding 71 bar. (i) 100% RT/UT on butt welds and full penetration branch welds. (ii) 100% MPE. (b) Temperature > 175 deg. C up to 400 deg C and/or pressure exceeding 17 bar and up to 71 bar. (i) 100% RT/UT on butt welds and full penetration branch welds for pipe dia more than 100 NB. (ii) 10% RT / UT on butt welds and full penetration branch welds for pipe dia up to 100 NB. (iii) 100% MPE. (c) Wherever SR/PWHT is envisaged, above NDTs shall be after SR/ PWHT. (d) For all other pipes not covered above (except oil piping), shall be subjected 100% MPE/DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT. (e) Hardness survey of welds shall be carried out on alloy steel/ stainless steel piping. (100% Hardness survey of welds on P91 material grade pipings). (f) For welds in P91 materials, only induction type of heating shall be deployed for heat treatment. (g) Oil piping shall be subjected to following NDT.		

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(i) Butt welds of Oil piping shall be subjected to 10% RT and 10% DP Test. For Jacking oil lines 100% RT & 100% DPT shall be carried out on butt welds. (ii) Fillet welds with load transfer shall be subjected to 100% MPE/DPT and fillet welds without load transfer shall be subjected to 10% MPE/ DPT. (h) Rubber lined pipes shall be hydraulically tested before rubber lining. All rubber lining is to be subjected to following tests as per IS-4682 part-I or acceptable equivalent: (i) Adhesion test (ii) Check for resistance to bleeding (iii) Measurement of thickness (iv) Shore hardness test (v) Visual examination and spark test at 5 kv/mm of thickness. 2.3.2 Metallic Expansion Bellows (a) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out. (b) All welds shall be subjected to 100% magnetic particle/dye penetrant check and butt welds shall be subjected to 100% radiographic testing. (c) All the bellows subjected to vacuum service shall be subjected to vacuum test. (d) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.		

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(e) Complete hanger will be subjected to performance test and load test. 2.4 <u>VALVES</u> 2.4.1 Inspection and testing requirements for valves other than extraction line valves and butterfly valves shall be as follows:- (a) Pressure retaining parts of valves shall be subjected to NDT as per Table 1. (b) Bar stock/forging above 40mm diameter for valve trim shall be subjected to UT. (c) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check. (d) Colour matching of valve disc/plug and seat shall be carried out to ensure contact. (e) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 16.34. (f) Air seat leak test shall be carried out as per applicable Standards/Codes. (g) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet: (i) Smooth operation (ii) Valve travel, closing and opening time. (iii) Current drawn by actuators. (h) Springs for safety valves shall be tested with suitable NDT and for spring rate. (i) Safety and safety relief valves shall be tested for performance.		

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TABLE-1
NDT REQUIREMENTS FOR PRESSURE RETAINING COMPONENTS OF
VALVES

	Valve size NB in mm	ANSI Class upto 300	ANSI Class above 300 upto 600	ANSI Class above 600 below 900	ANSI Class 900 & above & below 4500
1.0	Less than 50	Visual	Visual	Visual	MPI
2.0	50 & above but below 100	Visual	Visual	MPI	MPI & RT (on 10% of valves on 100% area)
3.0	100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on change of section & weld ends)	MPI & RT (on 100% area)
4.0	300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT on 100% area)

Note:

1. For body and bonnet forging UT with MPI may be adopted in place of RT. For austenitic steel MPI may be replaced by LPI.
2. Weld Edge Preparation shall be subjected to MPI/LPI
3. Each valve body and bonnet shall be hydraulically tested at 1.5 times the maximum working pressure.

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2.4.2 Extraction Line Valves (a) Surface crack examination and hardness check shall be carried out on all hard faced/ stellieted surfaces, if any. (b) As a minimum requirement of castings for all valves on cold reheat and extraction lines shall be subjected to 100% MPI on all areas and RT on Butt Weld ends and change of Section. For forging minimum requirement shall be 100% UT and 100% MPI. (c) Bar stock for valves stem shall be subjected to UT. Finish machined valve stem shall be subjected to magnetic particle examination/dye penetration test. (d) Wall thickness measurement by ultrasonic for critical and highly stressed zones of the casting/forging shall be carried out. (e) Colour matching of the valve disc and seat to ensure required contact area shall be carried out. (f) Hydraulic pressure tests shall be carried out on each valve to check body and bonnet strength. Seat leakage and back seat leakage test (wherever applicable) shall be carried out. Air seat leakage test shall also be carried out. Minimum test requirements of pressure shall be as per ANSI B 16.34. (g) Functional testing shall be carried out on each valve to check for freedom of movement, adherence to clearance, opening/closing etc. Type tests for discharge co-efficient and pressure drop co-efficient, shall be carried out. In case the type tests have been carried out in the past and documents generated, the same shall be furnished to the Owner for approval. 2.4.3 Butterfly valves (a) Valve disc shall be checked for surface and sub-surface defects by magnetic particle examination.		

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	(b) Stubs and driving shafts shall be tested for internal defects by ultrasonic method. (c) Dye penetration test shall be carried out on shafts, seat rings etc. (d) Test samples for rubber seal shall be subjected to tensile and hardness test for vulcanising and after ageing. Hydraulic stability test and ozone crack resistance tests also be carried out. (e) Valve shall be subjected to hydraulic pressure test for body and air seat leakage tests as per AWWA-C504 (f) Proof of design tests for valves and actuator shall be carried out as per AWWA-C504. In case the test has already been carried out on previous supplies, the Bidder may submit the test certification of same for approval of Project Manager. (g) After complete assembly each valve with actuator will be subjected to performance test by opening and closing the valve from fully closed to fully open position and the reverse, under no flow for at least 25 cycles to check. (i) Smooth uninterrupted movement of valve. (ii) Closing and opening time. (iii) Current drawn by actuator. (iv) Operation of tripping switch and position indicator. (h) After assembly, one valve of each size with respective actuator shall be shop operated over the full range of movement in both the directions, with the body subjected to the full hydrostatic pressure conditions, to demonstrate that the unit is in working order without any leakage through the joints and torque switches/clutches, limit switches are operating satisfactorily. During the test, hand wheel operation, opening/closing time and current drawn shall also be checked. The test shall be conducted for three consecutive cycles with valve shaft both in vertical and horizontal planes.	

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2.5	<u>MISCELLANEOUS ITEMS / EQUIPMENTS</u>	
2.5.1	Filters / Strainers	
	(a) Filters/strainers shall be tested as per the requirements of relevant codes/standards.	
	(b) Filters/strainer shall be performance tested for pressure drop, flow, particle size. If performance test is earlier established, then records shall be reviewed.	
2.5.2	Blowers/ Exhausters	
	(a) Rotors shall be dynamically balanced. Leakage tests (if applicable) shall be carried out.	
	(b) Performance tests including noise and vibration tests shall be carried out as per relevant standards/codes.	
2.5.3	LP Chemical Dosing System	
	(a) Pumps of chemical doing system shall be performance tested as per relevant international codes.	
	(b) In case of diaphragm type of pumps, the life cycle test shall be done on pumps. If this test is already conducted for same model in earlier projects, then TCs for same shall be reviewed.	
	(c) Dosing skid shall be subjected to leakage test and functional test.	
2.6	<u>SITE TEST:</u>	
	Quality requirements for site activities shall be as a minimum, those specified for corresponding shop activities.	
2.6.1	Hydraulic Test of Pressure Parts:	
	On completion of erection of pressure parts of each steam turbine generator, the unit with its fittings and mountings in position shall be	

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	subjected to hydraulic test pressure in accordance with requirement of Indian Boiler Regulations. Water used for hydraulic test shall be made alkaline by addition of suitable chemical. After the test, all parts shall be drained and suitably preserved 2.7 <u>FEED WATER HEATER AND DEAERATOR</u> / PRESSURE VESSEL 2.7.1 All raw materials used shall have co-related mill test certificate meeting mandatory and supplementary checks of material specification. 2.7.2 Material for Tube plates shall be ultrasonically tested. Finished plates shall be subjected to suitable NDT. For clad plates, bonding shall be checked by UT. Vendor shall furnish their practice regarding manufacturing & NDT for supply of clad plates for owner's review. Drilled Tube plates shall be checked for ovality of holes, ligaments, surface finish etc. 2.7.3 Dished ends shall be subjected to 100% MPI and RT/UT on welded joints. Knuckle portion shall be checked by MPI for surface defects and thinning shall be checked by UT. 2.7.4 Butt Welded/Full penetration joints shall be checked by suitable RT / UT. Fillet welds shall be checked by MPI / DPT. 2.7.5 Tubes shall be tested as per the relevant codes/specification/standards. 2.7.6 Before tubes expansion in the tube sheets, the mockup test for expansions shall be carried out, in case not done earlier. Torque setting of expander shall be based on mock up tests. Joints shall be checked for tube thinning. 2.7.7 Completed assemblies shall be pressure tested with working-fluid/ hydraulically/pneumatically. The heat exchangers shall be tested on both tube side and shell side. After hydrotest, the heat exchangers shall be suitably dried and nitrogen capped. Atmospheric tanks shall be tested for leakage by water fill test for at least 12 hrs. 2.7.8 At Site Field Tests shall cover the determination of dissolved oxygen (ASTM - D888) and free carbon-di-oxide (APHA) in de-aerator effluent along with	

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thermal and hydraulic performance of the de-aerator. All performance shall be tested and evaluated as per ASME PTC 12.3 (latest edition).		

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2.7.10 Deaerators / MBR MEMBRANE

Components / Activity	Tests/ Checks	Chemical Analysis	Mech. Properties	Impact	Hardness	Flattening	Flaring	UT	RT	MPI	DPT	Eddy Current	Helium Leak Test	SR	HT	Hydraulic	Pneumatic	Dimensions	WPS/PQR/WQR/A pp. Performance test	Mock up Test
1.0	Shell & Dished End	Y	Y	Y				Y(a)		Y(g)				Y(a)				Y(e)		
2.0	Fabrication/Welding													Y				Y		
(a)	Edge Preparation/Fillet Weld									Y(b)	Y(b)									
(b)	Butt Joints/Branch Welding							Y(c)	Y(c)	Y	Y			Y				Y(d)	Y	
3.0	Complete Deaerator															Y		Y		
4.0	Safety & Safety Relief Valve & other valves	Y	Y					Y(f)	Y(f)	Y(f)	Y(f)					Y		Y(h)		

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2.7.11 Remarks for Feed Water Heaters and Deaerators		
(a)	After forming of plates. For dished end and Hemi head.	
(b)	Tubes shall be solution annealed	
(c)	DPT may be used as an alternate to MPI.	
(d)	UT/RT to be decided according to configuration/accessibility.	
	(i) For plates	
	(ii) For welding	
	(iii) For wall thickness	
(e)	Including wall thickness	
	(i) 100% RT/UT shall be carried out on bodies, bonnets, nozzle and stem of valves of HP heater.	
	(ii) 100% DPT/MPI on machined surfaces of valve body, bonnet, stem, disc & springs.	
(f)	Outer surface (Dished end Knuckle Portion)	
(g)	Including – Seat leakage – Relieving Capacity-popping test at set and blow down pressure.	
(h)	Include ovality of holes, surface finish and size of holes.	
(i)	For cladding bond and cladding thickness during bond check and after drilling	
(j)	For feed nozzle (pipes)	
(k)	For forgings	

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(l)	After bending also		
(m)	Dimension to include wall thinning		
(n)	Both tube and shell side. After Hydro test drying and nitrogen filling to be done.		
(o)	As per the code.		
Note:			
1. Quantum of Checks Shall be 100% Unless Otherwise Specified.			
2. Chem. /Mech. shall be one/ per heat or HT batch.			

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1.0	<u>INSPECTION, AND TESTING</u>	
1.1	<u>GENERAL</u>	
	The testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/systems shall be furnished as part of the bid.	
2.0	SEWAGE TREATMENT PLANT	
2.1	<u>TESTS AT MANUFACTURER'S WORKS</u>	
	Shop tests shall include all tests to be carried out at Bidder's works, works of their sub-vendors and at works where raw materials to be used for fabrication of equipment are manufactured. The tests to be carried out shall include but not be limited to the following:	
	(a) Composition of all material, castings, forgings etc.	
	(b) Hydraulic tests for pressure vessels, pipes, valves, pump casing etc.	
	(c) Tests to check faults in rubber lining [as per IS-4682 (Part-I) or its equivalent] and painting. Static balancing tests on agitators, stirrers, paddles, etc.	
	(d) Static and dynamic balancing tests on all impellers.	
	(e) Performance tests (Head, Capacity and Power) for each of pumps and blowers.	
	(f) Tests of all electrical equipment/accessories as specified in respective electrical sub-sections.	

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(g) Control Systems are to be checked for dimensions, wiring continuity, insulation, tubing leakage etc. (h) All instruments and accessories are to be checked for performance, over range protection etc as per I.S.A. or other relevant standards. (i) Calibration tests of all standard orifices, nozzles, pressure & other instruments. (j) Control valves are to be tested for body/seat/diaphragm leakage, lift characteristics and material compositions of body, seat & bonnet. (k) Functional tests of the control system. (l) Load tests for monorail hoists. (m) Calibration tests for Weigh Machine/Load Indicator. 2.2 <u>TESTS AT SITE BEFORE TRIAL RUN</u> Bidder shall carry out tests at site to prove to the Purchaser that each equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run, the Bidder shall be required to conduct tests to demonstrate to the Purchaser that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows: 2.2.1 All piping and valves, after installation, shall be tested hydrostatically at a pressure, one and half times of the maximum attainable pressure in the system, to check against leak tightness. 2.2.2 All valves/gates (Manual/Automatic/Remotely Operated) shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.		

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2.2.3	All pumps shall be run with the specified fluid from shut off conditions to valve wide-open condition. Head developed shall be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicators where applicable. If flow indicators are not available in the system, capacity can be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) and duration of test. During the test, the pumps and drive motors shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc. (a) Pumps, blowers etc. shall be tested at site to run smoothly without undue vibration, flow pulsation, temperature rise in bearing parts, noise etc. (b) The tests to be carried out for the fabricated storage vessels shall include: (i) During fabrication and before lining: - Bottom testing for leakage by soap solution, after the bottom and at least the bottom course of the shell plate have been welded. - Hydraulic shell testing for leakage. - Fixed roof test for leakage by soap solution. (ii) After rubber lining: - Water leakage test for storage tank by filling it with water up to the overflow level. (c) All the rubber lining shall be subjected to the following tests as per IS: 4682 (Part-I). (i) Adhesion test	

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(ii) Resistance to bleeding (iii) Thickness measurement (iv) Shore hardness (v) High voltage spark test (d) Epoxy painting shall be checked by dry type thickness gauge. (e) Visual check on all structural components, welding, rubber lining, painting etc. and if doubt arises these shall be tested again. (f) All testing and calibrating instruments and equipment shall be arranged by the Bidder free of cost to the satisfaction of the Purchaser. (g) All monorail hoists shall be subjected to full working load during all motions without showing any sign of defect. (h) All the rotating/moving components shall be run at the rated speed with water/chemicals up to the normal water level for a period of twenty four (24) hours. During this period all the components shall function smoothly without any unbalance, vibration, overheating at bearing parts etc. (i) Checks on electrical items as mentioned under electrical specifications.		

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TITLE :

1X660 MW BHUSAWAL THERMAL POWER
STATION UNIT -6TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANTSPECIFICATION NO. PE-TS-415-673-
A001

SECTION : I

SUB-SECTION: I A

REV. NO. 00

DATE :

QUALITY ASSURANCE

Tests/Check Items / Components											Remarks
	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	
1. Horizontal Centrifugal Pumps				Y	Y			Y ¹	Y		LEGENDS: Y Applicable 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 20 mm or above. Y ^d Dynamic Balancing per ISO: 1940, Grade 6.3 minimum. Y ¹ As per HIS, USA. Y ² 10% RT to be conducted on butt welds for Thk $\geq$ 10 mm. Y ³ Seat Leakage Test for actuator operated valves shall be done by closing the valve with job actuator. Y ⁴ Tests on Rubber Diaphragms per batch of Rubber mix such as Tensile, Elongation, Hardness, Thickness, Bleed Resistance, Flex Test for 1500 cycles etc. shall be conducted. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted, if not carried out earlier. Y ⁵ Seat Leakage Test is required to be done in both directions. Disc strength test as per relevant code shall be carried out. Y ⁶ Blue Matching, Wear Travel for Gate Valves, reduced pressure test for check valves shall be conducted per relevant standards.
1.1. Casing	Y ^a		Y ^b				Y				
1.2. Impeller	Y ^a		Y ^b							Y ^d	
1.3. Shaft	Y ^a		Y						Y ^c		
2. Vertical Pumps				Y	Y			Y ¹	Y		
2.1. Casing	Y ^a		Y ^b				Y				
2.2. Impeller	Y ^a		Y ^b							Y ^d	
2.3. Shaft	Y ^a		Y						Y ^c		
2.4. Fabricated Parts	Y ^a	Y	Y ^b			Y ²	Y				
3. Dosing/ Metering Pumps	Y ^a						Y	Y ¹	Y		
4. Gate/ Globe/ Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ⁶	
5. Dual Plate Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ¹²	
6 Diaphragm Valves	Y ^a				Y		Y ³		Y	Y ⁴	
6. Butterfly Valves (Low Pr.)				Y	Y		Y ³	Y		Y ⁵	
7.1 Body (Cast)	Y ^a		Y ^b								
7.2 Disc (Cast)	Y ^a		Y ^b								
7.3 Shaft	Y ^a		Y ^b							Y ^c	
8. Plug/ Ball Valves (Low Pr.)	Y ^a		Y ^b	Y	Y		Y	Y	Y		
9. Blowers	Y ^a		Y ^b	Y	Y		Y	Y	Y	Y ^{dc}	
10. Atmospheric Storage Tanks/ Pressure Vessels	Y ^a	Y	Y ^b	Y	Y	Y ⁸	Y		Y ^c	Y ⁷	

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TITLE :

1X660 MW BHUSAWAL THERMAL POWER
STATION UNIT -6TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANTSPECIFICATION NO. PE-TS-415-673-
A001

SECTION : I

SUB-SECTION: I A

REV. NO. 00

DATE :

QUALITY ASSURANCE

Tests/Check Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	Remarks
11. Rubber lining	Y ^a				Y				Y	Y ^d	Y¹ 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 be stress relieved as per the requirement of code. Y⁸ RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT. Y⁹ 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. Y¹⁰ 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. Y¹¹ 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. Y¹² Blue Matching, reduced pressure test for check valves shall be conducted per relevant standards. Dry cycle test on valve spring for 100000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
12. Reactor Clarifier	Y ^a	Y	Y ^b	Y	Y				Y	Y ¹⁰	
13. Clariflocculator/ Plate or Tube Settler	Y ^a			Y	Y				Y		
14. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ⁸		Y	Y		
15. Chlorine Tonner	Y ^a	Y	Y ^b	Y	Y	Y ⁸	Y				
16. Chlorine Evaporator	Y ^a	Y	Y	Y	Y	Y	Y				
17. Chlorinator & injector	Y ^a			Y	Y		Y	Y			
18. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y		Y ¹⁰	
19. Pipes	Y ^a	Y		Y	Y		Y		Y		
20. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y		Y ¹¹	Y	Y	Y ^{dc}	
After erection, the complete Piping system along with valves & fittings shall be hydraulically tested.											

5176/2020/PS-PEM-MAX

	TITLE :		SPECIFICATION NO. PE-TS-415-673-A001	
	1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION: I A	
			REV. NO. 00	DATE :

Notes:

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.

		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		1X660 MW BHUSAWAL TPS UNIT-6			
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		ELECTRIC WIRE ROPE HOIST			
						REV	0	CONTRACT No					
						DATE	Mar, 2017	CONTRACTOR		BHEL-PEM			
						PAGE	1 of 4						
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
								D*	M	C	N		
1	2	3	4	5	6	7	8	9		**	10		11
1.0	RAW-MATERIALS												
1.1	a) STRUCTURAL MATERIAL b) RAW MATERIAL FOR HOIST AND GEAR BOX HOUSING, TROLLEY PLATE, ROPE DRUM IF FABRICATED ETC	CHEM & MECH PROPS	MA	Lab analysis	1 SAMPLE PER LOT%	IS 2062 /APPD. DRG./ DATA SHEET	MTC/IR	√	P/V	V	V		Test shall be carried out in absence of mill TC or non-correlation of TC with material.BHEL to identify Samples for testing. Test to be carried out at NABL accredited Lab. Reports to be submitted for verification during inspection.
		NDT	MA	UT	100%	ASTM A388-2004	NOTE 1	IR	√	P	V	V	For dia / plate thickness above 25 mm
1.1 A	SEAMLESS PIPE FOR ROPE DRUM	CHEMICAL , MECHANICAL	MA	Lab analysis	1 SAMPLE /pipe	Approved drg/ASTM A 106 Grade A or B	MTC/IR	√	P/V	V	V		Test shall be carried out in absence of mill TC or non-correlation of TC with material.BHEL to identify Samples for testing. Test to be carried out at NABL accredited Lab. Reports to be submitted for verification during inspection
		Flattening & Acid Etching test	MA	PHYSICAL & METALLOGRAPHY	1 SAMPLE /pipe	No cracks, pitting, rusting , damage etc		IR	√	P	V	V	
		SURFACE DEFECTS	MA	Visual	100%								
1.2	FORGINGS FOR GEARS BLANKS ,PINIONS, SHAFT/AXLES, WHEELS , STEEL CASTINGS	MECH , CHEM. PROPS	MA	Lab analysis	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET / IS:3938	LAB. REPORT / MANUFACTURER'S TEST CERTIFICATE	√	P	V	V	
		NDT	CR	UT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	V	V	IF DIA or THK > 50mm
		Hardness , surface defects after hardfacing and machining/grinding	MA	DPT/MPI	100%	ASTM E -165 /E-709, No linear indication		MTC	√	P	V	V	
1.3	WIRE ROPE	Dimensional, type, construction ,	MI	measurement	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	MFRS' TEST CERT.	√	P	V	V	
		EXAMINATION OF REPORT OF BREAKING LOAD CAPACITY	CR	Review of TC	100%	IS: 2266		MFRS' TEST CERT.	√	P	V	V	
1.4	HOOKS	MECH. , CHEM. PROPS.	MA	Lab analysis	100%	APPROVED DRG/DATA SHEET IS:15560		MFRS' TEST CERT.	√	P	V	V	
		U.T IF SHANK DIA > 50mm	CR	NDT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	V/W	V	SHANK PORTION ONLY
		Dimension & PROOF LOAD TESTING	CR	Measurment , PROOF LOAD TEST	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560		QCR	√	P	V/W	V	IF REQUIRED BY END CUSTOMER.
		DPT AFTER PROOF LOAD	CR	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V/W	V	
1.5	SHEAVES	MECH	MA	Tensile & hardness	1/lot	Approved drgs		MTC/IR	√	P	V	V	

		MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		1X660 MW BHUSAWAL TPS UNIT-6			
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE	ELECTRIC WIRE ROPE HOIST				
						REV	0	CONTRACT No					
						DATE	Mar, 2017	CONTRACTOR		BHEL-PEM			
						PAGE	1 of 4						
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS		
									D*	M	C	N	
1	2	3	4	5	6	7	8	9		**	10	11	
1.6	CASTING FOR BEARING PLATED, ROPE GUIDES, PULLEYS ETC	CHEMICAL & MECHANICAL	MAJOR	LAB ANALYSIS	1/LOT	APPROVED DRG/MFG STANDARD	APPROVED DRG/MFG STANDARD	LAB REPORT	√	P	V	V	
2.0	IN-PROCESS												
2.1	Welding process capability and welder skill	WPS,PQR & WPQ	MA	Welding procedure approval and Welder performance qualification in accordance with ASME Section IX	100%	ASME Section IX		WPS,PQR & WPQ		P	V	V	In case approved WPS/PQR/WPQ from BHEL/NTPC/EIL/LLOYDS/TPL available, then documents/records to be submitted for verification during inspection, else, Vendor shall get the approval of Welding Procedure / Welder from the identified agency prior to carrying out welding at the
2.2	Welding of trolley, rope drum etc	Fillet weld	MA	DPT	10%	ASTM E165 or Eq/ No cracks or linear indication		INSPN. REPORT	√	P	V	V	
		Butt welds	MA	RT, DPT	100%	ASME SEC VIII, DIV 1, UW 51/52		RT FILM & REPORT	√	P	V	V	100% RT for butt weld in tension and 10 % in compression. 100% RT on butt weld of rope drum
		DPT AFTER STRESS RELIEVING OF ROPE DRUM	MA	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V	V	
2.3	NDT OF LOAD BEARING BUTT WELDS (IF ANY)	WELD QUALITY OF BUTT WELDS IN TENSION	CR	PT & RT	100%	ASME SEC. VIII DIV. I	ASME SEC. VIII DIV. 4 . CLUW-51 FOR RT APPENDIX -8 FOR PT	INSPN. REPORT ND FILM	√	P	W	V/ W	FILMS TO BE REVIEWED BY BHEL & END CUSTOMER/THIRD PARTY. DPT SHALL BE CHP .
2.4	GEAR BOXES												
	COMPLETE ASSEMBLY	OVERALL DIMENSIONS. LEAK TEST, REDUCTION RATIO, BACK LASH AND CONTACT PATTERN,	MA	MEAS./VISUAL	100%	MFG. DRG./KERSON E TEST	MFG. DRG./NO LEAKAGE WHEN FILLED	INSPN. REPORT	√	P	V		
	NO LOAD RUN TEST FOR 4 HRS	CHECK FOR OIL LEAKAGE, VIBRATION, NOISE ,TEMP. RISE. REDUCTION RATIO, BACKLASH , CONTACT PATTERN	MA	PERFORMANCE	100%	APPROVED DRGS /No leakage,Noise 85dbA maxat 1 mtrs, vibration 75 microns max, oil temp rise 20 deg above ambient max		- DO -	√	P	V	V	
3.0	ELECTRICALS												
1	MOTORS & CABLES	Make, type , rating	MA	Visual /measurment	100%	Apprvd drg	IS 325 / IS:3938	IR, MTC	√	P	V	V	For motor refer Note: 2
		ROUTINE TESTS											
3	LIMIT SWITCHES,SFU, ISOLATOR/ O/L RELAY, MCB, FUSES,PUSH BUTTONS,CONTACTOR, INDICATING LAMPS etc	Make , type , rating, functional, Continuity	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	
4	BRAKES	Make , type , rating, HV/IR, Functional test	MA	Review of TC	100%	Approved drgs		IR, MTC	√	P	V	V	
5	DSL	Make , type , rating, dimension	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	
6	Control transformer	Make , type , rating, input/output	MA	Review of TC	100%	Approved drgs		IR	√	P	V	V	
	CONTROL PANEL, PENDANT SWITCH	* FIXING OF COMPONENTS WIRING MARKING CONTINUITY * FUNCTIONAL TEST * IR & H.V. TEST * IP - PROTECTION TEST * PAINT SHADE, THICKNESS, SHEET THICKNESS, ADHESION TEST * DIMENSION	MA	VISUAL/MEASUR	100%	APPD.DRG. WIRING DIAGRAM,	APPD. DRG. WIRING DIAGRAM,	IR	√	P	V	V	
8	VVVF DRIVES (IF APPLICABLE)	MAKE , TYPE , RATING , ROUTINE TESTS.	MA	VISUAL/ VERIFY	100%	APPROVED DRAWINGS	APPROVED DRAWINGS	MTC	√	P	V	V	

	MANUFACTURERS NAME & ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT		1X660 MW BHUSAWAL TPS UNIT-6				
	AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE	ELECTRIC WIRE ROPE HOIST					
					REV	0	CONTRACT No						
					DATE	Mar, 2017	CONTRACTOR	BHEL-PEM					
					PAGE	1 of 4							
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
									D*	M	C	N	
1	2	3	4	5	6	7	8	9		**	10	11	
4.0	FINAL INSPECTION												
4.1	COMPLETELY ASSEMBLED HOIST	1. COMPLETENESS, CORRECTNESS, WELD QUALITY, OVERALL DIMENSIONS.	MA	VISUAL, MEAS	100%	APPD. DRG.	APPD. DRG.	MNFRS' TEST CERT.	√	P	W	V	CHP
4.2	ASSEMBLED HOIST PERFORMANCE WITH ACTUAL CONTROL PANEL, AND PENDENT PUSH BUTTON	1. LOAD TEST	CR	LOAD TEST at SWL	100%	IS:6547 / IS:3938	IS:6547 / IS:3938	MNFRS' TEST CERT.	√	P	W	V	CHP
		2. HOISTING & LOWERING SPEED, PERFORMANCE OF CONTROLLERS SWITCHES CONTACTORS, RELAYS AND OTHER CONTROL DEVICES CORRELATIONS OF CIRCUITS AND INTERLOCKS AND SEQUENCES OF OPERATION, CURRENT MEASUREMENT LIMIT SWITCH OPERATION.	CR	MEAS & VISUAL	100%	IS:3938, TECH SPEC.	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	CHP
		3. OPERATION OF ALL PROTECTIVE DEVICES	CR	VISUAL	100%	TECH SPEC	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	CHP
4.3	OVER LOAD TEST	OVER LOAD TEST INCLUDING HOLDING CAPACITY OF BRAKES, LIFTING LOAD FROM MID AIR, SOUNDNESS OF WELD AFTER OVERLOAD TEST.	CR	TEST AT 125 % OF-SWL	100%	IS:3938	IS:3938	INSPN. REPORT	√	P	W	V	CHP
5	PAINTING												
5.1	PRIMER & FINISHING AND SHADE	Examination - Shade, DOP by paper insertion method	MI	visual	100%	DRG. & DATA SHEET & RELV. IS SPEC.		MNFRS' TEST CERT.		P	V		
		DFT	MA	measurement	Sample					P	V		
6	PACKING	STURDINESS, PROTECTION MARKING	MA	VISUAL	100%	MFG STD	MFG STD			P			
	NOTE:												
1	When back wall echo is set to 100% in sound area then a) defect echo shall not exceed 20% b) Back echo shall be minimum 80% in any area.												
2	Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows : It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of specific requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starting KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.												
	LEGND												
	* RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY MANUFACTURER IN QA DOCUMENTATION.												
	** M: MANUFACTURER/SUBCONTRACTOR												
	C: BHEL/BHEL NOMINATED THIRD PARTY INSPECTION AGENCY												
MANUFACTURER/ SUB CONTRACTOR	N: CUSTOMER/CUSTOMER'S CONSULTANT/CUSTOMER'S APPOINTED THIRD PARTY												
	P- PERFORM, W- WITNESS AND V- VERIFICATION												
SIGNATURE	CHP- CUSTOMER HOLD POINT												
	REVIEWED BY						NAME & SIGN OF APPROVING AUTHORITY & SEAL						

	MANUFACTURER'S NAME & ADDRESS :	MANUFACTURING QUALITY PLAN ITEM : Chain Pulley Block QP No.: REV.:0, Date.: , PAGE: 2 OF 4	PROJECT : 1X660 MW BHUSAWAL TPS UNIT-6 PACKAGE : CHAIN PULLEY BLOCK

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTU M OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
					6.					10.			
1.	2.	3.	4.	5.			7.	8.	9.				11.
1.3	RAW MATL. (BAR /FORGING) FOR GEAR BLANKS/SHAFTS/ PINIONS/AXLE/ RATCHET PAWL / RATCHET WHEEL & PLATES FOR FABRICATION ETC	CHEMICAL COMPOSITION MECHANICAL INTERNAL DEFECTS NDT AFTER MACHINING	MA MA MA MA	Review Review UT DPT	ONE SAMPLE PER HEAT 100% 100%	Material specification as per approved drawings. ASTM A-388 REFER NOTE 1 ASTM E-165 NO RELEVANT INDICATION		MFR’ S TC IR TC	✓ ✓ ✓	P P P P	V V V V	V V V V	TC or inspection report for components shall be given. For rounds ≥50mm and plates ≥25 mm.
1.4.	LOAD CHAIN WHEELS	- CHEMICAL & MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	APPD. DRG.	APPD. DRG.	MTC	✓	P	V	V	
1.5	BEARINGS	MAKE, TYPE, CATALOUGE NO.	MA	VISUAL	RANDOM	APP DRG / MFR’S CATALOGUE	APP DRG / MFR’S CATALOGUE	IR	✓	P	V	V	
1.6	HAND CHAIN WHEEL	CHEMICAL MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	
1.7	HAND CHAIN	GRADE/ DIMENSION	MA	GRADE DIMENSION	100%	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	

MANUFACTURER / CONTRACTOR	LEGEND:	FOR CUSTOMER USE	
SUB-CONTRACTOR	** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL
SIGNATURE			

	MANUFACTURER'S NAME & ADDRESS :	MANUFACTURING QUALITY PLAN ITEM : Chain Pulley Block QP No.: REV.:0, Date.: , PAGE: 3 OF 4	PROJECT : 1X660 MW BHUSAWAL TPS UNIT-6 PACKAGE : CHAIN PULLEY BLOCK

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTU M OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
					6.					10.			
1.	2.	3.	4.	5.			7.	8.	9.				11.

1.8	TROLLEY GEARS, PINION, WHEELS, AXLE	CHEMICAL & MECHANICAL	MA	LAB ANALYSIS,	100%		APPVD DRGS	APPVD DRGS	IR/TC	✓	P	V	V	
2	IN PROCESS													
2.1	RATCHET PAWL / RATCHET WHEEL	-HARDNESS -SURFACE CRACK	MA MA	HARDNESS DPT	100% 100 %		IS:3832/ APPD DRG. ASTM E165	IS:3832/ APPD. DRG. NO DEFECT	IR IR	✓ ✓	P P	V V	V V	
2.2	COMPONENTS AFTER HARDFACING & MACHINING	HEAT TREATMENT SURFACE HARDNESS SURFACE CRACK DIMENSION	MA MA MA MA	HT CHART HARDNESS DPT FOR SURFACE CRACK MEASURE	100% 10% 100% 10%		IS 1875/IS 4367/IS 3832 --DO-- ASTM E 165	 NO DEFECT	IR IR IR IR	✓ ✓ ✓ ✓	P P P P	V V V V	V V V V	
3.0	FINAL INSPECTION													
3.1	COMPLETE ASSEMBLY	OVERALL DIMENSION ENDURANCE TYPE TEST OPERATIONAL PROOF LOAD & LIGHT LOAD TEST, EFFORT. HEIGHT OF LIFT	CR MA CR MA	MEASUREMENT TYPE TEST LOAD TEST VISUAL	100 % 1 PER SIZE 100% 100 %		IS:3832 /APPD DRG IS 3832 -DO- -DO-	IS:3832 /APPD DRG IS 3832 -DO- -DO-	IR TC IR IR	✓ ✓ ✓ ✓	P P P P	W V W W	V V V V	

MANUFACTURER / CONTRACTOR	LEGEND:	FOR CUSTOMER USE	
SUB-CONTRACTOR	** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL
SIGNATURE			

	MANUFACTURER'S NAME & ADDRESS :	MANUFACTURING QUALITY PLAN ITEM : Chain Pulley Block QP No.: REV.:0, Date.: , PAGE: 4 OF 4		PROJECT : 1X660 MW BHUSAWAL TPS UNIT-6 PACKAGE : CHAIN PULLEY BLOCK

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTU M OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
					6.					10.			
1.	2.	3.	4.	5.			7.	8.	9.				11.

		SWIVELING OF HOOK	MA	VISUAL	100%	APPROVED DRG	APPROVED DRG	IR	✓	P	W	V	
		EFFORT	MA	PULL ON CHAIN	100%	-DO-	-DO-	IR	✓	P	W	V	
3.2	PAINTING	-CLEANING - SHADE & DFT OF PAINT	MA MI	VISUAL VISUAL	AT RANDOM AT RANDOM	APPROVED DRAWING/ SPECIFICATI ON	APPROVED DRAWING/ SPECIFICATI ON	IR IR		P p	--- W	--- ---	
3.3	NAME PLATE	VERIFICATION	MA	VISUAL	100%			IR		P	V	---	
3.4	PACKING	-VERIFICATION	MI	VISUAL	100%	SPECS.	SPECS.	IR		P	---	---	
3.5	REVIEW OF QA DOCUMENTATION	VERIFICATION	MA	VISUAL	100%	APPD. QP	APPD. QP		✓	V	V	V	

CR – CRITICAL, MA – MAJOR , MI – MINOR

NOTE 1: WHEN BACK WALL ECHO (BWE) IS SET AT 100% OF FULL SCREEN HEIGHT (FSH) IN DEFECT FREE AREA THEN

(A) DEFECT ECHO SHALL NOT EXCEED 20% OF FSH &

(B) BWE SHOULD BE MINIMUM 80% OF FSH IN ANY AREA.

NOTE 2: RECORDS IDENTIFIED WITH TICK SHALL BE ESSENTIALLY INLCUDED IN QA DOCUMENTATION.

MANUFACTURER / CONTRACTOR	LEGEND: ** M : MANUFACTURER / SUB-SUPPLIER C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER/ NOMINATED INSPECTION AGENCY. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION	FOR CUSTOMER USE	
SUB-CONTRACTOR		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL
SIGNATURE			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION :				
				BIDDER/ : VENDOR		TITLE		NUMBER :				
		SHEET 1 OF 9		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 2 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :					
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE					
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2		
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1		
1.6	SPACE HEATERS, CONN- ECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	FOR DIA OF 55 MM & ABOVE	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION :				
				BIDDER/ : VENDOR		TITLE		NUMBER :				
		SHEET 3 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP			SPECIFICATION :			
				BIDDER/ : VENDOR		TITLE			NUMBER :			
		SHEET 5 OF 9		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION :			
				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ASTM-E165	MANUF'S SPEC./BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :					
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE					
		SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-		(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-		
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1		
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-		FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-		THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-		
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION :				
				BIDDER/ : VENDOR		TITLE		NUMBER :				
		SHEET 7 OF 9		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME III			
									P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												

		QUALITY PLAN SHEET 8 OF 9		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	11	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	\$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	* REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	\$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	\$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR.
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 9 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V			REMARKS
1	2	3	4	5	6	7	8	9	10			11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS			BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									

		QUALITY PLAN SHEET 1 OF 2		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :			
				MAHAGENCO		1X660 MW BHUSAWAL TPP		NUMBER :			
				BIDDER/ :		TITLE		SPECIFICATION :			
		VENDOR		NUMBER PED-506-00-Q-006, REV-01		TITLE :					
SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
									P W V		
1	2	3	4	5	6	7	8	9	10	11	
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2 1 -		
NOTES:		1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.									
<u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY											
BHEL			PARTICULARS		BIDDER/VENDOR						
			NAME								
			SIGNATURE								
			DATE							BIDDER'S/VENDORS COMPANY SEAL	

 PEM :: C&I		QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)						QUALITY PLAN NO.: PE-QP-415-145-I 006					
								VOLUME IIB					
								SECTION C					
								ISSUE NO. 2		REV. NO. 3		DATE: 06.12.18	
								SHEET 2		OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
1.0	INCOMING MATERIAL												
1.1	Body & Bonnet casting / forgings, plug, valve stem, seat ring/cage.	1. Physical, Chemical properties	MA	Physical, Chemical tests	One/ Heat(HT Batch)	Approved drg. / data sheet /	Approved drg. / data sheet /	Test Certificate	3	---	2,1	TC for body/bonnet from foundry only	
		2. Heat Treatment	MA	Review of H.T. Chart	Each H.T.	Approved drg. / data sheet /	Approved drg. / data sheet /	Test Certificate	3/2	2	1	1.IBR Certification (if applicable) to be verified by BHEL. 2.Applicable for body /bonnet only	
		3. Internal quality of castings	MA	RT for Body & UT for Bonnet	100%	ASME B 16.34	ASME B 16.34	Test Report / FILM	3/2	2	1	Applicable for body and bonnet for rating ANSI 900 and above.	
		4. Surface Quality	MA	1. Visual	100%	MSS-SP-55	MSS-SP-55	Test Certificate	3/2	---	2		
				2. MT/PT	100%	ASME B 16.34	ASME B 16.34	Test Certificate	3	2	1	After Machining on machined surface only	
		5. Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	For Body & Bonnet after machjning.	
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1		

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

RT- Radiographic Test
UT – Ultrasonic Test

PT – Dye penetrant Test
MT- Magnetic Test

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL 4-MAHAGENCO
2 - Vendor
3 - Sub-vendor