

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION (Technical Specification for Fire Hydrant, Spray, Jockey & Booster Pump including Drives)	Std. / Doc. Number	
			PY51282	
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TECHNICAL SPECIFICATION FOR FIRE WATER PUMPS (HYDRANT, SPRAY WATER, JOCKEY & BOOSTER PUMPS INCLUDING DRIVES) [HORIZONTAL CENTRIFUGAL SPLIT CASING TYPE FIRE WATER PUMPS]

PROJECT :	2 X 660 MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS
OWNER :	TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
OWNER CONSULTANT :	DESEIN PRIVATE LIMITED DESEIN HOUSE, GREATER KAILASH – II. NEW DELHI – 110 048

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	 R. MURALIDHAR	 GIRISH PRASAD PALO	 M. SIVA PRASAD BABU	28.09.17



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DOCUMENTS TO BE SUBMITTED WITH THE BID:

The bidder must submit the following documents along with their bid to enable BHEL to evaluate their offer.

- a) Duly filled in Pump-Motor-Diesel Engine datasheet **(Annexure-2A/2B/2C)**
- b) Tentative GAD for Pump with Motor & Engine
- c) Performance curves for pump
- d) Un-priced copy of price in attached BHEL price bid formats **(Annexure-4)** indicating quoted/ not quoted against each row & column.
- e) Equipment qualification criteria / PTR / Reference Lists
- f) Checklist as per **(Annexure-5)**
- g) ****Deviation list [if any] as per (Annexure-11)**

**** Bidder shall submit Annexure-11 indicating as NO DEVIATION along with their offer. Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-12 before submission of Techno Commercial offer.**

In case the above-mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.

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Sheet **5** of **23****1. INTENT OF SPECIFICATION**

This specification specifies the requirement of Design, Engineering, Manufacturing, Assembling, Inspection, Testing at manufacturer's works and Delivery of properly packed and painted **Fire water pumps [Hydrant, Spray, Jockey and Booster Pumps]** including drives with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

2. SPECIAL NOTES TO BIDDERS

- 2.1 This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this specification & its enclosures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its enclosures, calls for decision of owner/BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, so as to enable owner/BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by owner/BHEL then, without any cost, delivery, or any other commercial implications.
- 2.2 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.
- 2.3 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment's. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the Pump unit is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.
- 2.4 Bidder shall quote strictly as per the scope of supply and requirements of this specification.
- 2.5 Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.
- 2.6 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.
- 2.7 Incase Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non



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participation by the bidder is attributable to reasons other than any specification requirements.

3. PROJECT INFORMATION

	Owner	TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
1.	Project	2 X 660 MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS
2.	Owner's consultant	DESEIN PRIVATE LIMITED DESEIN HOUSE, GREATER KAILASH – II. NEW DELHI – 110 048
3.	Location	Vayalur Village near Ennore Port (Approx. 5 km)
4.	Nearest Airport	Chennai International Airport
5.	Nearest Railway Station	Athipattu Pudunagar Railway station
6.	Access to site	By Train: Athipattu Pudunagar Railway station By Road: 35 km (Approx.) from Chennai
7.	Co-ordinates	Latitude : 13° 17' N to 13° 18' N Longitude : 80° 18' E to 80° 19' E
8.	Maximum Ambient Air Temperature (deg. C)	41.5
9.	Minimum Ambient Air Temperature (deg. C)	24
10.	Dry Bulb Temperatures (deg. C)	Later
11.	Design Ambient Temperature (deg.C)	35
12.	Design Ambient for Electrical equipment / system (deg. C)	50
13.	Relative Humidity	36-100 %
14.	Design AMB Humidity	75%
15.	Seismic coefficient	Seismic zone III as per IS 1893 - 2002

Note: Any data required for designing the equipment, bidder may ask prior to the submission of bid.

4. APPLICATION OF SYSTEM

2 Nos of Electric motor driven Hydrant Water Pump (Centrifugal, Horizontal type) is envisaged for supplying water to Hydrant header from the fire water storage sump.

2 Nos of Diesel Engine driven Hydrant Water Pump (Centrifugal, Horizontal type) is envisaged for supplying water to Hydrant header from the fire water storage sump.



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1 No of Electric motor driven Spray water Pump (Centrifugal, Horizontal type) is envisaged for supplying the water to the spray water system from the Fire water storage sump.

1 No of Diesel Engine driven Spray water Pump (Centrifugal, Horizontal type) is envisaged for supplying the water to the spray water system from the Fire water storage sump.

2 Nos of Electric motor driven Jockey Pump (Centrifugal, Horizontal type) for Hydrant-Spray System are envisaged for replenishing the level of water in the Hydro Pneumatic tank by supplying water from Fire water storage sump.

1 No of Electric motor driven Booster Pump (Centrifugal, Horizontal type) for Spray System are envisaged for replenishing the level of water in the Hydro Pneumatic tank by supplying water from Fire water storage sump

1 No of Diesel Engine driven Booster Pump (Centrifugal, Horizontal type) for Spray System are envisaged for replenishing the level of water in the Hydro Pneumatic tank by supplying water from Fire water storage sump

5. TECHNICAL DETAILS/REQUIREMENTS

5.1. Design Parameters of the Hydrant and Spray water Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature Of Fluid	Deg. C	Ambient
3	Capacity Of each pump	m3/hr	410
4	Pump Differential Head(At Discharge Flange)	mWC	120
5	Available Pressure at Center line of Suction nozzle of Pump	Kg/cm ² (a)	1.0 kg/cm ²
6	NPSHA at pump suction flange	mlc	10.0 m
7	Margin between NPSH _A & NPSH _R		1 m at rated condition & NPSHR shall be less than NPSHA at the end of the curve condition.

5.2. Design Parameters of the Jockey Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature Of Fluid	Deg. C	Ambient
3	Capacity Of each pump	m3/hr	50



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4	Pump Differential Head(At Discharge Flange)	mwc	125
5	Available Pressure at center line of Suction nozzle of Pump	Kg/cm2 (a)	1.0 kg/cm2
6	NPSHA at pump suction flange	mlc	10.0 m
7	Margin between NPSHA & NPSHR		1 m at rated condition & NPSHR shall be less than NPSHA at the end of the curve condition.

5.3. Design Parameters of the Booster Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature Of Fluid	Deg. C	Ambient
3	Capacity Of each pump	m3/hr	171
4	Pump Differential Head(At Discharge Flange)	mwc	45
5	Available Pressure at center line of Suction nozzle of Pump	Kg/cm2 (a)	15.8 kg/cm2 [max]
6	NPSHA at pump suction flange	mlc	80 m to 120.0 m
7	Margin between NPSHA & NPSHR		1 m at rated condition & NPSHR shall be less than NPSHA at the end of the curve condition.

6. SCOPE OF SUPPLY

The scope of supply for this enquiry is as given below:

Please refer to the enclosed P&ID for Hydrant, Spray water Pumps and Jockey Pump (Annexure-1) for general clarity on scope of supply. The system shall be provided as per annexure-1 taking into all requirements including for testing, painting, documentation, sub vendor list, equipment specifications etc., specified in this specification and enclosures.

Quantity of Pump & Drive Assembly:

- (i) 4 Nos. of Hydrant Water Pump [2 No. of Motor Driven & 2 No. for Engine Driven]
- (ii) 2 Nos. of Spray Water Pump [1 No. of Motor Driven & 1 No. for Engine Driven]
- (iii) 2 Nos. of Jockey Pump [Motor Driven]
- (iv) 2 Nos. of Booster Pump [1 No. of Motor Driven & 1 No. for Engine Driven]

The scope of supply for each pump & motor/ Diesel Engine drive assembly is as given



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6.1. Pump

Horizontal Centrifugal pump complete with all accessories as per specification.

Performance requirement, Design and construction of the pump shall be guided by the TAC recommendations & as per enclosed specification. (Also Refer Annexure-2A/2B/2C for more details).

6.2. Drives for pumps [Motor/Diesel Engine]

6.2.1. Motor

Suitable drive motor complete with terminal box, canopy, space heater, cable glands and lugs, earthing lugs and all other accessories required as per specification. Performance requirement, Design and construction of the Motor shall be guided by the TAC recommendations & as per enclosed specification. (Also Refer Annexure-2A/2B/2C and Annexure-3 for more details on Voltage Level & Technical Details of Motor).

LT Motor shall be IE-3 Type with starting current as per IS12615.

Note: For Hydrant/Spray pump, the Supply voltage level is 3.3 kV, irrespective of Motor Rating

6.2.2. Diesel Engine

6.2.2.1. Performance

Performance requirement, Design and construction of the diesel engine shall be guided by the TAC recommendations including type of cooling for diesel engine & as per enclosed specification. (Also Refer Annexure-2A/2B/2C for more details).

- The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at its duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. Deaerating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only :

a) 3% for each 305 meter elevation above MSL

b) 1% for each 5.6 deg C rise in air temperature above 15.6 deg C

- The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.



6.2.2.2. Diesel Engine Control Panel

PLC based Diesel Engine Control panel meeting to the requirements of TAC for each engine shall be included in bidder scope of supply. The various panels shall be operated on DC Supply, suitably converted by dedicated rectifier bank, redundant transformers from mains A.C. Further, Battery back-up shall also be provided along with auto-change over from normal to Battery supply in case of non-availability of Mains supply. The Control panel shall be mounted on structural steel. All cabling [control/signal/power] from engine to control panel, panel to battery and engine to battery selector switch shall be in BHEL scope of supply. Bidder to furnish cable BOQ & electrical loads. Exact power supply to the panel shall be discussed during detailed engineering stage.

Technical details of local control panel are indicated in **Annexure-13, C&I Specification**.

6.2.2.3. Diesel Engine Fuel Tank

Fuel oil tank having storage capacity sufficient to run the engine at full load for at least six (6) hours, Level switch and Gauge glass type Fuel Oil Tank level indicator and required piping [5 m length] & valves [from tank to engine] for each engine(As per Annexure-1) shall be included in bidder scope. Valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. Pipe joints shall not be soldered and plastic tubing shall not be used.

Structural Steel for supporting structures is in BHEL scope. All fixing accessories for mounting tank on the structure shall be included in bidder scope.

6.2.2.4. Diesel Engine Fuel Pump

1 No. of suitable 1 phase 230 Volt fuel pump (portable) with ex-proof motor to be supplied to fill up diesel oil from Diesel Drum received from supplier of Diesel.

1 No. of hand operated pump shall be supplied to fill up diesel oil from diesel drum received from supplier of diesel. Necessary tubing [5m length] from Diesel Engine pump to the fuel tank along with valve (If any) to be supplied by Bidder.

6.2.2.5. Instrumentation & Control

The diesel engine shall be provided with adequate instrumentation. These shall include but not limited to the following :

- a) Temperature indicator (contact type) in cooling water inlet and outlet.
- b) Temperature indicator in lubricating oil outlet from the oil cooler.
- c) Pressure gauges (contact type) for lubricating oil system.
- d) Differential pressure gauges (contact type) across strainers/ filters.
- e) Speed indicator.
- f) Running hour meter.
- g) Dip. stick type lubricating oil sump level indicator.



- h) Gauge glass type Fuel Oil Tank level indicator.
- i) Voltmeter & Ammeter in dynamo type battery charging circuit.

6.2.2.6. Diesel Engine Exhaust System

Bidder to consider 15 m of exhaust piping with silencer & insulation with 6 Nos. of bends. The exhaust piping shall consist of bends, hood, bird screen etc. [For Additional Details please refer Annexure-1].

6.2.2.7. Battery & Battery Charger

- i. Two (2) sets (1 working & 1 standby, 100% capacity) of 24 Volt (2x12V) Automotive type battery with charger for each diesel engine driven fire water pumps primarily for starting the engine and control power supply to local control panel.
- ii. Each engine shall be provided with 2 Nos. Lead-acid type battery units as per IS. Battery shall be sized to Cater for the following without any charging in between
 - a) Crank the engine twelve times successively, each for a duration of 10 sec.
 - b) Control panel stand by load requirements for 72 hours.
- iii. Arrangement for both trickle and booster charge of the batteries shall be provided. When the engine starts running, provision should be kept to ensure that the charger is automatically disconnected and the battery is charged by engine dynamo.
- iv. Each diesel engine shall be provided with two (2) battery charger units of air cooled design. Each charger unit shall be capable of charging one (1) set of battery at a time. Provision shall, however, be kept so that any of the charger units of a particular engine can be utilised for charging any one of the two (2) batteries of that engine.

All other details shall be as per TAC guide lines.

6.3. Coupling Between Pump and Drives [motor/engine]

Coupling between pump and motor/engine shall comply with the following:

- a) Coupling shall be as per as per manufacturer's standard
- b) Metallic, Non-lubricated, flexible element type [diaphragm or disc type],
- c) With Non sparking type coupling guard
- d) With spacer [The spacer nominal length shall be at least 125 mm and shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.]
- e) With a minimum service factor of 1.5.

- 6.4. Common base frame with fixing bolts for each Pump & its drives. The Pumping set(s) shall be securely mounted on a robust bedplate and shall be free from vibration at all Variations of load.**

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6.5. MECHANICAL SEAL

Cartridge type Mechanical seal as per manufacturer's standard.

6.6. Interconnecting Piping & Instrumentation

Interconnecting piping and instrumentation as per P&I D [Annexure-1]

Reducer/expander, Flanges & Counter flanges with necessary gaskets & bolts at all terminal points as per annexure-1. All counter flanges shall be of weld neck type. Suction Reducer/expander shall be eccentric type.

Pipes: M. S. ERW pipes as per IS-1239, Part – 1 heavy grade (for pipes of sizes 150 mm NB or below) and IS-3589 Gr.410 ERW (for sizes 200 mm NB and above) or equivalent and galvanized as per IS 4736 for pipes normally empty and periodically charged with water and foam system application.

Flanges: ASTM A234 Gr. WPB or ASTM A105 or equivalent.

Fittings: The material shall conform to ASTM A234 Gr. WPB or ASTM A105 or equivalent and dimensional standard conforming to ANSI B 16.9 (socket & threaded type), ANSI B 16.22 (for flanges and flanged fittings).

Fabricated fittings shall not be acceptable up to pipe size of 300 NB. For sizes 350 NB & above, fittings may be fabricated as per BS:2633/BS:534.

The fittings shall be galvanized as per IS: 4736 for galvanized pipe application.

6.7. Necessary Foundation Bolts, Nuts, Shims/Grouting Pads etc.**6.8. Supply of Accessories and Services**

Following accessories shall be included in bidder scope:

- a) Base Plate
- b) Priming connection with 3 way SS isolating valve
- c) Vent with 3 way SS isolating valve
- d) Pump-motor coupling and guard
- e) Drain connection with valve
- f) Eye-bolts, lifting tackle etc.

6.9. Provision for Vibration Probes

Only provision for mounting probes shall be made available on Pump & Drives.

Only provision for Key Phasor to be provided on Motor. Notch dimension on motor and vibration pad details (Dimension, tapping details) shall be provided during detail engineering stage.



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Refer C&I Specification [Annexure - 13]

6.10.1. For Pump (HT Motor Driven)

- 1) 1 No. RTD for Pump DE
- 2) 1 No. RTD for Pump NDE

6.10.2. For HT Motor

- 1) RTD's for winding temperature detection -4 Nos. of simplex type or 2 Nos. of Duplex platinum resistance type for each phase stator winding.
- 2) RTD's for Bearing Temperature Detection - 1 No. of Duplex platinum resistance type for Each Bearing.
- 3) 1 No. Dial Type Thermometer with adjustable alarm contact for each bearing.

6.10.3. Junction Box

For Pump Instruments: 1 No. JB/Pump

For Motor Winding & Bearing RTDs -1 No. of JB/Motor (Generally this is provided by motor manufacturer, it is the integral part of motor)

6.11. Complete Unit Test: Complete unit test is included in the bidder scope of supply.**6.12. First Fill of Lubricant:** Excluded from bidder scope of supply.**6.13. All other items necessary for safe and smooth running of pump & Accessories required to make the supplied equipment complete in all respect.****6.14. Commissioning Spares****A.1) For Hydrant- Spray Pump & Drives Assembly**

Three sets (One set for each pump & motor assembly) of commissioning spares for Hydrant and Spray Pump with drive motor shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.

Three sets (One set for each pump & Diesel Engine assembly) of commissioning spares for Hydrant and Spray Pump with Diesel Engine shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.



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1 set stands for requirement for one no. of pump & drive assembly. Bidder to furnish the list along with the offer.

Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor.

A.2) For Jockey Pump & Motor Assembly

Two sets (2 Set) of commissioning spares for Jockey Pump with Motor shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.

1 set stands for requirement for one no. of pump & drive assembly. Bidder to furnish the list along with the offer.

Any commissioning spare required over and above the recommended commissioning spares commissioning shall be supplied free of cost by the equipment vendor.

A.3) For Booster Pump & Drives Assembly

One set for each pump & motor assembly of commissioning spares for Booster Pump with drive motor shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation.

One set for each pump & Diesel Engine assembly of commissioning spares for Booster Pump with Diesel Engine shall be quoted as per manufacturer's recommendation. Commissioning spares shall contain Minimum 1 Set of O rings & gaskets for each Pump & 1 Set of Commissioning Spares for Drive as per Manufacturer recommendation

1 set stands for requirement for one no. of pump & drive assembly. Bidder to furnish the list along with the offer.

Any commissioning spare required over and above the recommended commissioning spares commissioning shall be supplied free of cost by the equipment vendor.

6.15. Mandatory Spares

Mandatory Spare shall be in line with Price Bid format

For Pump ; Refer price bid format

For Motor: Refer price bid format

For Engine: Refer price bid format

Instrumentation: Refer price bid format



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6.16. Auxiliaries equipment's/Spares

Bidder to include all auxiliary equipment [clause no 7.4.5.7.3 of TAC] & spares [7.4.5.11 of TAC] as per TAC in addition to above mandatory spares.

6.17. Special Tools and Tackles

1) For Hydrant and Spray water pump with drives:

The bidder shall furnish a complete 2 sets [1 set each for Pumps with Drive Motors & Pumps with Diesel Engines] of all special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance [disassemble, assemble, or maintaining the unit] of the Hydrant & Spray water Pump supplied, as a part of scope of supply. **Bidder shall furnish a list of such tools along with offer for the system.** Prices for the special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

2) For Jockey pump with drives:

1 set for Pumps with Drive Motors

The bidder shall furnish a complete 1 set of all special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance [disassemble, assemble, or maintaining the unit] of the Jockey Pump supplied, as a part of scope of supply. **Bidder shall furnish a list of such tools along with offer for the system.** Prices for the special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

3) For Booster pump with drives:

The bidder shall furnish a complete 2 sets [1 set each for Pumps with Drive Motors & Pumps with Diesel Engines] of all special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance [disassemble, assemble, or maintaining the unit] of the Hydrant & Spray water Pump supplied, as a part of scope of supply. **Bidder shall furnish a list of such tools along with offer for the system.** Prices for the special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

6.18. Conflicts in Specification Requirement

In case of any conflict between this specification and Annexures stringent of the requirement will govern.

7. OPTIONAL PRICES

Please Refer to Attached Price Bid Format.

Bidder to furnish the following as optional prices:

- 1) 2 year recommended spares for each pump



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2) Supervision charges for erection & commissioning of the supplied package for each pump.

8. EQUIPMENT QUALIFICATION CRITERIA (EQC)

Bidder to submit the Equipment Qualification Criteria for Centrifugal Horizontal type of Hydrant/Spray water Pump and Jockey pump (fire water Pump) as detailed below:

The bidder shall be an established manufacturer of Horizontal Centrifugal design pumps for Fire Protection System & having adequate engineering, manufacturing & testing facilities for pumps confirming to the relevant HIS, IS-5120, IS-6595 Part-2/Equivalent Standard & Comply with the regulations of Tariff Advisory Committee (TAC)/LPA India or Oil industry safety directorate (OISD) or any other International reputed authority (like LPC-UK or NFPA, USA). The pump model offered shall be from the existing regular manufacturing range of bidder.

The offered pump model shall meet the minimum service & manufacturing experience specified as below:

Bidder should have engineered, manufactured, tested, supplied and commissioned at least TEN (10) nos. of identical or similar packages (or higher capacity packages) in terms of Flow, Differential Pressure, Material of construction(CS/CI/SS), speed in the last Ten years and at least Three (3) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on 31st October 2016. Vendor to give documentary evidence for the same. **As a proof for the same, Date of Supply/ Commissioning report/Customer Satisfaction report will be considered and same to be provided by Bidder.**

Bidder to furnish dully filled in proforma as per Annexure-8.

9. QUALITY PLAN & INSPECTION AGENCY & TESTING

9.1. QUALITY PLAN

Quality plan will be reviewed during detailed Engineering stage with respect to Inspection, standard Engineering practices & Specification Requirements and various tests and stages of inspection and appropriate agencies for Inspection will be Intimated. Bidder to abide by the same.

For guide lines & format: Refer **Annexure-7**.

9.2. INSPECTION AGENCY

BHEL/Third Party appointed by BHEL.

The various review/witness/observation stages by individual agencies (or) Group of Agencies as above will be in line with approved quality plan. Also refer Annexure-07.



9.3. TESTING

The design and Testing Standards of the Pumps shall conform to the standards as indicated in the TAC recommendation.

However, Performance tolerance shall be as mentioned below:

- Rated head at rated flow: Zero negative tolerance
- Shut-off head: Zero negative tolerance. 5% Positive tolerance permitted.
- Rated BkW: Zero positive tolerance. Positive tolerance permitted till motor rating meets end of the curve condition

10. PAINTING

Painting for Pump, Motor, Engine and all other accessories shall be as follows:

Surface Preparation: Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

Painting Scheme:

At Shop:

- a) Primer: Two (2) layers of Zinc phosphate epoxy

Film Thickness: Min. 75µm (Total)

~~Total Film Thickness: Min. 60 microns~~

- ~~b) Intermediate Paint: A two pack air drying high build epoxy resin based paint with MIO.~~

~~Film Thickness: Min. 80 microns/DFT~~

- c) Finish Paint: (2) finishing coats of chlorinated rubber paint.

Film Thickness: Min. 30-40 microns DFT each coat

At Site:

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.

Pump:



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Final Color: Fire Red, 536 as per IS 5

Motor:

Painting shall be as specified in relevant TAC/IEC/IS standards.

Final Color: Fire Red, 536 as per IS 5

Engine:

Painting shall be as specified in relevant TAC/IS standards.

Final Color: Fire Red, 536 as per IS 5

11. PACKING AND FORWARDING

Bidder to note that Packing and Forwarding shall be as per manufacturing standard meeting the requirement is acceptable. Packing shall be suitable for outdoor storage: More than 6 months. Being minor the same shall be discussed during Detail Engineering.

12. SUB VENDORS

1) HT Motors: BHEL-Bhopal

2) Other items as per attached Annexure-9. [PE&SD PMD list]

Bidder shall follow sub vendors list enclosed as Annexure-9. In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list. For other items for which sub vendors are not specified, bidder can follow their standard vendors. However, they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

13. DOCUMENTATION**13.1. Master Document List: Refer Annexure-10**

- i. A master documentation shall be prepared during kick off meeting identifying all the DOCUMENTS / DRAWINGS to be submitted by the bidder as part of documentation. Bidder shall ensure submission of all documentation as per approved Master Document List.
- ii. 12.1.2 Bidder to note that the dates of submission of all the documents shall be finalized based on PO date. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.



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13.2. DRAWING APPROVAL / REVIEW CATEGORY

The master document list shall clearly identify the class of review to be performed against each document.

Following classes of review shall be followed for all the documents engineered by the bidder

- APPROVAL (A): Approval is mandatory and bidder cannot proceed without obtaining Purchaser's approval.
- INFORMATION / RECORDS (I): This type of documents shall be submitted to Purchaser for his information. Bidder can proceed if Purchaser's comments are not received within 14 working days of receipt in Purchaser's office.

13.3. DRAWINGS REVIEW & APPROVALS:

- Each drawing submitted by the bidder shall be with a title block furnished by BHEL during detailed engg stage.
- All drawings / documents shall be thoroughly checked, duly signed, and stamped by the vendor including drawing /documents of sub-vendor, before submission to BHEL. Documents, which are unchecked, unsigned, and without revisions marked clearly, shall be returned without review. Any delay on account of this shall be to the vendor's account. After first review of documents, vendor to submit all the further revisions of documents along with comment resolution sheet. Successive documents submitted without comment resolution sheet shall be returned without review.
- The approval and /or review by BHEL /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.
- Documents once reviewed in Code-1 shall not be submitted (incorporating some changes) again for review, however if some change is really necessary, the same shall be brought to the notice of BHEL separately through design change note for review / information. Finally As-built drawings, duly updated, shall be submitted.
- During detailed engg stage, BHEL shall furnish check list reg minimum contents in GA drawing. Bidder to submit GAD [duly incorporating all requirements as per the check list] along with signed checklist. GAD shall not be reviewed without duly filled in checklist signed by the bidder.

13.4. NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED

All the documents shall be submitted as given below:

SL NO.	DESCRIPTION	NO. OF COPIES /	WHEN TO SUBMIT
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		PIECES TO BE SUBMITTED	
1)	Initial drawings/documents under approval and information category.	Soft copy only	Within 2 weeks of placement of order
2)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission
3)	*Revised drawings/documents along with compliance sheet incorporating all BHEL comments. *Vendor to incorporate all BHEL	Soft copy only	Within 1 weeks of receipt of commented Drawings from BHEL
4)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 2 weeks of document submission
5)	Final Drawings/documents including As-BUILT	12	Within 2 months of placement of order.
6)	Erection Documentation	5	1 month before dispatch of equipment. The list of documents identified under master document list for
7)	Draft O & M Manuals for BHEL review. Note: Bidder to furnish final hard copy of O&M only after getting concurrence	Soft copy	At least 2 months before the delivery date of equipment
8)	Revised O & M Manuals with Test Certificates to be submitted to BHEL	12	Within one month before the delivery date of equipment
9)	Final O&M manuals in a CD	4	Within one month after dispatch of equipment after

NOTE: The O&M manuals shall contain the following as minimum:

- 1) The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., full contact address with telephone, fax, & e-mail details.
- 2) Brief description of the system.
- 3) All approved documents [Drawings, documents & test procedures as per MDL]
- 4) Bill of material, BBU, LO schedule, sub vendor list, Mandatory & commissioning spares list etc.
- 5) Operation, Instruction & maintenance manuals of all equipments / items fo the complete package
- 6) System unloading, storage erection, start up, commissioning, shut down requirements.
- 7) Operational & environmental safety instructions.



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- 8) Test reports and certificates.
- 9) Catalogues of the equipment & instrumentation.

14. PRICE BID FORMAT

Bidder to indicate his offer as per Price Bid format enclosed as Annexure-4A/4B/4C.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per annexure-12, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be in bidder scope Only.

Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. Prices quoted by the bidder shall remain firm till the successful handing over of the entire package to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

The Priced Bid shall be submitted in Original (without any copy) duly signed and stamped on each page in a separate sealed envelope super scribing "Price Bid –Do not Open" This shall not contain any condition whatsoever failing which the Bids shall be liable to be rejected. In case of any correction, the bidder shall put its signature and its stamp. Eraser fluid will not be allowed for making any correction.

Bidder shall confirm to the un-priced bid as part of their offer.

15. PRE-BID CLARIFICATIONS & DEVIATIONS

- i. Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.



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- ii. Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.
- iii. Bidders may also please note that the data sheets for, valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.
- iv. All pre-bid clarifications & deviations shall be clear bring as per annexure- 11 & 12. Only.
- v. In case bidder doesn't bring any clarification/deviation in prebid stage , the same shall be brought in their offer with following conditions:
 - a. Any deviations to Customer specifications, same are acceptable provided these deviations are also regularly accepted by Customer for their direct orders on bidders. During detailed engineering stage if it is found that any deviation brought out by bidder is not a regular deviation accepted by Customer, the particular deviation brought out by bidder will not be considered as an acceptable deviation.
 - b. Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.
 - c. Price implication due to non-acceptance [by BHEL/Customer] of the deviations asked by bidder shall not be acceptable by BHEL.

• **VARIANT TABLE:**

<u>Variant</u>	<u>Item</u>	<u>Material Code</u>
01	Hydrant Pump with Drive Motor	PY9751282012
02	Spray Pump with Drive Motor	PY9751282020
03	Hydrant Pump with Diesel Engine Drive	PY9751282039
04	Spray Pump with Diesel Engine Drive	PY9751282047
05	Jockey Pump with Drive Motor	PY9751282055
06	Booster Pump with Drive Motor	PY9751282063
07	Booster Pump with Diesel Engine Drive	PY9751282071
08	Mandatory Spares for Motor and Diesel Engine Driven Hydrant & Spray Pump	PY9851282081
09	Mandatory Spares for Motor Driven Jockey Pump	PY9851282090
10	Mandatory Spares for Motor and Diesel Engine Driven Booster Pump	PY9851282103



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RECORD OF REVISIONS

[illegible]

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

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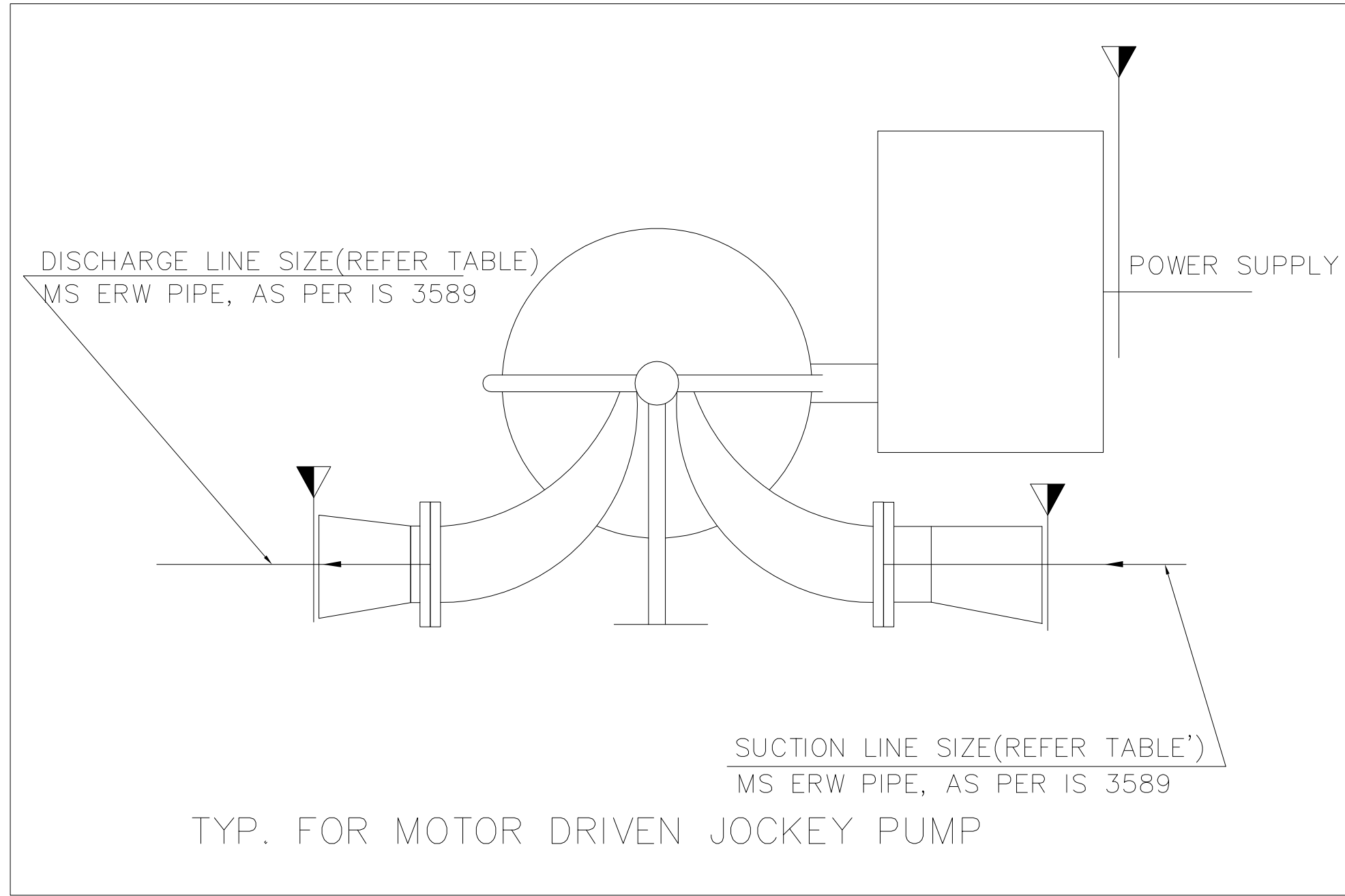
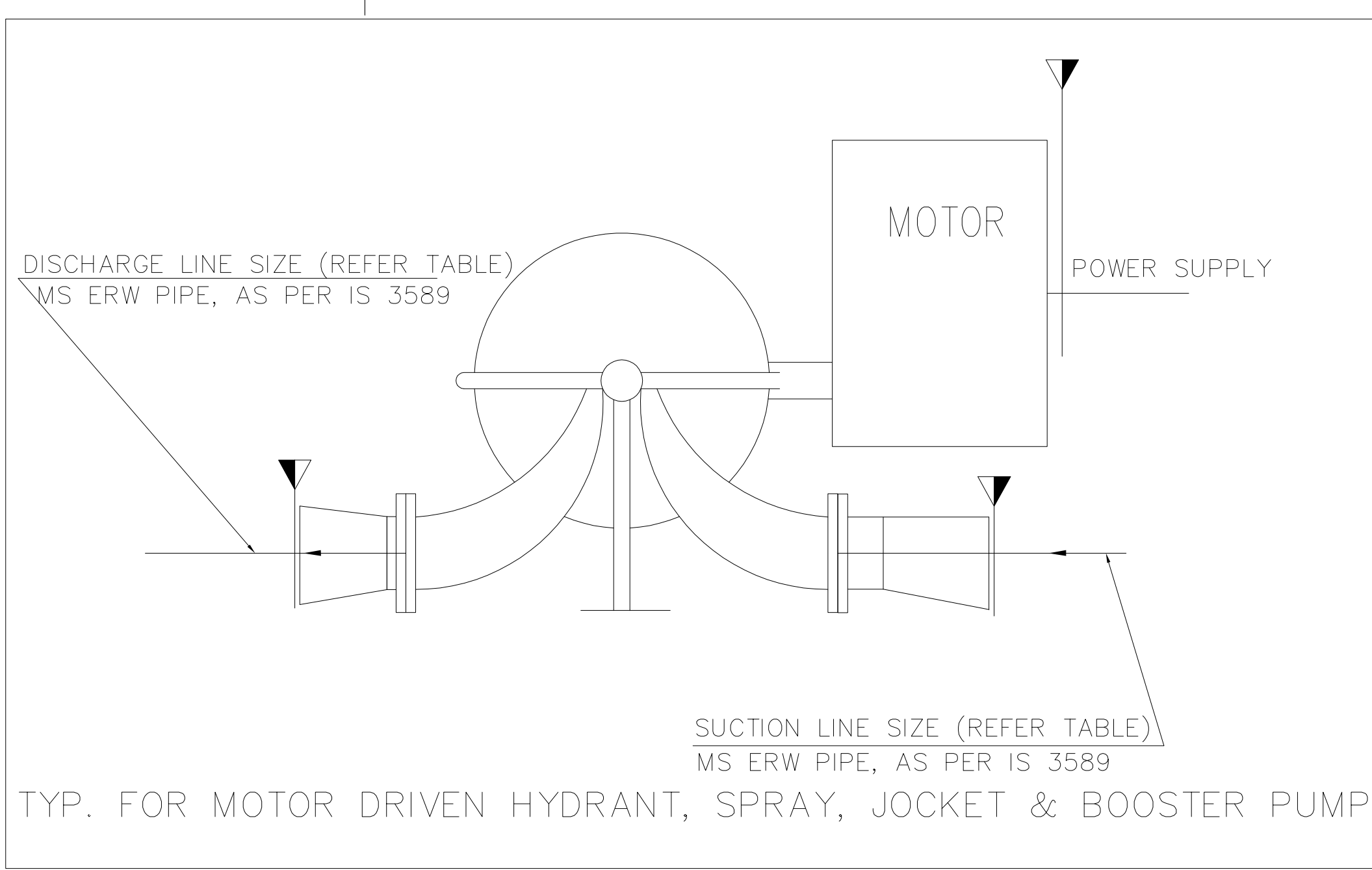
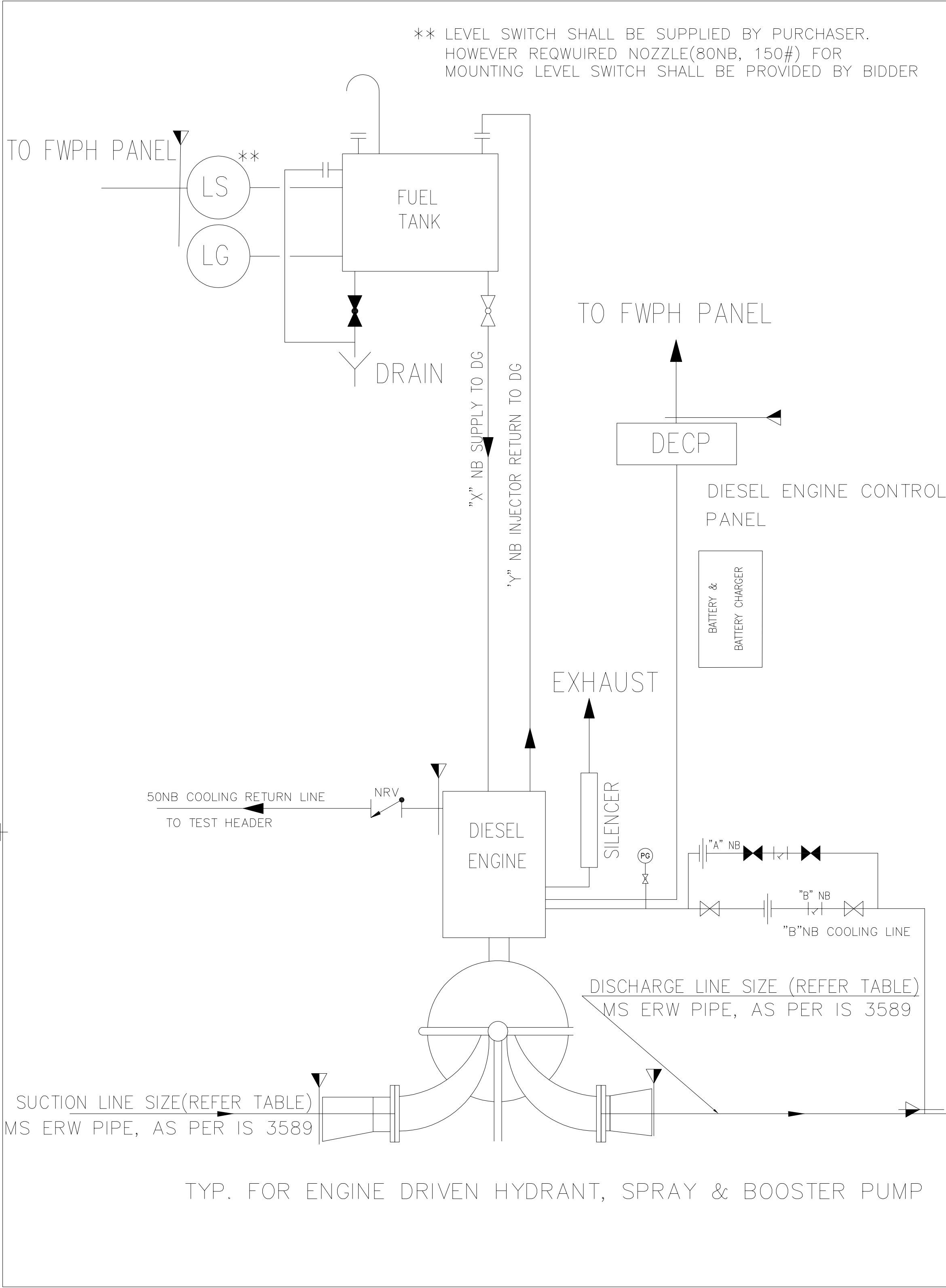
REF. DRG. NO.
13910000136

SIGN. AND DATE

INVENTORY NO

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)



ANNEXURE-1

NOTES

- SCOPE OF BATTERY AND BATTERY CHARGER, DIESEL ENGINE CONTROL PANEL, FUEL TANK,PIPING BETWEEN FUEL TANK TO DIESEL ENGINE,HOSE FROM FUEL PUMP TO DIESEL ENGINE ARE IN SCOPE OF BIDDER'S SCOPE.
- PUMP ARE OF HORIZONTAL CENTRIFUGAL TYPE. SPLIT CASING TYPE IS INDICATED IN THIS DRAWING. HOWEVER, BIDDER SHALL SELECT SUITABLE AVAILABLE MODEL FOR THIS FIRE WATER APPLICATION MEETING ALL THE TENDER SPECIFICATION REQUIREMENTS.
- COOLING WATER REQUIREMENT FOR DIESEL ENGINE/PUMP TO BE FED FROM DISCHARGE OF PUMP. ACCORDINGLY THE PUMP RATED FLOW TO BE SELECTED.ALL PIPING INCLUDING VALVES/FITTINGS,INSTRUMENTS ETC FOR COOLING WATER CIRCUIT IS IN BIDDER'S SCOPE.

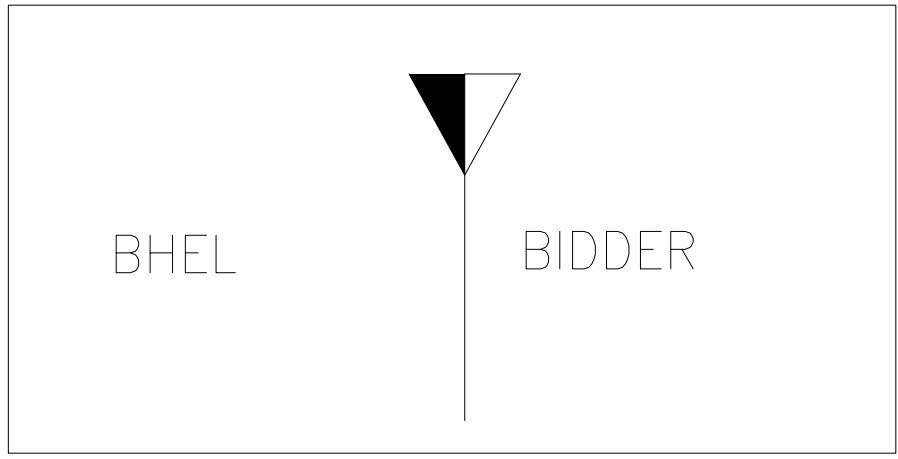
TABLE - LIST OF SUCTION AND DISCHARGE NOZZLES			
S.NO	PUMP DESC.	SUCTION NOZZLE(NB)	DISCHARGE NOZZLE(NB)
1.	MD HYDRANT & SPRAY PUMP	350NB	250NB
2.	MD HYDRANT & SPRAY PUMP	350NB	250NB
3.	JOCKET PUMP	100NB	100NB
4.	MD BOOSTER PUMP	200NB	150NB
5.	DE DRIVEN BOOSTER PUMP	200NB	150NB

NOTE: THIS IS JUST A TYPICAL SCHEMATIC, BIDDER TO SUPPLY ALL THE NECESSARY EQUIPMENTS
REQUIRED FOR SMOOTH FUNCTIONING OF PUMP,MOTOR & DIESEL ENGINE AS PER SPECIFICATION.

"X" & "Y"—Based on Manufacturer Recommendation.

"A" & "B"—Based on Manufacturer Recommendation.

SCOPE DEMARCATION



CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)				
PROJECT: 2 X 660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS				
	BHARAT HEAVY ELECTRICALS LTD.		NAME	SIGN.
	HYDERABAD		DRN.	MURALIDHAR
			CHD.	GIRISH PALO
DEPT. PE&SD	UNTOL. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.
CODE 450	9/M/7	N.T.S	N.A.	N.A.
TITLE		CARD CODE	NO. OF ITEMS	REV.
ANNEX-1: P&ID HYDRANT, SPRAY JOCKET & BOOSTER PUMPS		NA	N.A.	00
SHT. No		NO. OF SHT.		
01		01		

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

ANNEXURE-2A : DATA SHEET FOR HYDRANT-SPRAY WATER PUMP - MOTOR - DIESEL ENGINE			
Sl.no	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	Hydrant Pump : For supplying water to Hydrant header from the fire water storage sump Spray water Pump : For supplying the water to the spray water system from the Fire water storage sump.	
2	Number of Pumps	Total : 10 Nos. 4 Nos. for Hydrant Pump[2W+2S][2 No. Motor + 2 No. Diesel Engine driven] 2 Nos. for Spray Pump[1W+1S] [1 No. Motor + 1 No. Diesel Engine driven]	
3	Location	Indoor	
4	Duty	Intermittent. However pump shall be suitable for continuous operation.	
5	Drives	Motor & Diesel Engine	
6	Pumping fluid	Water	
7	Fluid temp. Deg C	Ambient	
PUMP PERFORMANCE & OTHER DETAILS			
8	Pump Type	Horizontal, Centrifugal type	
9	Design Standard of pump	HIS/IS 5120/ Equivalent standard The pumps shall comply with the regulations of Tariff Advisory Committee (TAC).	
10	Rated Flow (m ³ /hr)	410	
11	Rated Differential Head (mlc)	120	
12	Inline with TAC requirement, Pumps shall be capable of furnishing not less than 150 % of rated capacity at		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be same for both Motor & Engine driven pump. Bidder to indicate pump model	
15	No. of Stages of pump	Bidder To Furnish	
16	Parallel operation	Yes. Load sharing between Pumps: Not exceeding 5% over entire operating range when operating in parallel with other pumps	
17	Rated Speed of Pump (rpm)	1500	
18	Rated speed of Motor (rpm)	1500	
19	Rated speed of Engine (rpm)	1500	
20	Pump Efficiency in %	Bidder To Furnish	
21	Available Pressure at centre line of Suction nozzle of Pump m/c	Min. 1.0 kg/cm ²	
22	NPSH(A) at pump suction nozzle (mlc)	10.0 m	
23	NPSH(R) (mlc)	Bidder to furnish.	
24	NPSH(A) - NPSH(R)	1 m at rated condition & NPSHR shall be less than NPSHA till end of the curve condition.	
25	Pump shut off head.	Flow vs Head curve shall be continuously rising towards shut-off head.	
26	Pump shut off head/rated head.	Shall not be exceed 120% of rated head inclusive of all tolerance, as per TAC.	
27	BEP of the offered pump, m ³ /Hr	Bidder To Furnish	
28	Thermal minimum flow, m ³ /Hr	Bidder To Furnish	
29	Stable minimum flow, m ³ /Hr	Bidder To Furnish	
30	Pump End of the curve flow, m ³ /hr	Bidder To Furnish	
31	Impeller type	Closed	
32	Pump rated impeller dia, mm	Bidder To Furnish	
33	Pump max. impeller dia, mm	Bidder To Furnish	
34	Pump minimum impeller dia., mm	Bidder To Furnish	
PUMP CONSTRUCTION FEATURES			
35	Material of Construction: Casing : SS316 Casing liner: SS316 Diffuser: SS316 Impeller : SS316 Wearing rings: SS316 Pump shaft: SS316 Shaft sleeve: SS316 Shaft bearings : By bidder Base plate : Carbon steel as per IS-2062 with epoxy painting Wetted fasteners: SS-316 Companion Flange : MS All hardware underground: SS316		
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard	
37	Flushing Plan		
38	Cooling Plan		
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media		

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

Sl.no	Description	BHEL Requirement	DETAILS
40	Type of axial thrust balancing arrangement	Bidder To Furnish	
41	Type of main bearings for pump	Bidder To Furnish	
42	Main bearings lubrication	Bidder To Furnish	
43	Type of thrust bearings for pump	Bidder To Furnish	
44	Thrust bearing lubrication	Bidder To Furnish	
45	Direction of rotation of Pump	Bidder To Furnish	
46	Direction of rotation of Motor	Bidder To Furnish	
47	Direction of rotation of Engine	Bidder To Furnish	
COUPLING			
48	Coupling standard	Manufacturer Standard	
49	Type of coupling	Metallic, non-lubricated, flexible element type (i.e. either diaphragm or disc type) with spacer [The spacer nominal length shall be at least 125 mm and shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.]	
50	Non sparking type couplign guard	Yes	
51	Service factor for the coupling	1.5	
PERFORMANCE TEST STANDARD FOR PUMPS			
52	Performance test standard	The testing Standards of the Pumps shall conform to the standards as indicated in TAC recommendation. Performance tolerance shall be as mentioned below: a) Rated head at rated flow: Zero negative tolerance b) Shut-off head: Zero negative tolerance. 5% Positive tolerance permitted. c) Rated BkW: Positive tolerance permitted till selected motor rating meets end of the curve condition d) Efficiency at rated capacity: No negative tolerance	
53	Maximum Allowed Working Pressure (MAWP) in Kg/cm ² g	Bidder To Indicate	
54	Hydraulic test pressure of casing Kg/cm ² (g)	Hydraulic test pressure of casing shall be 1.5 times the MAWP. Test duration shall be minimum 30 min.	
	**Bidder to confirm that the casing material mentioned in sl no 35 shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in sl no 54..If Not, bidder to consider superior material of casing.		
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	a) 1 No. RTD for Pump DE b) 1 No. RTD for Pump NDE	
PUMP TERMINAL POINT DETAILS			
58	Pump Suction nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
59	Pump Discharge nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
60	Pump Cooling water inlet/outlet sizes - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
61	Vent/Drain connection: 1.Vent with 3 way SS isolating valve 2.Drain connection with valve	Bidder To Indicate	
MOTOR DETAILS FOR MOTOR DRIVEN PUMPS[For More Details Please refer Attached Motor Specification(Annexure-3)]			
62	Drive/Installation	Motor/Horizontal	
63	BKW at the rated point		
64	BKW at end of curve		
65	Selected drive rating in kW: The motor rating [At 50 Deg.C ambient] shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.	Bidder to mention motor kW rating for the motor duly taking care of the requirements.	
66	Design Standard of Motor	IS 325	
67	Manufacturer	BHEL Bhopal Only.	

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

Sl.no	Description	BHEL Requirement	DETAILS
68	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with a maximum ambient temperature of 50 Deg C.	
69	Area classification for motor	Safe Area	
70	Rated Voltage & Frequency	3.3 kV & 50 Hz	
71	Permissible variations in Voltage/Frequency/Combined	(+/-)/10%/(+/-)/5%/(+/-)/10%	
72	No of poles / synchronous speed	4/1500 rpm	
73	Energy efficient class		
74	Starting Current as % of FLC	450% of FLC inclusive of all tolerances.	
75	Method of Starting	Motor shall be capable of starting with DOL	
76	Method of cooling	IC 411(TEFC) /IC 511(TETV) /IC 611(CACA) / (CACW)	
77	Class of Insulation & Temp. rise	Class F with Temperature rise ltd. to class B	
78	Space Heater	Required for all motors 30 kw and above	
79	Degree of protection/Canopy Required	IP 55/Yes	
80	TB Short time-Current & Short time-Time	40 kA , 0.25 Sec	
81	TB To be provided on the right hand side as viewed from the drive end.		
82	Cable, Cable glands & Lugs	Cable details shall be furnished during During Detail Engg. Accordingly suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
83	No. of Starts	Motors shall be capable of three equally spread starts per hour under normal condition or two starts in quick succession from cold	
84	Bearing RTDs, Winding RTDs & TGs	a) RTD's for winding temperature detection -4 Nos. of simplex type or 2 Nos. of Duplex platinum resistance type for each phase stator winding. b) RTD's for Bearing Temperature Detection - 1 Nos. of Duplex platinum resistance type for Each Bearing. c) 1 No. Dial Type Thermometer with adjustable alarm contact for each bearing.	
85	Noise	85 DBA at 1 m distance, in any direction	
86	Vibration	As per IS12075/IEC 60034-14	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS			
87	Drive	Diesel Engine	
88	Type	The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).	
89	Location	Indoor	
90	BKW at the rated point	As per TAC / Factory Mutual	
91	BKW at end of curve		
92	Slected drive rating: The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at it's duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. Deaerating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only : a) 3% for each 305 meter elevation above MSL b) 1% for each 5.6 deg C rise in air temperature above 15.6 deg C The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.	Bidder to mention engine HP rating for the motor duly taking care of the requirements.	

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

Sl.no	Description	BHEL Requirement	DETAILS
93	Drive Standard	IS -10000, BS- 5514 and as per standard practice of diesel engine manufacturer's association of USA. Selection, Design and construction of the diesel engine shall be guided by the TAC recommendations.	
94	Name of Manufacturer	Bidder to furnish.	
95	Model No	Bidder to furnish.	
96	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
97	Speed	Not more than 2300 rpm.	
98	Type of cooling	Bidder to Furnish	
99	Noise	105 DBA at 1 m distance, in any direction	
100	Vibration	As per IS standard	

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

ANNEXURE-2B : DATA SHEET FOR HYDRANT-SPRAY WATER PUMP - MOTOR - DIESEL ENGINE			
Sl.no	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	Jockey Pump[For Replenishing the level of water in the Hydro Pneumatic tank by supplying water from Fire water storage sump.]	
2	Number of Pumps	Total : 2 Nos. 2 Nos. for Jockey Pump[1W+1S] [All Motor Driven]	
3	Location	Indoor	
4	Duty	Intermittent. However pump shall be suitable for continuous operation.	
5	Drives	Motor	
6	Pumping fluid	Water	
7	Fluid temp. Deg C	Ambient	
PUMP PERFORMANCE & OTHER DETAILS			
8	Pump Type	Horizontal, Centrifugal type	
9	Design Standard of pump	HIS/IS 5120/ Equivalent standard The pumps shall comply with the regulations of Tariff Advisory Committee (TAC).	
10	Rated Flow (m ³ /hr)	50	
11	Rated Differential Head (mlc)	125	
12	Inline with TAC requirement, Pumps shall be capable of furnishing not less than 150 % of rated		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be same for both the Pumps	
15	No. of Stages of pump	Bidder To Furnish	
16	Parallel operation	Yes. Load sharing between Pumps: Not exceeding 5% over entire operating range when operating in parallel with other pumps	
17	Rated Speed of Pump (rpm)	1500	
18	Rated speed of Motor (rpm)	1500	
19	Rated speed of Engine (rpm)	1500	
20	Pump Efficiency in %	Bidder To Furnish	
21	Available Pressure at centre line of Suction nozzle of Pump m/c	Min. 1.0 kg/cm ²	
22	NPSH(A) at pump suction nozzle (mlc)	10.0 m	
23	NPSH(R) (mlc)	Bidder to furnish.	
24	NPSH(A) - NPSH(R)	Minimum 1 m of margin between NPSH(A) & NPSH(R) to be maintained.	
25	Pump shut off head.	Flow vs Head curve shall be continuously rising towards shut-off head.	
26	Pump shut off head/rated head.	Shall not be exceed 120% of rated head inclusive of all tolerance, as per TAC.	
27	BEP of the offered pump, m ³ /Hr	Bidder To Furnish	
28	Thermal minimum flow, m ³ /Hr	Bidder To Furnish	
29	Stable minimum flow, m ³ /Hr	Bidder To Furnish	
30	Pump End of the curve flow, m ³ /hr	Bidder To Furnish	
31	Impeller type	Closed	
32	Pump rated impeller dia, mm	Bidder To Furnish	
33	Pump max. impeller dia, mm	Bidder To Furnish	
34	Pump minimum impeller dia., mm	Bidder To Furnish	
PUMP CONSTRUCTION FEATURES			
35	Material of Construction: Casing : SS316 Casing liner: SS316 Diffuser: SS316 Impeller : SS316 Wearing rings: SS316 Pump shaft: SS316 Shaft sleeve: SS316 Shaft bearings : By bidder Base plate : Carbon steel as per IS-2062 with epoxy painting Wetted fasteners: SS-316 Companion Flange : MS All hardware underground: SS316		
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard	
37	Flushing Plan		

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
CUSTOMER: TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
CONSULTANT: DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI

Sl.no	Description	BHEL Requirement	DETAILS
38	Cooling Plan		
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling		
40	Type of axial thrust balancing arrangement	Bidder To Furnish	
41	Type of main bearings for pump	Bidder To Furnish	
42	Main bearings lubrication	Bidder To Furnish	
43	Type of thrust bearings for pump	Bidder To Furnish	
44	Thrust bearing lubrication	Bidder To Furnish	
45	Direction of rotation of Pump	Bidder To Furnish	
46	Direction of rotation of Motor	Bidder To Furnish	
47	Direction of rotation of Engine	Bidder To Furnish	
COUPLING			
48	Coupling standard	Manufacturer Standard	
49	Type of coupling	Metallic, non-lubricated, flexible element type (i.e. either diaphragm or disc type) with spacer [The spacer nominal length shall be at least 125 mm and shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.]	
50	Non sparking type couplign guard	Yes	
51	Service factor for the coupling	1.5	
PERFORMANCE TEST STANDARD FOR PUMPS			
52	Performance test standard	The testing Standards of the Pumps shall conform to the standards as indicated in TAC recommendation. Performance tolerance shall be as mentioned below: a) Rated head at rated flow: Zero negative tolerance b) Shut-off head: Zero negative tolerance. 5% Positive tolerance permitted. c) Rated BKW: Positive tolerance permitted till selected motor rating meets end of the curve condition d) Efficiency at rated capacity: No negative tolerance	
53	Maximum Allowed Working Pressure (MAWP) in Kg/cm ² g	Bidder To Indicate	
54	Hydraulic test pressure of casing Kg/cm ² (g)	Hydraulic test pressure of casing shall be 1.5 times the MAWP. Test duration shall be minimum 30 min.	
	**Bidder to confirm that the casing material mentioned in sl no 35 shall cater to the Hydraulic test		
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	Not Applicable.	
PUMP TERMINAL POINT DETAILS			
57	Pump Suction nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
58	Pump Discharge nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
59	Pump Cooling water inlet/outlet sizes - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
60	Vent/Drain connection: 1.Vent with 3 way SS isolating valve 2.Drain connection with valve	Bidder To Indicate	
MOTOR DETAILS FOR MOTOR DRIVEN PUMPS [For More Details Please refer Attached Motor Specification(Annexure-3)]			
61	Drive/Installation	Motor/Horizontal	
62	BKW at the rated point		
63	BKW at end of curve		

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Sl.no	Description	BHEL Requirement	DETAILS
64	Selected drive rating in kW: The motor rating [At 50 Deg.C ambient] shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.	Bidder to mention motor kW rating for the motor duly taking care of the requirements.	
65	Design Standard of Motor	IS 325	
66	Manufacturer	As per Approved Sub Vendor List	
67	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with a maximum ambient temperature of 50 Deg C.	
68	Area classification for motor	Safe Area	
69	Rated Voltage & Frequency	415 V & 50 Hz	
70	Permissible variations in Voltage/Frequency/Combined	(+/-)/10%/(+/-)/5%/(+/-)/10%	
71	No of poles / synchronous speed	4/1500 rpm	
72	Energy efficient class		
73	Energy efficient class	IE-3 Type with starting current as per IS12615.	
74	Starting Current as % of FLC	600% of FLC inclusive of all tolerances.	
75	Method of cooling	IC 411(TEFC) /IC 511(TETV) /IC 611(CACA)	
76	Class of Insulation & Temp. rise	Class F with Temperature rise Ltd. to class B	
77	Space Heater	Required for all motors 30 kw and above	
78	Degree of protection/Canopy to be provided	IP 55/Yes	
79	TB Short time-Current & Short time-Time	50 kA , 0.25 Sec	
80	TB To be provided on the right hand side as viewed from the drive end.		
81	Cable, Cable glands & Lugs	Cable details shall be furnished during DDE. Accordingly suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
82	No. of Starts	Motors shall be capable of three equally spread starts per hour under normal condition or two starts in quick succession from cold[Refer Cl. No. 05.02.03 of Motor Specification(Annexure-3)].	
83	Bearing RTDs, Winding RTDs & TGs	Not Applicable.	
84	Noise	85 DBA at 1 m distance, in any direction	
85	Vibration	As per IS12075/IEC 60034-14	

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
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ANNEXURE-2C : DATA SHEET FOR BOOSTER WATER PUMP - MOTOR - DIESEL ENGINE			
Sl.no	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	Booster water Pump : For boosting the pressure of hydrant water system.	
2	Number of Pumps	Total : 2 Nos. 2 Nos. for Booster Pump[1W+1S] [1 No. Motor + 1 No. Diesel Engine driven]	
3	Location	Indoor	
4	Duty	Intermittent. However pump shall be suitable for continuous operation.	
5	Drives	Motor & Diesel Engine	
6	Pumping fluid	Water	
7	Fluid temp. Deg.C	Ambient	
PUMP PERFORMANCE & OTHER DETAILS			
8	Pump Type	Horizontal,Centrifugal type	
9	Design Standard of pump	HIS/IS 5120/ Equivalent standard The pumps shall comply with the regulations of Tariff Advisory Committee (TAC).	
10	Rated Flow (m ³ /hr)	171	
11	Rated Differential Head (mlc)	45	
12	Inline with TAC requirement,Pumps shall be capable of furnishing not less than 150 % of rated capacity at a		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be same for both Motor & Engine driven pump	
15	No. of Stages of pump	Bidder To Furnish	
16	Parallel operation	Yes. Load sharing between Pumps:Not exceeding 5% over entire operating range when operating in parallel with other pumps	
17	Rated Speed of Pump (rpm)	1500	
18	Rated speed of Motor (rpm)	1500	
19	Rated speed of Engine (rpm)	1500	
20	Pump Efficiency in %	Bidder To Furnish	
21	Available Pressure at centre line of Suction nozzle of Pump m/c	15.8 kg/cm2 a [max]	
22	NPSH(A) at pump suction nozzle (mlc)	80 m to 120.0 m	
23	NPSH(R) (mlc)	Bidder to furnish.	
24	NPSH(A) - NPSH(R)	Minimum 1 m of margin between NPSH(A) & NPSH(R) to be maintained.	
25	Pump shut off head.	Flow vs Head curve shall be continuously rising towards shut-off head.	
26	Pump shut off head/rated head.	Shall not be exceed 120% of rated head inclusive of all tolerance,as per TAC.	
27	BEP of the offered pump, m3/Hr	Bidder To Furnish	
28	Thermal minimum flow , m3/Hr	Bidder To Furnish	
29	Stable minimum flow, m3/Hr	Bidder To Furnish	
30	Pump End of the curve flow, m3/hr	Bidder To Furnish	
31	Impeller type	Closed	
32	Pump rated impeller dia, mm	Bidder To Furnish	
33	Pump max. impeller dia, mm	Bidder To Furnish	
34	Pump minimum impeller dia., mm	Bidder To Furnish	
PUMP CONSTRUCTION FEATURES			
35	Material of Construction: Casing : SS316 Casing liner: SS316 Diffuser: SS316 Impeller : SS316 Wearing rings: SS316 Pump shaft: SS316 Shaft sleeve: SS316 Shaft bearings : By bidder Base plate : Carbon steel as per IS-2062 with epoxy painting Wetted fasteners: SS-316 Companion Flange : MS All hardware underground: SS316		
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard	
37	Flushing Plan		
38	Cooling Plan		
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media		
40	Type of axial thrust balancing arrangement	Bidder To Furnish	
41	Type of main bearings for pump	Bidder To Furnish	
42	Main bearings lubrication	Bidder To Furnish	
43	Type of thrust bearings for pump	Bidder To Furnish	
44	Thrust bearing lubrication	Bidder To Furnish	
45	Direction of rotation of Pump	Bidder To Furnish	
46	Direction of rotation of Motor	Bidder To Furnish	

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Sl.no	Description	BHEL Requirement	DETAILS
47	Direction of rotation of Engine	Bidder To Furnish	
COUPLING			
48	Coupling standard	Manufacturer Standard	
49	Type of coupling	Metallic, non-lubricated, flexible element type (i.e. either diaphragm or disc type) with spacer [The spacer nominal length shall be at least 125 mm and shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.]	
50	Non sparking type couplign guard	Yes	
51	Service factor for the coupling	1.5	
PERFORMANCE TEST STANDARD FOR PUMPS			
52	Performance test standard	The testing Standards of the Pumps shall conform to the standards as indicated in TAC recommendation. Performance tolerance shall be as mentioned below: a) Rated head at rated flow: Zero negative tolerance b) Shut-off head: Zero negative tolerance. 5% Positive tolerance permitted. c) Rated BKW: Positive tolerance permitted till selected motor rating meets end of the curve condition d) Efficiency at rated capacity: No negative tolerance	
53	Maximum Allowed Working Pressure (MAWP) in Kg/cm ² g	Bidder To Indicate	
54	Hydraulic test pressure of casing Kg/cm ² (g)	Hydraulic test pressure of casing shall be 1.5 times the MAWP. Test duration shall be minimum 30 min.	
	**Bidder to confirm that the casing material mentioned in sl no 35 shall cater to the Hydraulic test pressure of		
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	NA	
PUMP TERMINAL POINT DETAILS			
58	Pump Suction nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
59	Pump Discharge nozzle - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
60	Pump Cooling water inlet/outlet sizes - Size - Rating - Standard - Facing - Location	Bidder To Indicate	
61	Vent/Drain connection: 1.Vent with 3 way SS isolating valve 2.Drain connection with valve	Bidder To Indicate	
MOTOR DETAILS FOR MOTOR DRIVEN PUMPS[For More Details Please refer Attached Motor Specification(Annexure-3)]			
62	Drive/Installation	Motor/Horizontal	
63	BKW at the rated point		
64	BKW at end of curve		
65	Selected drive rating in kW: The motor rating [At 50 Deg.C ambient] shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.	Bidder to mention motor kW rating for the motor duly taking care of the requirements.	
66	Design Standard of Motor	IS 325	
67	Manufacturer	As per Approved Sub Vendor List	
68	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with a maximum ambient temperature of 50 Deg C.	
69	Area classification for motor	Safe Area	
70	Rated Voltage & Frequency	415 V & 50 Hz	
71	Permissible variations in Voltage/Frequency/Combined	(+/-)/10%/(+/-)/5%/(+/-)/10%	
72	No of poles / synchronous speed	4/1500 rpm	
73	Energy efficient class		
74	Starting Current as % of FLC	600% of FLC inclusive of all tolerances.	
75	Method of Starting	Motor shall be capable of starting with DOL	
76	Method of cooling	IC 411(TEFC) /IC 511(TETV) /IC 611(CACA) / (CACW)	
77	Class of Insulation & Temp. rise	Class F with Temperature rise ltd. to class B	
78	Space Heater	Required for all motors 30 kw and above	
79	Degree of protection/Canopy Required	IP 55/Yes	
80	TB Short time-Current & Short time-Time	50 kA , 0.25 Sec	

PROJECT: 2 X 660 MW ENNORE SEZ SUPER THERMAL POWER PROJECT
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Sl.no	Description	BHEL Requirement	DETAILS
81	TB To be provided on the right hand side as viewed from the drive end.		
82	Cable, Cable glands & Lugs	Cable details shall be furnished during Detail Engg. Accordingly suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
83	No. of Starts	Motors shall be capable of three equally spread starts per hour under normal condition or two starts in quick succession from cold [Refer Cl. No. 05.02.03 of Motor Specification (Annexure-3)].	
84	Bearing RTDs, Winding RTDs & TGs	Not Applicable.	
85	Noise	85 DBA at 1 m distance, in any direction	
86	Vibration	As per IS12075/IEC 60034-14	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS			
87	Drive	Diesel Engine (Internal Combustion)	
88	Type	Compression ignition, mechanical (airless) direct injection, multicylinder and four stroke cycle and cold starting type.	
89	Location	Indoor	
90	BKW at the rated point	As per TAC / Factory Mutual	
91	BKW at end of curve		
92	Selected drive rating: The continuous engine brake horse power rating (after accounting for all auxiliary power consumption) at the site conditions shall be at least 20% greater than the brake horse power required to drive the pump at its duty point at rated R.P.M. and in no case less than the brake horse power required to drive the pump at 150% of rated discharge or at any condition of operation of pump. Deaerating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than the following for normally aspirated engines only : a) 3% for each 305 meter elevation above MSL b) 1% for each 5.6 deg C rise in air temperature above 15.6 deg C The base power rating of the diesel engine shall be referred to any accepted datum like BS/SAE Standard condition or equivalent. In any case, horsepower rating shall not be higher than the limit set by Tariff Advisory Committee.	Bidder to mention engine HP rating for the motor duly taking care of the requirements.	
93	Drive Standard	IS -10000, BS- 5514 and as per standard practice of diesel engine manufacturer's association of USA. Selection, Design and construction of the diesel engine shall be guided by the TAC recommendations.	
94	Name of Manufacturer	Bidder to furnish.	
95	Model No	Bidder to furnish.	
96	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
97	Speed	Not more than 2300 rpm.	
98	Type of cooling	Bidder to Furnish	
99	Noise	105 DBA at 1 m distance, in any direction	
100	Vibration	As per IS standard	

CHAPTER – 12

MOTORS

1.00.00 DESIGN CRITERIA

1.00.01 For the purpose of design of equipments /systems, an ambient temperature of 50 °C and relative humidity of 85% shall be considered. The equipment shall operate in a highly polluted environment.

1.00.02 Transient voltage dip on starting of the largest motor with DOL shall be limited to 20% of the nominal system voltage at the voltage terminals.

1.00.03 Rating

The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency.

All motors shall be continuously rated (S1 duty). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

1.00.04 Starting Voltage requirement for all motors (except mill motors):

1. 85 % of rated voltage for motors up to 1000 kW
2. 80 % of rated voltage for above 1000 kW and up to 4000 kW
3. 75 % of rated voltage for above 4000 kW

For Mill Motors:

1. 85 % of rated voltage for motors above 1000 kW
2. 90 % of rated voltage for motors up to 1000 kW

1.00.05 Canopy shall be provided for outdoor motors.

1.01.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services.



1.02.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.03.00 Voltage and frequency variations:

Frequency: (+) 3% and (-) 5%

Voltage : **i. AC**

a. $\pm 6\%$ for 11 kV/3.3 kV

b. $\pm 10\%$ for 415 V

Combined 10 % (absolute sum)

ii. DC- +10% to -15% for 220 V DC

1.04.00 All LV motors above 10 kW with S1 duty shall be compulsorily of Energy efficient level IE 2 as per IS 12615: 2011.

1.05.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

1.06.00 Type

AC Motors:

(a.) Squirrel cage induction motor suitable for direct-on-line starting.

(b.) Crane duty motors shall be slip ring type induction motor

DC Motors

(a.) Shunt wound.

1.07.00 Temperature Rise

Air cooled motors

70°C by resistance method

Water cooled

80° C over inlet cooling water temperature mentioned elsewhere, by resistance method.

1.08.00 Degree of Protection

Degree of protection for various enclosures shall be as follows :

i) Indoor motors — IP 54



- | | | | |
|------|--|---|-------|
| ii) | Outdoor motors | – | IP 55 |
| iii) | CW motors (in case of screen prot. Drip proof) | – | IP 23 |
| iv) | Cable box – indoor area | – | IP 54 |
| v) | Cable box – outdoor area | – | IP 55 |

2.00.00 CODES AND STANDARDS

2.01.00 All motors shall confirm to the latest editions including all applicable amendment of relevant IS, IEC and CBIP standards/Publications. In case any other standard is followed that ensures equal or better quality, may be accepted. However the English version of the Standard adopted shall be submitted.

2.02.00 Major Standards, which shall be followed, are listed below. Any other applicable Indian standards for any component part even if not covered in the list shall also be followed

- | | | | |
|-----|---|---|--|
| 1.) | Three phase induction motors | : | IS:325, IEC:60034 |
| 2.) | Single phase AC motors | : | IS:996, IEC:60034 |
| 3.) | Crane duty motors | : | IS:3177, IEC:60034 |
| 4.) | DC motors/generators | : | IS:4722 |
| 5.) | Degree of protection by enclosures for rotating electrical machines | : | IS: 4691
IS: 4728
IS: 6362
IS: 2253 |
| 6.) | Noise levels for rotating electrical machines | : | IS: 12065 |
| | Mechanical Vibrations for rotating electrical machines | : | IS: 12075 |

3.00.00 OPERATIONAL REQUIREMENTS

3.01.00 Starting Time

3.01.01 For motors with starting time up to 20 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs more than starting time .



- 3.01.02 For motors with starting time more than 20 secs and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs more than starting time.
- 3.01.03 For motors with starting time more than 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- 3.01.04 Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
- 3.01.05 Motors shall be capable of restarting under full load after a momentary loss of voltage with the possibility of 150 % nominal voltage during fast bus transfer.
- 3.02.00 Torque Requirements
- 3.02.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- 3.02.02 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

4.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

- 4.00.01 Suitable single phase space heaters shall be provided on motors rated 30 kW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.

- 4.00.02 All motors shall be suitable for direct on line starting through any type of breaker.
- L All motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below

- (a) Fuel oil area : Group - IIB
- (b) Hydrogen generation plant Group - IIC
area :

- 4.00.03 Winding and Insulation

- (a) Type : Non-hygroscopic, oil resistant, flame resistant



- (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature
- (c) 11 kV / 3.3 kV AC motors : Class F: with winding temperature rise limited to class B. They shall withstand 1.2/50 micro sec switching surges of $4U+5$ KV (U=Line voltage in KV). The coil inter-turn insulation shall be suitable for 0.3/3 micro sec. surge of 32 KVp and 12 kVp for 11 kV and 3.3 kV system respectively followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.
- (d) 415V AC & 220V DC motors : Class 'F' with temperature rise limited to class 'B'
- 4.00.04 Motors rated above 1000 kW shall have insulated bearings to prevent flow of shaft currents.
- 4.00.05 Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
- 4.00.06 Noise level and vibration shall be limited within the limits prescribed in IS: 12065 & IS: 12075 respectively. Motors shall withstand vibrations produced by driven equipment.
- 4.00.07 In MV/HV motors, 12 nos. simplex or 6 nos. duplex RTDs (two per phase), each having D.C. resistance of 100 ohms at 0°C, embedded in the stator winding at locations where highest temperatures may be expected, shall be provided. The material of the ETD's shall be platinum. Each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. All HV motors shall be provided with shaft grounding rings for bearing protection and earthing shaft current.
- 4.00.08 MV/HV motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage and shall be capable of either two starts in quick succession with third start after 5 minutes in cold condition or two starts at 15 minutes intervals in hot condition, both cases with voltage and frequency variation within specified limits.
- 4.00.09 Locked rotor current of the MV motors shall be limited to 600% (subject to IS tolerance) of the full load current of the motors and for HV motor shall be limited to 450% (inclusive of IS tolerance) of full load current of the motor.



Locked rotor current of the LV motor shall not exceed 600% of full load current inclusive of IS tolerance.

- 4.00.10 MV Motors shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. These differential protection CTs shall be supplied loose by 11/ 3.3 kV switchgear manufacturer.
- 4.00.11 Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
- 4.00.12 HV motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
- 4.00.13 All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
- 4.00.14 The motors shall be suitable for bus transfer schemes provided on the 11 kV, 3.3 kV/415V systems without any injurious effect on its life.
- 4.00.15 All motors below 15 kW shall be provided with sealed ZZ bearings.
- 4.00.16 For motors rated 1000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
- 4.00.17 All motors shall be provided with an emergency stop push button near the motor as per the Indian Statutory regulations.
- 4.00.18 The motor terminal box shall be suitable for withstanding the maximum system fault current for a duration of at least 0.25 seconds.
- 4.00.19 Neutral in case of HV motors shall be kept accessible.



- 4.00.20 Motors shall be designed to easy access for drilling holes through motor feed of mounting flange for installation of dowel pins after assembly of the motor and driven equipment.
- 4.00.21 Well spacious working platforms shall be provided around the motor area for carrying out maintenance & testing works. Platform shall be minimum of 300 mm below the level of motor base plate.
- 4.00.22 Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
- 4.00.23 For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box..
- 4.00.24 Lube oil pressure transmitters shall be provided to DCS for remote monitoring. Lube oil pressure very low trip to HV equipment shall be 2 out of 3 logic.
- 4.00.25 Capillary type temperature gauge cum switch shall be provided for DE / NDE of HV Motors
- 4.00.26 Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
- Hot and cold air temperatures of the closed air circuit for CACA motors.
 - Hot and cold, air and water temperatures for CACW motors.
- The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.

4.00.27 Lifting Provisions

Motor weighing 25 kg or more shall be provided with eye bolt or other adequate provision for shifting. Electrical hoists shall be provided for motors above 1000 kgs for maintenance of the same.

4.00.28 DC MOTORS

DC motors shall be provided where specified/required. DC Motors shall be sized for operation with fixed resistance starting for reliability. DC motors shall be shunt wound type. Motors shall be capable of delivering the rated output at 220 V DC with (+) 10% and (-) 15% variations without exceeding its guaranteed temperature limits. 220 V DC



system shall be unearthed. Starting current of the DC motors shall be limited to 200% of the full load current of the motor, and is subject to IS tolerance. DC Motors shall be similar to AC Motors with respect to other features like enclosure type, cooling and class of insulation

4.00.30 Painting

Motor including fan shall be painted with corrosion proof paints of colour shade Siemens grey (RAL 7032).

4.00.31 Local Push Button Stations

The LPBS shall be installed near the motors to be controlled. Individual channel supports shall be used for each LPBS. These shall be installed as per approved erection detail drawing. LPBS for hazardous areas shall be CMRS certified and CCE approved.

All LPBS shall have necessary canopies. Wiring of LPBS shall be checked before giving control supply.

5.00.00 LIST OF TESTS TO BE CONDUCTED FOR HV, MV and LV MOTORS

5.01.00 TYPE TESTS

- (a) No load saturation and loss curves up to approximately 115% of rated voltage
- (b) Momentary overload test
- (c) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., core temp., coolant flow and its temperature shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
- (d) Surge withstand test on the sample coil after placing it in stator core at $(4U + 5 \text{ KV})$ and with at least five impulse of 1.2/50 micro sec. wave, for HV motors only, where U is the line to line voltage in kV.
- (e) Surge-withstand test with 0.3/3 micro sec. wave on each type of 3.3/11 kV motor coils with at least five such impulses, followed by one minute power frequency high voltage test on turn to turn insulation, after cutting the coil and bringing out



the turns suitably. The power frequency test voltage shall be decided during detailed engineering.

- f) Dimensions (for motors covered by IS 1231:1974 and IS 2223:1983 only)
- g) Measurement of resistance of windings of stator and wound rotor.
- h) Reduced voltage running up test at no load (for squirrel cage motors up to 37kw only)
- i) Full load test to determine efficiency, power factor and slip.
- j) Insulation resistance test
- k) Test for vibration severity of motor
- l) Test for noise levels of motor
- m) Test for degree of protection by enclosure
- n) Temperature rise test at limiting values of voltage and frequency variations
- o) Over speed test

5.02.00 ROUTINE TESTS

The following shall constitute the routine tests.

- a) Insulation resistance test
- b) Measurement of resistance of windings of stator and wound rotor.
- c) No load test
- d) Locked rotor readings of voltage, current and power input at a suitable reduced voltage
- e) Reduced voltage running up test (for squirrel cage motor)
- f) Open circuit voltage ratio of stator and rotor windings (for slip ring motors); rotor;
- g) High voltage test

6.00.00 INSPECTION AND TESTING AT SITE

6.01.01 Insulation resistance of 415V motors shall be measured between the winding of the machine and its frame by means of a 500/1000V megger. A minimum value of 1 mega ohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be brought up by any of the following methods as desired by the Site Engineer:

- (a.) Blowing hot air in case of big motors.
- (b.) Putting the motor in electric oven in case of smaller motors.
- (c.) Placing heaters or lamps around and inside in case of small motors after making suitable guarding and covering arrangements so as to conserve the heat.



6.01.02 Site Test

- (a.) Measurement of vibration.
- (b.) Measurement of insulation resistance and polarization index.
- (c.) Measurement of full load current.
- (d.) Test running of the motors, checking the temperature rise and identifying the hot spot etc.

6.01.03 3.3 kV motors shall be tested for insulation by 500/1000V megger and its value should not be less than the safe minimum insulation of $\geq 20 \text{ M}\Omega$ resistance at 60 deg. C. In case the insulation is low, the following method of drying has to be adopted:

- a. By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals that full load current flows in the stator, keeping the stator winding temperature below 90 deg. C. In this a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. Value becomes steady.
- b. By blasting hot air from external source, Maximum temperature of winding while drying should be 70 deg. C to 80 deg. C. (Thermometer) or 90 deg. C. to 95 deg. C. by resistance method. Heating should be done slowly till steady temperature of winding is reached after 4 to 5 hours and for large machines after 10 hours. A record has to be kept for drying process, with half an hour readings and, after steady temperature is reached, at an interval of 2 hours. In case it is essential, the drying process can be supplemented by blower.



Annexure-4A

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
	PROJECT ENGINEERING & SYSTEMS DIVISION				
	PRICE FORMAT (R00) FOR HYDRANT AND SPRAY WATER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4A to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI				
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. :<Bidder to indicate> BHEL Enq. No. & date :<Bidder to indicate>				
I	MAIN OFFER [Note:Prices for individual items to be quoted as indicated in the price bid format.]				
A	MATERIAL SUPPLY: HYDRANT-SPRAY WATER PUMP WITH MOTOR				
A.1	Hydrant water Pump along with drive motor assembly complete with all accessories as per specification.	2	Set		
A.2	Spray water Pump along with drive motor assembly complete with all accessories as per specification.	1	Set		
A.3	Commissioning Spares-Hydrant water Pump				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	2	Set		
A.4	Commissioning Spares-Spray water Pump				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	1	Set		
B	MATERIAL SUPPLY: HYDRANT-SPRAY WATER PUMP WITH DIESEL ENGINE				
B.1	Hydrant water pump along with Diesel Engine Complete with all accessories as per specification.	2	Set		
B.2	Spray water pump along with Diesel Engine Complete with all accessories as per specification.	1	Set		
B.3	Commissioning spares-Hydrant water Pump				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	2	Set		
B.4	Commissioning spares-Spray water Pump				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	1	Set		
C	Special tools & tackles				
C.1	Special tools & tackles for Pump and Motor				
	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	1	Set		
C.2	Special tools & tackles for Pump and Diesel Engine				

Annexure-4A

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
	PROJECT ENGINEERING & SYSTEMS DIVISION				
	PRICE FORMAT (R00) FOR HYDRANT AND SPRAY WATER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4A to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI				
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. :<Bidder to indicate> BHEL Enq. No. & date :<Bidder to indicate>				
	Special tools & tackles as per manufacture recommendations. 1 set standas for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	1	Set		
D	MANDATORY SPARES: Note:Prices for individual items to be quoted as indicated in the price bid format.[Refer Note 8]				
D.1	For Hydrant & Spray Pump:				
1	IMPELLER	1 NO. OF EACH TYPE AND SIZE	No.		
2	PUMP BEARINGS	1 NO. OF EACH TYPE AND SIZE	No.		
3	PUMP SHAFT	1 NO. OF EACH TYPE AND SIZE	No.		
4	BEARING RINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
5	SHAFT SLEEVES	2 SET. OF EACH TYPE AND SIZE	Sets		
6	BUSHINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
7	BEARING HOUSING (IF PROVIDED)	2 SET. OF EACH TYPE AND SIZE	Sets		
8	COUPLING AND NUTS (WITH BUSHES)	2 SET. OF EACH TYPE AND SIZE	Sets		
D.2	For Diesel Engine of Hydrant & Spray Pump:				
1	FUEL INJECTION NOZZLE	2 SET. OF EACH TYPE AND SIZE	Sets		
2	PISTON RING	1 COMPLETE SET FOR EACH CYLINDER.	Set		
3	FUEL FILTERS ELEMENTS AND SEALS	2 SETS	Sets		
4	LUBRICATING OIL FILTER ELEMENTS & SEALS	2 SETS	Sets		
5	ENGINE JOINTS, GASKETS AND HOSES	1 SETS	Set		
6	INLET VALVE	1 NO.	No.		
II	Optional Items				
E	Supervison charges for erection & commissioning at site				
E.1	Per diem rate for the supervision of Erection & commissioning of Hydrant-Spray Pump [Refer Note 12]	12	Days		
E.2	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Hydrant-spray Pump [Refer Note 12]	6	Visit		
E.3	Per diem rate for the supervision of Erection & commissioning of Motor for Hydrant-spray Pump[Motor driven] [Refer Note 10]	6	Days		
E.4	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Motor for Hydrant-Spray Pump[Motor driven][Refer Note 12]	3	Visit		
E.5	Per diem rate for the supervision of Erection & commissioning of Diesel engine of Hydrant-Spray Pump(Diesel Engine driven) [Refer Note 12]	6	Days		

Annexure-4A

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032			
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR HYDRANT AND SPRAY WATER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4A to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENnore SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>					
E.6	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Diesel Engine for Hydrant-Spray(Diesel Engine driven) [Refer Note 12]	3	Visit		
F	2 Years Recommended Spares				
	Recommended spares list for two years normal operation along with unit price breakup for Pump, Drives & other accessories. (List with price break up to be enclosed) (1 set stands for quantity required for the replacement of one pump, drive (or) accessories)	As per List	Set		
TOTAL					
Notes:					
1) Bidder to quote strictly as per BHEL's NIT requirements.					
2) Bidder to note that this is a LUMP SUM Turn Key Order. However (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably. (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.					
3) Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.					
4) Prices quoted by bidders for items under main offer : Sl. No. I [A to D] will be considered for evaluation of lowest bidder. However, BHEL reserves the right (a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evaluation will be intimated to vendor during technical evaluation (before price bid opening). (b) To place PO for any of the Optional items within the contract period. Hence bidders need to mandatorily quote reasonable prices for all optional items considering such requirement and keep the validity of the prices till the end of contract period.					
5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 5.b) Bidder must not change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price. 5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.					
6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.					
7 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended (as per bidders experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum. 7.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.					
8) With respect to Mandatory Spares; A) If any of above items indicated by the specified name are not applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced. B) If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed engg. stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL.					
9) Reference document: BHEL Specification PY51282 R00 & all its annexures.					

Annexure-4A

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR HYDRANT AND SPRAY WATER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4A to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. :<Bidder to indicate> BHEL Enq. No. & date :<Bidder to indicate>					
10) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.					
11) In case the systems are being supplied from outside India , reputed Third Party Inspection like Llyods or equivalent has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency.					
12) With respect to Supervision charges,Optional prices to be quoted by bidder & the same shall be considered for L1-bidder evaluation. Referring to SI no E.1 TO E.2, Hydrant-Spray water pump, For the purpose of Quotation, total no of 12 man days for Pump will be covered in 6 visits [1 visit for each pump] have been considered. payment against SI.No D.1 TO D.2 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to SI no E.3 TO E.4, Motor , For the purpose of Quotation, total no of 6 man days for Motor will be covered in 3 visits [1 visit for each motor] have been considered. Payment against SI.No E.3 TO E.4 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to SI no E.5 TO E.6, Diesel Engine , For the purpose of Quotation, total no of 6 man days for Diesel Engine will be covered in 3 visits [1 visit for each Diesel Engine] have been considered. Payment against SI.No E.5 TO E.6 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Purchase Order for supply of main items, (A to D) shall be placed by BHEL-Hyderabad. For Supervision of E&C,LOI shall be placed by PE&SD and PO By BHEL-PSSR.					

Annexure-4B

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
	PROJECT ENGINEERING & SYSTEMS DIVISION				
	PRICE FORMAT (R00) FOR JOCKEY PUMP WITH DRIVE MOTOR [Annexure-4B to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI				
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate>				
I	MAIN OFFER				
A	MATERIAL SUPPLY: JOCKEY PUMP WITH DRIVE MOTOR				
A.1	Jockey Pump along with drive motor assembly complete with all accessories as per specification.	2	Set		
A.2	Commissioning spares				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump and drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	2	Set		
B	NIL				
C	Special tools & tackles				
C.1	Special tools & tackles for Pump and Motor				
	Special tools & tackles as per manufacture recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	1	Set		
D	MANDATORY SPARES: Note:Prices for individual items to be quoted as indicated in the price bid format. [Refer Note 8]				
D.1	For Jockey Pump:				
1	IMPELLER	1 NO. OF EACH TYPE AND SIZE	No.		
2	PUMP BEARINGS	1 NO. OF EACH TYPE AND SIZE	No.		
3	PUMP SHAFT	1 NO. OF EACH TYPE AND SIZE	No.		
4	BEARING RINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
5	SHAFT SLEEVES	2 SET. OF EACH TYPE AND SIZE	Sets		
6	BUSHINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
7	BEARING HOUSING (IF PROVIDED)	2 SET. OF EACH TYPE AND SIZE	Sets		
8	COUPLING AND NUTS (WITH BUSHES)	2 SET. OF EACH TYPE AND SIZE	Sets		
II	Optional Items				
E	Supervision charges for erection & commissioning at site				
E.1	Per diem rate for the supervision of Erection & commissioning of Jockey Pump [Refer Note 12]	4	Days		
E.2	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Jockey Pump [Refer Note 12]	1	Visit		
G	2 Years Recommended Spares				
	Recommended spares list for two years normal operation along with unit price breakup for Pump, Drives & other accessories. (List with price break up to be enclosed) (1 set stands for quantity required for the replacement of one pump, drive (or) accessories)	As per List	Set		

Annexure-4B

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR JOCKEY PUMP WITH DRIVE MOTOR [Annexure-4B to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate>					
TOTAL					
Notes: 1) Bidder to quote strictly as per BHEL's NIT requirements. 2) Bidder to note that this is a LUMP SUM Turn-Key Order. However (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably. (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage. 3) Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. 4) Prices quoted by bidders for items under main offer : Sl. No. I [A to D] will be considered for evaluation of lowest bidder. However, BHEL reserves the right (a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evaluation will be intimated to vendor during technical evaluation (before price bid opening). (b) To place PO for any of the Optional items with in the contract period. Hence bidders need to mandatorily quote reasonable prices for all optional items considering such requirement and keep the validity of the prices till the end of contract period. 5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 5.b) Bidder must not change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price. 5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection. 6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately. 7 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended (as per bidders experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum. 7.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor. 8) With respect to Mandatory Spares; A) If any of above items indicated by the specified name are not applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced. B) If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed engg. stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL. 9) Reference document: BHEL Specification PY51282 R00 & all its annexures. 10) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format. 11) In case the systems are being supplied from outside India , reputed Third Party Inspection like Llyods or equivalent has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency. 12) With respect to Supervision charges, Optional prices to be quoted by bidder but may or may not be ordered by BHEL. Referring to Sl no E.1 TO E.2, Jockey pump, For the purpose of Quotation, total no of 2 man days for Pump will be covered in 1 visit [1 visit for each pump] have been considered. payment against Sl.No E.1 TO E.2 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to Sl no E.3 TO E.4, Motor, For the purpose of Quotation, total no of 2 man days for Motor will be covered in 1 visit [1 visit for each motor] have been considered. Payment against Sl.No E.3 TO E.4 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates— Purchase Order for supply of main items, (A to D) shall be placed by BHEL-Hyderabad. For Supervision of E&C, LOI shall be placed by PE&SD and PO By BHEL-PSSR.					

Annexure-4C

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
	PROJECT ENGINEERING & SYSTEMS DIVISION				
	PRICE FORMAT (R00) FOR BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4C to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI				
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
	Bidder's Name : <Bidder to indicate>				
I	MAIN OFFER				
A	MATERIAL SUPPLY: BOOSTER PUMP WITH MOTOR				
A.1	Booster Pump along with drive motor assembly complete with all accessories as per specification.	1	Set		
A.2	Commissioning Spares - Booster Pump with motor				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump and drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	1	Set		
B	MATERIAL SUPPLY: BOOSTER PUMP WITH DIESEL ENGINE				
B.1	Booster pump along with Diesel Engine Complete with all accessories as per specification.	1	Set		
B.3	Commissioning Spares - Booster Pump with motor				
	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump and drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7)	1	Set		
C	Special tools & tackles				
C.1	Special tools & tackles for Pump and Motor				
	Special tools & tackles as per manufacture recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	1	Set		
C.2	Special tools & tackles for Pump and Diesel Engine				
	Special tools & tackles as per manufacture recommendations. 1 set standas for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	1	Set		
D	MANDATORY SPARES:				
D.1	Note:Prices for individual items to be quoted as indicated in the price bid format.[Refer Note 8]				
D.1	For Hydrant & Spray Pump:				
1	IMPELLER	1 NO. OF EACH TYPE AND SIZE	No.		
2	PUMP BEARINGS	1 NO. OF EACH TYPE AND SIZE	No.		
3	PUMP SHAFT	1 NO. OF EACH TYPE AND SIZE	No.		
4	BEARING RINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
5	SHAFT SLEEVES	2 SET. OF EACH TYPE AND SIZE	Sets		
6	BUSHINGS	2 SET. OF EACH TYPE AND SIZE	Sets		
7	BEARING HOUSING (IF PROVIDED)	2 SET. OF EACH TYPE AND SIZE	Sets		
8	COUPLING AND NUTS (WITH BUSHES)	2 SET. OF EACH TYPE AND SIZE	Sets		
D.2	For Diesel Engine of Hydrant & Spray Pump:				
1	FUEL INJECTION NOZZLE	2 SET. OF EACH TYPE AND SIZE	Sets		
2	PISTON RING	1 COMPLETE SET FOR EACH CYLINDER.	Set		
3	FUEL FILTERS ELEMENTS AND SEALS	2 SETS	Sets		
4	LUBRICATING OIL FILTER ELEMENTS & SEALS	2 SETS	Sets		

Annexure-4C

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4C to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate>					
5	ENGINE JOINTS, GASKETS AND HOSES	1 SETS	Set		
6	INLET VALVE	1 NO.	No.		
II	Optional Items	--	--		
E	Supervision charges for erection & commissioning at site				
E.1	Per diem rate for the supervision of Erection & commissioning of Booster Pump [Refer Note 12]	2	Days		
E.2	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Booster Pump [Refer Note 12]	1	Visit		
E.3	Per diem rate for the supervision of Erection & commissioning of Motor for Booster Pump[Motor driven] [Refer Note 10]	2	Days		
E.4	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Motor for Booster Pump[Motor driven][Refer Note 12]	1	Visit		
E.5	Per diem rate for the supervision of Erection & commissioning of Diesel engine of Booster Pump(Diesel Engine driven) [Refer Note 12]	2	Days		
E.6	Travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer per visit for supervision of erection & commissioning of Diesel Engine for Booster(Diesel Enginedriven) [Refer Note 12]	1	Visit		
F	2 Years Recommended Spares				
	Recommended spares list for two years normal operation along with unit price breakup for Pump, Drives & other accessories. (List with price break up to be enclosed) (1 set stands for quantity required for the replacement of one pump, drive (or) accessories)	As per List	Set		
TOTAL					
Notes:					
1) Bidder to quote strictly as per BHEL's NIT requirements.					
2) Bidder to note that this is a LUMP SUM Turn-Key Order. However					
3) Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items					
4) Prices quoted by bidders for items under main offer : Sl. No. I [A to D] will be considered for evaluation of lowest bidder. However, BHEL					
5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection.					
5.b) Bidder must not change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price.					
5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.					
6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be					
7 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended(as per bidders experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum.					
7.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.					
8)With respect to Mandatory Spares;					
9) Reference document: BHEL Specification PY51282 R00 & all its annexures.					
10) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.					
11) In case the systems are being supplied from outside India , reputed Third Party Inspection like Llyods or equivalent has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency.					

Annexure-4C

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION					
PRICE FORMAT (R00) FOR BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)[Annexure-4C to Doc. No.PY-51282] FOR PROJECT: 2X660 MW ENNORE SEZ PROJECT CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION CONSULTANT: DESEIN, NEW DELHI					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)
Bidder's Name : <Bidder to indicate>					
12) With respect to Supervision charges, Optional prices to be quoted by bidder & the same shall be considered for L1 bidder evaluation. Referring to SI no E.1 TO E.2, Booster pump, For the purpose of Quotation, total no of 2 man days for Pump will be covered in 1 visit [1 visit for each pump] have been considered. payment against SI.No E.1 TO E.2 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to SI no E.3 TO E.4, Motor , For the purpose of Quotation, total no of 2 man days for Motor will be covered in 1 visit [1 visit for each motor] have been considered. Payment against SI.No E.3 TO E.4 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Referring to SI no E.5 TO E.6, Diesel Engine , For the purpose of Quotation, total no of 2 man days for Diesel Engine will be covered in 1 visit [1 visit for each Diesel Engine] have been considered. Payment against SI.No E.5 TO E.6 above shall be made as per the actual number of visits and man days required for the supervision of the complete E&C activities as per these diem rates. Purchase Order for supply of main items, (A to D) shall be placed by BHEL-Hyderabad. For Supervision of E&C, LOI shall be placed by PE&SD and PO By BHEL-PSSR.					

CHECKLIST FOR OFFER FOR HYDRANT PUMP/ SPRAY WATER PUMP WITH DRIVES (MOTOR/DIESEL ENGINE)

S.No.	Description	Bidder's Reply
1.	Bidder to confirm that Performance requirement, Design and construction of the offered Pump model shall be guided by the TAC/LPA recommendations.	
2.	Bidder to confirm that Performance requirement, Design and construction of the offered Motor shall be guided by the TAC/LPA recommendations.	
3.	Bidder to confirm that Performance requirement, Design and construction of the offered Diesel Engine shall be guided by the TAC/LPA recommendations.	
4.	Refer Annexure-2A of Tender Specification: Datasheet of Hydrant and Spray Water Pump-Motor & Engine Datasheet. Duly filled Annexure-2A is enclosed with bidder's offer as indicated in Pg 04 of 24 of Tender Specification, PY-51282. Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
5.	As per Cl. No. 6 of Tender Specification, PY-51282 and all its annexures, Scope of supply as per this clause shall be in bidder's scope. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
6.	<u>Cable Glands & Lugs:</u> As per Cl. No. 6.2.1 of Tender Specification, PY-51282, suitable power & control cable glands & lugs shall be included in bidder scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
7.	As per Cl. No. 6.2.2.4 of Tender Specification, PY-51282, 1 No. of suitable motor(ex-proof type) operated and 1No. of hand operated pumps are considered by the bidder. Deviation in this is not acceptable. Bidder to Confirm.	
8.	As per Cl. No. 6.2.2.5 of Tender Specification, PY-51282, minimum instrumentations indicated is considered by bidder in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
9.	As per Cl. No. 6.2.2.6 of Tender Specification, PY-51282, 15 m of exhaust piping with silencer & insulation with 6 Nos. of bends are included in bidder's scope of supply. The exhaust piping shall consist of bends, hood, bird screen etc. Deviation in this is not acceptable. Bidder to Confirm.	
10.	<u>Battery & Battery Charger:</u> As per Cl. No. 6.2.2.7 of Tender Specification, PY-51282, battery [Lead Acid type] and battery charger is considered by bidder in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	

11.	<u>Coupling between pump and drives [Motor/Engine] :</u> As per Cl. No. 6.3 of Tender Specification, PY-51282, Coupling between pump and drives, [Motor/Engine] shall be BHEL Tender Specification. Accordingly coupling mandatory spares to be considered as per BHEL Tender Specification. Deviation in this is not acceptable. Bidder to Confirm.	
12.	As per Cl. No. 6.6 of Tender Specification, PY-51282, that all the Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal points are considered by bidder. Deviation in this is not acceptable. Bidder to Confirm.	
13.	As per Cl. No. 6.14 of Tender Specification, PY-51282, All the list of commissioning spares indicated in this clause are included in bidder's scope of supply. Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor. Deviation in this is not acceptable. Bidder to Confirm.	
14.	<u>Auxiliaries Equipment/Spares:</u> As per Cl. No. 6.16 of Tender Specification, PY-51282, all auxiliary equipment [clause no 7.4.5.7.3 of TAC] & spares [7.4.5.11 of TAC] as per TAC are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
15.	As per Cl. No. 6.17 of Tender Specification, PY-51282, All the special tools and tackles indicated in this clause are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
16.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4A(Price Bid Format). Bidder to Confirm.	
17.	As per Cl. No. 8 of Tender Specification, PY-51282, bidder is meeting the Equipment Qualification Criteria. All the references shall be submitted along with the offer as per Annexure-8 Deviation in this is not acceptable. Bidder to Confirm.	
18.	Painting schedule shall be as per Cl. No. 10 of Tender Specification, PY-51282. Bidder to Confirm.	
19.	<u>Inspection, Testing requirements for Pump & Drive assembly:</u> Inspection, Testing requirements shall be as per BHEL QAP & specification requirement only. Bidder to note that QAP shall be as per Annexure-7 & the same shall be discussed during detail engg. However in case of practical difficulties in meeting the quality requirement, same shall be mutually discussed & agreed during detail engg. Stage. Bidder to note & confirm.	
20.	Make of all the items shall be as per Annexure-9(Sub-Vendor List). Bidder to confirm.	
21.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, PY-51282 wrt list of documents, schedule of submission.	
22.	Bidders to comment on the instrumentation requirement as per P&ID (Annexure -1) based on their experience. If any other instruments are required as per good engg practice, bidder to highlight & Consider the same.	
23.	Bidder shall submit Annexure-11 indicating as <u>NO DEVIATION</u> along with their offer. Any specific deviations, which are	

	impractical, shall be raised in form of pre-bid queries as per Annexure-12 before submission of Techno Commercial offer. Any deviation/ queries raised during technical bid submission shall not be entertained. Bidder to Confirm.	
24.	Bidder to quote as per Annexure-4A, Price Bid Format only. Price quoted as per the price bid format, clearly indicating all the applicable items are quoted, and not applicable items are clearly highlighted. Un priced copy of the same is enclosed with bidder's offer. Bidder to check and confirm.	
25.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
26.	Refer Annexure-2A of Tender Specification, PY-51282. The casing material mentioned in sl no 35 shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in sl no 54..If Not, bidder to consider superior material of casing. Bidder to confirm.	
27.	Bidder to confirm that the following documents are submitted along with their offer to enable BHEL to evaluate the offer. a) Duly filled in Pump-Motor-Diesel Engine datasheet (Annexure-2A) b) Tentative GAD / P&ID for Pump with Motor & Engine(Stamped Copy of Annexure-1) c) Performance curves for pump d) Un-priced copy of price in attached BHEL price bid formats(Annexure-4A) indicating quoted/ not quoted against each row & column. e) Equipment qualification criteria / PTR / Reference Lists f) Checklist as per (Annexure-5A) g) Deviation list [Indicating as No Deviation] as per (Annexure-11)	
28.	All important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily to be furnished by bidder along with their offer for evaluation. Bidder to once again check their offer before submission and confirm.	
29.	<u>BoQ for Main Equipment:</u> Bill of Quantity for Fire Water Pumps is enclosed with this checklist. This is the minimum BOQ identified by purchaser. However any other item required for successful commissioning of the fire water pump and drive assembly shall be considered by the bidder. Bidder to check and fill their confirmation whether the BoQ indicated is considered in their offer.	
30.	<u>BoQ for Commissioning Spares:</u> Bill of Quantity for Commissioning spares is enclosed with this checklist. Bidder to Confirm and furnish the list of commissioning spares considered by the bidder.	
31.	<u>BoQ for Special Tools and Tackles:</u> Bill of Quantity for special tools and tackles is enclosed with this checklist. Bidder to Confirm and furnish the list of special tools and tackles considered by the bidder.	

MAIN EQUIPMENT - BOQ OF FIRE WATER PUMPS(Hydrant & Spray) along with Drives(Motor & Diesel Engine)

SI No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Hydrant Pump-Motor Assembly: Horizontal Centrifugal type, Motor driven (410 M3/Hr.; 120 MWC, HT Motor, Base plate, Coupling, Coupling guard, foundation bolts etc.). For Details Refer Annexure-2A: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
1.1	Pump	Nos.	1		
1.2	HT Motor(Suitable Rating)	Nos.	1		
1.3	Common Base Frame for Pump & Motor Assembly	Nos.	1		
1.4	Mechanical Seal(1 no for each pump)	Nos.	1		
1.5	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
1.6	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
1.7	Motor Canopy(1 no for each motor)	Nos.	1		
1.8	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
1.9	Lugs and Glands for Motors	Sets	1		
1.10	Vibration pads [Bidder to consider suitable nos]	Nos.			

1.11	Vent valve on pump	Nos.	1		
1.12	Suitable Concentric Reducer (Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #150. Details of Discharge Pipe Size are indicated in Annexure-1 of Tender Specification, PY 51282	Sets	1		
1.13	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #150. Details of Discharge Pipe Size are indicated in Annexure-1.	Sets	1		
1.14	Suitable Studnuts and Bolts for suction flange	Set	1		
1.15	Suitable Studnuts and Bolts for Discharge flange	Set	1		
1.16	Suitable Gaskets for suction flange	Set	1		
1.17	Suitable Gaskets for Discharge flange	Set	1		
1.18	Pump Casing Drain valve/plug	Nos.	1		
1.19	Base Frame Casing Drain valve/plug	Nos.	1		
1.20	SS piping for Flusing Plan	Sets	1		
2	Spray Pump-Motor Assembly: Horizontal Centrifugal type, Motor driven (410 M3/Hr.; 120 MWC, HT Motor, Base plate, Coupling, Coupling guard, foundation bolts etc.). For Details Refer Annexure-2A: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
2.1	Pump	Nos.	1		
2.2	HT Motor(As per required Rating in kW)	Nos.	1		
2.3	Common Base Frame for Pump & Motor Assembly	Nos.	1		
2.4	Mechanical Seal(1 no for each pump)	Nos.	1		
2.5	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
2.6	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
2.7	Motor Canopy(1 no for each motor)	Nos.	1		
2.8	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
2.9	Lugs and Glands for Motors	Sets	1		
2.10	Vibration pads [Bidder to consider suitable nos]	Nos.			
2.11	Vent valve on pump	Nos.	1		

2.12	Suitable Eccentric Reducer(Suction side) with welded Flange and counter flange(loose supply) as per ANSI 16.5 #150. Details of Suction Pipe Size are indicated in Annexure-1.	Sets	1		
2.13	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #150. Details of Discharge Pipe Size are indicated in Annexure-1 of Tender Specification, PY 51282	Nos.	1		
2.14	Suitable Studnuts and Bolts for suction flange	Set	1		
2.15	Suitable Studnuts and Bolts for Discharge flange	Set	1		
2.16	Suitable Gaskets for suction flange	Set	1		
2.17	Suitable Gaskets for Discharge flange	Set	1		
2.18	Pump Casing Drain valve/plug	Nos.	1		
2.19	Base Frame Casing Drain valve/plug	Nos.	1		
2.20	SS piping for Flusing Plan	Sets	1		
3	Hydrant Pump-Engine Driven Assembly: Horizontal Centrifugal type, Engine driven Pump (410 M3/Hr.; 120 MWC), Diesel Engine, Base plate, Coupling, Coupling guard, foundation bolts etc. For Details Refer Annexure-2A: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
3.1	Pump	Nos.	1		
3.2	Diesel Engine(Suitable Rating)	Nos.	1		
3.3	DC Motor(to start engine)	Nos.	1		
3.4	Sludge and Sediment Trap	Nos.	1		
3.5	Filter(for diesel pump)	Nos.	1		
3.6	Screwed plugs(for bleeding of air in diesel piping)	Sets	1		
3.7	Belts for engine	Sets	2		
3.8	Inlet valve & Exhaust valve	Sets	1		
3.9	Air filter	Nos.	1		
3.10	Governor	Nos.	1		
3.11	Complete set of engine-joints, gaskets and hoses	Sets	1		
3.12	Battery(12 V, 2 nos for each Engine)	Nos.	2		

3.13	Charger cum Control Panel(With Ammeter & Voltmeter) for Diesel Engine, Tank and Battery	Nos.	1		
3.14	Battery Selector Panel for Charging	Nos.	1		
3.15	Control Panel(integral of Engine)	Nos.	1		
3.16	Silencer for Diesel Engine	Nos.	1		
3.17	Insulation for Silencer	Sets	1		
3.18	Diesel Tank	Nos.	1		
3.19	Level Switch on Diesel Tank	Nos.	1		
3.20	Level Gauge on Diesel Tank	Nos.	1		
3.21	Electric Operated [Ex Proof] Barrel Unloading pump with discharge hose	Nos.	1		
3.22	Manual Operated Barrel Unloading pump with discharge hose	Nos.	1		
3.23	Common Base Frame for Pump & Engine Assembly	Nos.	1		
3.24	Mechanical Seal(1 no for each pump)	Nos.	1		
3.25	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
3.26	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
3.27	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
3.28	Vibration pads	Nos.			
3.29	Vent valve on pump	Nos.	1		
3.30	Suitable Studnuts and Bolts for suction flange	Set	1		
3.31	Suitable Studnuts and Bolts for Discharge flange	Set	1		
3.32	Suitable Gaskets for suction flange	Set	1		
3.33	Suitable Gaskets for Discharge flange	Set	1		
3.34	Pump Casing Drain valve/plug	Nos.	1		
3.35	Base Frame Casing Drain valve/plug	Nos.	1		
3.36	X" suitable pipe of length for exhaust of Diesel Engine	mtrs	15		
3.37	X" suitable elbows for exhaust pipe of Diesel Engine	Nos.	6		
3.38	NIL.				
3.39	Y" Pipe for interconnecting fuel tank to engine	mtrs	3		
3.40	Y" Elbows for interconnecting fuel tank to engine	Nos.	5		
3.41	Temperature indicator(contact type) in cooling water inlet & outlet	Nos.	2		

3.42	Temperature indicator in lubricating oil outlet from the oil cooler	Nos.	1		
3.43	Pressure Gauges(contact type) for lubricating oil system	Nos.	1		
3.44	Speed indicator	Nos.	1		
3.45	Running hour meter	Nos.	1		
3.46	Dip stick type lubricating oil sump	Nos.	1		
4	Spray Pump-Engine Driven Assembly: Horizontal Centrifugal type, Engine driven Pump (410 M3/Hr.; 120 MWC), Diesel Engine, Base plate, Coupling, Coupling guard, foundation bolts etc. For Details Refer Annexure-2A: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
4.1	Pump	Nos.	1		
4.2	Diesel Engine(Suitable Rating)	Nos.	1		
4.3	DC Motor(to start engine)	Nos.	1		
4.4	Sludge and Sediment Trap	Nos.	1		
4.5	Filter(for diesel pump)	Nos.	1		
4.6	Screwed plugs(for bleeding of air in diesel piping)	Sets	1		
4.7	Belts for engine	Sets	2		
4.8	Inlet valve & Exhaust valve	Sets	1		
4.9	Air filter	Nos.	1		
4.10	Governor	Nos.	1		
4.11	Complete set of engine-joints, gaskets and hoses	Sets	1		
4.12	Battery(12 V, 2 nos for each Engine)	Nos.	2		
4.13	Charger cum Control Panel(With Ammeter & Voltmeter) for Diesel Engine, Tank and Battery	Nos.	1		
4.14	Battery Selector Panel for Charging	Nos.	1		
4.15	Control Panel(integral of Engine)	Nos.	1		
4.16	Silencer for Diesel Engine	Nos.	1		
4.17	Insulation for Silencer	Sets	1		
4.18	Diesel Tank	Nos.	1		
4.19	Level Switch on Diesel Tank	Nos.	1		
4.20	Level Gauge on Diesel Tank	Nos.	1		

4.21	Electric Operated [Ex Proof] Barrel Unloading pump with discharge hose	Nos.	1		
4.22	Manual Operated Barrel Unloading pump with discharge hose	Nos.	1		
4.23	Common Base Frame for Pump & Engine Assembly	Nos.	1		
4.24	Mechanical Seal(1 no for each pump)	Nos.	1		
4.25	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
4.26	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
4.27	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
4.28	Vibration pads [Bidder to consider suitable nos]	Nos.			
4.29	Vent valve on pump	Nos.	1		
4.30	Suitable Studnuts and Bolts for suction flange	Set	1		
4.31	Suitable Studnuts and Bolts for Discharge flange	Set	1		
4.32	Suitable Gaskets for suction flange	Set	1		
4.33	Suitable Gaskets for Discharge flange	Set	1		
4.34	Pump Casing Drain valve/plug	Nos.	1		
4.35	Base Frame Casing Drain valve/plug	Nos.	1		
4.36	X" suitable pipe for exhaust of Diesel Engine	mtrs	15		
4.37	X" suitable elbows for exhaust pipe of Diesel Engine	Nos.	6		
4.38	NIL				
4.39	Y" Pipe for interconnecting fuel tank to engine	mtrs	3		
4.40	Y" Elbows for interconnecting fuel tank to engine	Nos.	5		
4.41	Temperature indicator(contact type) in cooling water inlet & outlet	Nos.	2		
4.42	Temperature indicator in lubricating oil outlet from the oil cooler	Nos.	1		
4.43	Pressure Gauges(contact type) for lubricating oil system	Nos.	1		
4.44	Speed indicator	Nos.	1		
4.45	Running hour meter	Nos.	1		
4.46	Dip stick type lubricating oil sump	Nos.	1		

COMMISSIONING SPARES - BOQ OF FIRE WATER PUMPS(Hydrant & Spray) along with Drives(Motor & Diesel Engine)

Sl No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Hydrant Pump-Motor Assembly: Commissioning Spares				
1.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	1		
2	Spray Pump-Motor Assembly: Commissioning Spares				
2.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	1		
3	Hydrant Pump-Diesel Engine Assembly: Commissioning Spares				
3.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	1		
4	Spray Pump-Diesel Engine Assembly: Commissioning Spares				

4.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Comissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	1		
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SPECIAL TOOLS AND TACKLES - BOQ OF FIRE WATER PUMPS(Hydrant & Spray) along with Drives(Motor & Diesel Engine)					
SI No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Hydrant Pump-Motor Assembly: Commissioning Spares				
1.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		
2	Spray Pump-Motor Assembly: Commissioning Spares				

2.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		
3	Hydrant Pump-Diesel Engine Assembly: Commissioning Spares				
3.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		
4	Spray Pump-Diesel Engine Assembly: Commissioning Spares				
4.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		

SIGNATURE:

NAME:

DESIGNATION:

COMPANY:

DATE:

ANNEXURE-5B to PY-51282

CHECKLIST FOR OFFER FOR JOCKEY PUMP WITH DRIVES (MOTOR DRIVEN)

S.No.	Description	Bidder's Reply
1.	Bidder to confirm that Performance requirement, Design and construction of the offered Pump model shall be guided by the TAC/LPA recommendations.	
2.	Bidder to confirm that Performance requirement, Design and construction of the offered Motor shall be guided by the TAC/LPA recommendations.	
3.	NIL.	
4.	Refer Annexure-2B of Tender Specification: Datasheet of Jockey Pump-Motor Driven. Duly filled Annexure-2B is enclosed with bidder's offer as indicated in Pg 04 of 24 of Tender Specification, PY-51282. Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
5.	As per Cl. No. 6 of Tender Specification, PY-51282 and all its annexures, Scope of supply as per this clause shall be in bidder's scope. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
6.	<u>Cable Glands & Lugs:</u> As per Cl. No. 6.2.1 of Tender Specification, PY-51282, suitable power & control cable glands & lugs shall be included in bidder scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
7.	As per Cl. No. 6.2.1 of Tender Specification, PY-51282, all LT Motors shall be of IE-3 type in-line with IS-12615. Deviation in this is not acceptable. Bidder to Confirm.	
8.	As per Cl. No. 6.2.2.5 of Tender Specification, PY-51282, minimum instrumentations indicated is considered by bidder in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
9.	NIL.	
10.	NIL.	

11.	<u>Coupling between pump and drives [Motor] :</u> As per Cl. No. 6.3 of Tender Specification, PY-51282, Coupling between pump and drives, [Motor] shall be BHEL Tender Specification. Accordingly coupling mandatory spares to be considered as per BHEL Tender Specification. Deviation in this is not acceptable. Bidder to Confirm.	
12.	As per Cl. No. 6.6 of Tender Specification, PY-51282, that all the Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal points are considered by bidder. Deviation in this is not acceptable. Bidder to Confirm.	
13.	As per Cl. No. 6.14 of Tender Specification, PY-51282, All the list of commissioning spares indicated in this clause are included in bidder's scope of supply. Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor. Deviation in this is not acceptable. Bidder to Confirm.	
14.	<u>Auxiliaries Equipment/Spares:</u> As per Cl. No. 6.16 of Tender Specification, PY-51282, all auxiliary equipment [clause no 7.4.5.7.3 of TAC] & spares [7.4.5.11 of TAC] as per TAC are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
15.	As per Cl. No. 6.17 of Tender Specification, PY-51282, All the special tools and tackles indicated in this clause are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
16.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4B(Price Bid Format). Bidder to Confirm.	
17.	As per Cl. No. 8 of Tender Specification, PY-51282, bidder is meeting the Equipment Qualification Criteria. All the references shall be submitted along with the offer as per Annexure-8 Deviation in this is not acceptable. Bidder to Confirm.	
18.	Painting schedule shall be as per Cl. No. 10 of Tender Specification, PY-51282. Bidder to Confirm.	

19.	<u>Inspection, Testing requirements for Pump & Drive assembly:</u> Inspection, Testing requirements shall be as per BHEL QAP & specification requirement only. Bidder to note that QAP shall be as per Annexure-7 & the same shall be discussed during detail engg. However in case of practical difficulties in meeting the quality requirement, same shall be mutually discussed & agreed during detail engg. Stage. Bidder to note & confirm.	
20.	Make of all the items shall be as per Annexure-9(Sub-Vendor List). Bidder to confirm.	
21.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, PY-51282 wrt list of documents, schedule of submission.	
22.	Bidders to comment on the instrumentation requirement as per P&ID (Annexure -1) based on their experience. If any other instruments are required as per good engg practice, bidder to highlight & Consider the same.	
23.	Bidder shall submit Annexure-11 indicating as <u>NO DEVIATION</u> along with their offer. Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-12 before submission of Techno Commercial offer. Any deviation/ queries raised during technical bid submission shall not be entertained. Bidder to Confirm.	
24.	Bidder to quote as per Annexure-4B, Price Bid Format only. Price quoted as per the price bid format, clearly indicating all the applicable items are quoted, and not applicable items are clearly highlighted. Un priced copy of the same is enclosed with bidder's offer. Bidder to check and confirm.	
25.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
26.	Refer Annexure-2A of Tender Specification, PY-51282. The casing material mentioned in sl no 35 shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in sl no 54..If Not, bidder to consider superior material of casing. Bidder to confirm.	
27.	Bidder to confirm that the following documents are submitted along with their offer to enable BHEL to evaluate the offer. a) Duly filled in Pump-Motor datasheet (Annexure-2B) b) Tentative GAD / P&ID for Pump with Motor & Engine(Stamped Copy of Annexure-1) c) Performance curves for pump d) Un-priced copy of price in attached BHEL price bid formats(Annexure-4B) indicating quoted/ not quoted against each row & column. e) Equipment qualification criteria / PTR / Reference Lists	

	f) Checklist as per (Annexure-5B) g) Deviation list [Indicating as No Deviation] as per (Annexure-11)	
28.	All important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily be furnished by bidder along with their offer for evaluation. Bidder to once again check their offer before submission and confirm.	
29.	<u>BoQ for Main Equipment:</u> Bill of Quantity for Fire Water Pumps is enclosed with this checklist. This is the minimum BOQ identified by purchaser. However any other item required for successful commissioning of the fire water pump and drive assembly shall be considered by the bidder. Bidder to check and fill their confirmation whether the BoQ indicated is considered in their offer.	
30.	<u>BoQ for Commissioning Spares:</u> Bill of Quantity for Commissioning spares is enclosed with this checklist. Bidder to Confirm and furnish the list of commissioning spares considered by the bidder.	
31.	<u>BoQ for Special Tools and Tackles:</u> Bill of Quantity for special tools and tackles is enclosed with this checklist. Bidder to Confirm and furnish the list of special tools and tackles considered by the bidder.	

MAIN EQUIPMENT - BOQ OF FIRE WATER PUMPS(Jockey) along with Motor Drive

Sl No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Jockey Pump-Motor Assembly: Horizontal Centrifugal type, Motor driven (410 M3/Hr.; 120 MWC, HT Motor, Base plate, Coupling, Coupling guard, foundation bolts etc.). For Details Refer Annexure-2B: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	2		
1.1	Pump	Nos.	2		
1.2	LT Motor(Suitable Rating)	Nos.	2		
1.3	Common Base Frame for Pump & Motor Assembly	Nos.	2		
1.4	Mechanical Seal(1 no for each pump)	Nos.	2		
1.5	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	2		
1.6	Coupling guard along with bolts, nuts and gaskets	Nos.	2		
1.7	Motor Canopy(1 no for each motor)	Nos.	2		

1.8	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	16		
1.9	Lugs and Glands for Motors	Sets	2		
1.10	Vibration pads [Bidder to consider suitable nos]	Nos.			
1.11	Vent valve on pump	Nos.	2		
1.12	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #150. Details of Discharge Pipe Size are indicated in Annexure-1 of Tender Specification, PY 51282	Sets	2		
1.13	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #150. Details of Discharge Pipe Size are indicated in Annexure-1.	Sets	2		
1.14	Suitable Studnuts and Bolts for suction flange	Set	2		
1.15	Suitable Studnuts and Bolts for Discharge flange	Set	2		
1.16	Suitable Gaskets for suction flange	Set	2		
1.17	Suitable Gaskets for Discharge flange	Set	2		
1.18	Pump Casing Drain valve/plug	Nos.	2		
1.19	Base Frame Casing Drain valve/plug	Nos.	2		
1.20	SS piping for Flusing Plan	Sets	2		

COMMISSIONING SPARES - BOQ OF FIRE WATER PUMPS(Booster) along with Drive Motor

Sl No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Booster Pump-Motor Assembly: Commissioning Spares				
1.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	2		
2	Booster Pump-Diesel Engine Assembly: Commissioning Spares				
2.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	2		

SPECIAL TOOLS AND TACKLES - BOQ OF FIRE WATER PUMPS(Jockey) along with Drive Motor					
SI No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Hydrant Pump-Motor Assembly: Commissioning Spares				
1.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	2		

SIGNATURE:

NAME:

DESIGNATION:

COMPANY:

DATE:

ANNEXURE-5C to PY-51282

CHECKLIST FOR OFFER FOR BOOSTER PUMP WITH DRIVES (MOTOR/DIESEL ENGINE)

S.No.	Description	Bidder's Reply
1.	Bidder to confirm that Performance requirement, Design and construction of the offered Pump model shall be guided by the TAC/LPA recommendations.	
2.	Bidder to confirm that Performance requirement, Design and construction of the offered Motor shall be guided by the TAC/LPA recommendations.	
3.	Bidder to confirm that Performance requirement, Design and construction of the offered Diesel Engine shall be guided by the TAC/LPA recommendations.	
4.	Refer Annexure-2C of Tender Specification: Datasheet of Booster Pump-Motor & Engine Driven. Duly filled Annexure-2C is enclosed with bidder's offer as indicated in Pg 04 of 24 of Tender Specification, PY-51282. Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
5.	As per Cl. No. 6 of Tender Specification, PY-51282 and all its annexures, Scope of supply as per this clause shall be in bidder's scope. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
6.	<u>Cable Glands & Lugs:</u> As per Cl. No. 6.2.1 of Tender Specification, PY-51282, suitable power & control cable glands & lugs shall be included in bidder scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
7.	As per Cl. No. 6.2.1 of Tender Specification, PY-51282, all LT Motors shall be of IE-3 type in-line with IS-12615. Deviation in this is not acceptable. Bidder to Confirm.	
8.	As per Cl. No. 6.2.2.4 of Tender Specification, PY-51282, A suitable 1 phase 230 Volt fuel pump (portable) to be provided to fill up diesel oil from Diesel Drum received from supplier of Diesel. This pump should also have facility to be operated by hand, in case electricity fails. However, is same is not available in market then bidders can supply one hand pump & one motor drive pump [ex-proof] separately. Necessary tubing [5m length] from Diesel Engine pump to the fuel tank along with valve (If any) to be supplied by Bidder. Deviation in this is not acceptable. Bidder to Confirm.	
9.	As per Cl. No. 6.2.2.5 of Tender Specification, PY-51282, minimum instrumentations indicated is considered by bidder in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	

10.	As per Cl. No. 6.2.2.6 of Tender Specification, PY-51282, 15 m of exhaust piping with silencer & insulation with 6 Nos. of bends are included in bidder's scope of supply. The exhaust piping shall consist of bends, hood, bird screen etc. Deviation in this is not acceptable. Bidder to Confirm.	
11.	<u>Battery & Battery Charger:</u> As per Cl. No. 6.2.2.7 of Tender Specification, PY-51282, battery and battery charger is considered by bidder in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
12.	<u>Coupling between pump and drives [Motor/Engine] :</u> As per Cl. No. 6.3 of Tender Specification, PY-51282, Coupling between pump and drives, [Motor/Engine] shall be BHEL Tender Specification. Accordingly coupling mandatory spares to be considered as per BHEL Tender Specification. Deviation in this is not acceptable. Bidder to Confirm.	
13.	As per Cl. No. 6.6 of Tender Specification, PY-51282, that all the Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal points are considered by bidder. Deviation in this is not acceptable. Bidder to Confirm.	
14.	As per Cl. No. 6.14 of Tender Specification, PY-51282, All the list of commissioning spares indicated in this clause are included in bidder's scope of supply. Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor. Deviation in this is not acceptable. Bidder to Confirm.	
15.	<u>Auxiliaries Equipment/Spares:</u> As per Cl. No. 6.16 of Tender Specification, PY-51282, all auxiliary equipment [clause no 7.4.5.7.3 of TAC] & spares [7.4.5.11 of TAC] as per TAC are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
16.	As per Cl. No. 6.17 of Tender Specification, PY-51282, All the special tools and tackles indicated in this clause are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
17.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4C(Price Bid Format). Bidder to Confirm.	
18.	As per Cl. No. 8 of Tender Specification, PY-51282, bidder is meeting the Equipment Qualification Criteria. All the references shall be submitted along with the offer as per Annexure-8 Deviation in this is not acceptable. Bidder to Confirm.	

19.	Painting schedule shall be as per Cl. No. 10 of Tender Specification, PY-51282. Bidder to Confirm.	
20.	<u>Inspection, Testing requirements for Pump & Drive assembly:</u> Inspection, Testing requirements shall be as per BHEL QAP & specification requirement only. Bidder to note that QAP shall be as per Annexure-7 & the same shall be discussed during detail engg. However in case of practical difficulties in meeting the quality requirement, same shall be mutually discussed & agreed during detail engg. Stage. Bidder to note & confirm.	
21.	Make of all the items shall be as per Annexure-9(Sub-Vendor List). Bidder to confirm.	
22.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, PY-51282 wrt list of documents, schedule of submission.	
23.	Bidders to comment on the instrumentation requirement as per P&ID (Annexure -1) based on their experience. If any other instruments are required as per good engg practice, bidder to highlight & Consider the same.	
24.	Bidder shall submit Annexure-11 indicating as <u>NO DEVIATION</u> along with their offer. Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-12 before submission of Techno Commercial offer. Any deviation/ queries raised during technical bid submission shall not be entertained. Bidder to Confirm.	
25.	Bidder to quote as per Annexure-4C, Price Bid Format only. Price quoted as per the price bid format, clearly indicating all the applicable items are quoted, and not applicable items are clearly highlighted. Un priced copy of the same is enclosed with bidder's offer. Bidder to check and confirm.	
26.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
27.	Refer Annexure-2C of Tender Specification, PY-51282. The casing material mentioned in sl no 35 shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in sl no 54..If Not, bidder to consider superior material of casing. Bidder to confirm.	
28.	Bidder to confirm that the following documents are submitted along with their offer to enable BHEL to evaluate the offer. a) Duly filled in Pump-Motor-Diesel Engine datasheet (Annexure-2A) b) Tentative GAD / P&ID for Pump with Motor & Engine(Stamped Copy of Annexure-1) c) Performance curves for pump d) Un-priced copy of price in attached BHEL price bid formats(Annexure-4C) indicating quoted/ not quoted against each row & column. e) Equipment qualification criteria / PTR / Reference Lists f) Checklist as per (Annexure-5C) g) Deviation list [Indicating as No Deviation] as per (Annexure-11)	
29.	All important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily to be furnished by bidder along with their offer for evaluation. Bidder to once again check their offer before submission and confirm.	
30.	<u>BoQ for Main Equipment:</u> Bill of Quantity for Fire Water Pumps is enclosed with this checklist. This is the minimum BOQ identified by	

	purchaser. However any other item required for successful commissioning of the fire water pump and drive assembly shall be considered by the bidder. Bidder to check and fill their confirmation whether the BoQ indicated is considered in their offer.	
31.	<u>BoQ for Commissioning Spares:</u> Bill of Quantity for Commissioning spares is enclosed with this checklist. Bidder to Confirm and furnish the list of commissioning spares considered by the bidder.	
32.	<u>BoQ for Special Tools and Tackles:</u> Bill of Quantity for special tools and tackles is enclosed with this checklist. Bidder to Confirm and furnish the list of special tools and tackles considered by the bidder.	

MAIN EQUIPMENT - BOQ OF FIRE WATER PUMPS(Booster) along with Drives(Motor & Diesel Engine)					
Sl No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Booster Pump-Motor Assembly: Horizontal Centrifugal type, Motor driven (410 M3/Hr.; 120 MWC, HT Motor, Base plate, Coupling, Coupling guard, foundation bolts etc.). For Details Refer Annexure-2C: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
1.1	Pump	Nos.	1		
1.2	LT Motor(Suitable Rating)	Nos.	1		

1.3	Common Base Frame for Pump & Motor Assembly	Nos.	1		
1.4	Mechanical Seal(1 no for each pump)	Nos.	1		
1.5	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
1.6	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
1.7	Motor Canopy(1 no for each motor)	Nos.	1		
1.8	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
1.9	Lugs and Glands for Motors	Sets	1		
1.10	Vibration pads [Bidder to consider suitable nos]	Nos.			
1.11	Vent valve on pump	Nos.	1		
1.12	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #300. Details of Discharge Pipe Size are indicated in Annexure-1 of Tender Specification, PY 51282	Sets	1		
1.13	Suitable Concentric Reducer(Discharge side) with welded Flange and Counter Flange(Loose Supply) as per ANSI 16.5 #300. Details of Discharge Pipe Size are indicated in Annexure-1.	Sets	1		
1.14	Suitable Studnuts and Bolts for suction flange	Set	1		
1.15	Suitable Studnuts and Bolts for Discharge flange	Set	1		
1.16	Suitable Gaskets for suction flange	Set	1		
1.17	Suitable Gaskets for Discharge flange	Set	1		
1.18	Pump Casing Drain valve/plug	Nos.	1		
1.19	Base Frame Casing Drain valve/plug	Nos.	1		
1.20	SS piping for Flusing Plan	Sets	1		
2	Booster Pump-Engine Driven Assembly: Horizontal Centrifugal type, Engine driven Pump (410 M3/Hr.; 120 MWC), Diesel Engine, Base plate, Coupling, Coupling guard, foundation bolts etc. For Details Refer Annexure-2C: Technical Datasheet for Pump and drive assembly, enclosed with Tender Specification, PY-51282	Set	1		
2.1	Pump	Nos.	1		

2.2	Diesel Engine(Suitable Rating)	Nos.	1		
2.3	DC Motor(to start engine)	Nos.	1		
2.4	Sludge and Sediment Trap	Nos.	1		
2.5	Filter(for diesel pump)	Nos.	1		
2.6	Screwed plugs(for bleeding of air in diesel piping)	Sets	1		
2.7	Belts for engine	Sets	2		
2.8	Inlet valve & Exhaust valve	Sets	1		
2.9	Air filter	Nos.	1		
2.10	Governor	Nos.	1		
2.11	Complete set of engine-joints, gaskets and hoses	Sets	1		
2.12	Battery(12 V, 2 nos for each Engine)	Nos.	2		
2.13	Charger cum Control Panel(With Ammeter & Voltmeter) for Diesel Engine, Tank and Battery	Nos.	1		
2.14	Battery Selector Panel for Charging	Nos.	1		
2.15	Control Panel(integral of Engine)	Nos.	1		
2.16	Silencer for Diesel Engine	Nos.	1		
2.17	Insulation for Silencer	Sets	1		
2.18	Diesel Tank	Nos.	1		
2.19	Level Switch on Diesel Tank	Nos.	1		
2.20	Level Gauge on Diesel Tank	Nos.	1		
2.21	Electric Operated(Ex-Proof) Barrel Unloading pump with discharge hose	Nos.	1		
2.22	Manual Operated Barrel Unloading pump with discharge hose	Nos.	1		
2.23	Common Base Frame for Pump & Engine Assembly	Nos.	1		
2.24	Mechanical Seal(1 no for each pump)	Nos.	1		
2.25	Flexi Metallic Spacer type coupling(1 no for each pump)	Sets	1		
2.26	Coupling guard along with bolts, nuts and gaskets	Nos.	1		
2.27	Suitable Foundation Bolts with Nuts (8 nos for each assembly)	Sets	8		
2.28	Vibration pads [Bidder to consider suitable nos]	Nos.			

2.29	Vent valve on pump	Nos.	1		
2.30	Suitable Studnuts and Bolts for suction flange	Set	1		
2.31	Suitable Studnuts and Bolts for Discharge flange	Set	1		
2.32	Suitable Gaskets for suction flange	Set	1		
2.33	Suitable Gaskets for Discharge flange	Set	1		
2.34	Pump Casing Drain valve/plug	Nos.	1		
2.35	Base Frame Casing Drain valve/plug	Nos.	1		
2.36	X" suitable pipe for exhaust of Diesel Engine	mtrs	15		
2.37	X" suitable elbows exhaust pipe of Diesel Engine	Nos.	6		
2.38	NIL.	Nos.	1		
2.39	Y" Pipe for interconnecting fuel tank to engine	mtrs	3		
2.40	Y" Elbows for interconnecting fuel tank to engine	Nos.	5		
2.41	Temperature indicator(contact type) in cooling water inlet & outlet	Nos.	2		
2.42	Temperature indicator in lubricating oil outlet from the oil cooler	Nos.	1		
2.43	Pressure Gauges(contact type) for lubricating oil system	Nos.	1		
2.44	Speed indicator	Nos.	1		
2.45	Running hour meter	Nos.	1		
2.46	Dip stick type lubricating oil sump	Nos.	1		

COMMISSIONING SPARES - BOQ OF FIRE WATER PUMPS(Booster) along with Drive Motor

Sl No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Booster Pump-Motor Assembly: Commissioning Spares				
1.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	2		
2	Booster Pump-Diesel Engine Assembly: Commissioning Spares				
2.1	Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Commissioning spares for drive as per Manufacturer recommendation. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer	Set	2		

SPECIAL TOOLS AND TACKLES - BOQ OF FIRE WATER PUMPS(Booster) along with Drives(Motor & Diesel Engine)

SI No.	Item Description	UOM	Total Quantity (Per Pump and Drive Assembly)	Bidder has Considered in their offer [YES/NO]. Bidder to indicate their response YES/No in this Column. Important note: * No Deviation is allowed. Bidder to Mandatorily Consider this item in their offer except if item is not applicable or not available in the market. In such case bidder to justify in remarks column.	REMARKS (By Bidder)
1	Booster Pump-Motor Assembly: Commissioning Spares				
1.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		
2	Booster Pump-Diesel Engine Assembly: Commissioning Spares				
2.1	Special tools & tackles as per manufacturer's recommendations. 1 set stands for requirement for each pump, drive and other accessories. Bidder to furnish the list along with offer.	Set	1		

SIGNATURE:
NAME:
DESIGNATION:
COMPANY:
DATE:

CHAPTER - 6**PAINTING****1.0 SCOPE**

This section defines the technical requirements for surface preparation, selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The bidder shall submit a detailed painting procedure for approval of owner/ owner's representative after the award of contract.

The following surface and material shall require painting:

- a. All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
- b. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
- c. All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting :

- a. Non-ferrous materials
- b. Austenitic stainless steel
- c. Plastic and / or plastic coated materials
- d. Insulated surface of equipment and pipes except color coating wherever required.
- e. Painted equipment like blowers, pumps, valves etc. with finishing coats in good condition and with matching color code.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of pipelines
IS:1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)



IS:2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS:2932	:	Enamel Synthetic exterior (a) Undercoating (b) finishing
IS:4682	:	Code of practice for lining of vessels & equipment
SIS 559000	:	Swedish standard for blasting
ISO 8504-2	:	Preparation of steel substrates before application of paints and related products. Surface preparation methods Part 2 Abrasive blast cleaning
ISO 8501-1	:	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Part 1 : Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
SIS 05 5800	:	Surface preparation by acid pickling
SSPC SP08	:	Surface preparation by acid pickling
IS 2629	:	Recommended practice for hot dip galvanizing of iron and steel
ASTM A780	:	Standard practice for repair of damaged galvanized coatings
SSPC	:	Steel structures painting council
NACE	:	National association of Corrosion Engineers
DIN	:	Deutsehes Institute for Normung
BS	:	British Standard
ASTM	:	American Society for Testing material
AWWA	:	American Water works association

3.0 SURFACE PREPARATION

The surface shall be prepared in a manner suitable for coatings. Chemical derusters or rust converters shall not be applied. Acid cleaning is subject to approval of Purchaser/ Purchaser's representative.

3.1 BLASTING

The surface of the part/ component shall be blasted before the coating material is applied.

Compressed air supply for blast cleaning shall be free of water and oil. Air compressors shall not be allowed to deliver air above 1100C. Blasting activity shall be performed at temperatures 30C above dew point and substrata temperature between 50C & 500C and relative humidity not exceeding 85% shall be maintained during painting. Necessary safety precautions for equipment and operator shall be adhered to and shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work.



Abrasive used for blast cleaning carbon steel and alloy steel shall be as per ISO 8504-2 and SSPC painting manual. Suggested abrasives are chilled iron grit, shot steel, malleable iron grit and shots of non metallic abrasive (aluminum oxide, copper slag, garnet etc.).

The grade of blasting shall be performed in line with the approved painting scheme.

The nature, quality and grain size of abrasives and the parameter of their use are to be chosen to obtain the required surface profile depth and cleanliness.

Surfaces prepared for coating shall be coated the same day and before any visible rusting occurs (the time elapsed between blast cleaning and commencement of painting shall under no circumstances exceed 4 hours, but in any case must commence before signs of degradation occur).

The grades of surface finish

	ISO 8501-1	SIS 055900	SSPC	NACE
White metal	Sa3	Sa3	SP5	1
Near White metal	Sa 2½	Sa 2½	SP10	2
Commercial Blast	Sa2	Sa2	SP6	3
Brush off blast	Sa1	Sa1	SP7	4

Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting

(a) Blasting according to SIS 055900, Grade Sa 2½

Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer coat shall be 15-25 µm.

3.2 Manual Rust Removal

Manual rust removal shall be allowed for welded zones and for touching up installed components.

3.3 Cleaning

Removal of impurity

	Impurity	Removal
a)	Dust, Loose deposits	Vacuum cleaning, brushing
b)	Adhesive deposits	Power brushing
c)	Oils, greasy impurities	Wet Blasting, Use of Detergent Additives by agreement
d)	Salt deposits	Rinsing
e)	Markings (eg felt up pen)	Organic solvents to manufacturer's specifications eg Trichloro trifluoro ethane and solvents containing acetone (renew solvent and rag frequently)

3.4 Acid Pickling

Prior to galvanizing the surface preparation shall be done by acid pickling as per SSPC-SP-08.



4.0 PROCESSING

4.1 General Application Conditions

The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature shall be + 5°C and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3°C above dew point.

4.2 Application Procedure

The primer shall be applied by means of brush or by spary. The top coats shall be applied by means of brush, roller or spray.

At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed.

4.3 Touching Up

Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning according coating manufacturers specification. The final top shall be reapplies completely.

4.4 Uncoated Surfaces

Moving parts of machines (e.g stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating upto a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.

4.5 Bond Strength

The pill off stress determined using the pull off test method for adhesion shall not be less than 1.5 N/mm², according to ISO 4624.

5.0 SURFACE CONDITIONS OF COATING SURFACES

The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.

6.0 COATING SYSTEMS

6.1 General Requirements for Coating Systems

Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating this



specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.

The colour and gloss of top coats shall be in accordance with sub clause suggested colour codes for painting (Sub Clause 6.8)

6.2 Standard Coating System (External Coatings)

(a) Steel Surfaces

- (i) All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.
- (ii) Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted as explained in clause 3.1 to Sa 2½ finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.
- (iii) Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.
- (iv) Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.
- (v) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

(b) Gratings and Step Threads

(i) Surface Preparation

Gratings and step threads shall be cleared by acid pickling as per SSPC-SP-08

(ii) Hot Dip galvanizing

The hot dip galvanizing shall be done as per IS 2629. The average mass of coating shall be 610 gm/m².



(iii) Post Treatment

Immediately after galvanizing post treatment such as chromating shall be applied to retard white rust attack.

(iv) Touch up mechanical damages

The repair of damages coatings shall be done as per the recommended practice ASTM A780.

6.3 Painting of Indoor components such as valves, pumps, motors, electrical parts, tanks etc.**At Works****Surface Preparation**

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

At Site

Thorough cleaning to remove oil, grease, dirt and any other contaminants. Derusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.

Remarks

Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.

6.4 Painting of Outdoor equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.

Weather exposure, weather resistance, temperature upto 120°C as per clause 6.1 & 6.3. However

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry film thickness 75µm.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.

6.5 Special Coating

(a) Parts exposed to temperatures above 120°C, upto 200°C, not insulated

(i) At Works

Surface Preparation

Blasting according to SIS 055900 grade Sa 2½ and ISO 8501-1:1958. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to ISO 8501-1:1989, grade St 3 touch up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50µm.

Intermediate Coat

1 pack silicon acrylic dry film thickness 35 µm.

Final Coat

1 pack silicon acrylic, dry film thickness as 35µm.
Total system dry film thickness 145µm.
Final coat according to colour code.



(b) Parts exposed to temperatures above 200°C, upto 400°C, not insulated**(i) At Works****Surface Preparation**

Blasting according to ISO 8501-1:1958 grade Sa-2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm.

(ii) At Site**Pretreatment**

Derusting of all mechanical damages, according to standard Sa 2½ to ISO 8501-1:1988. Touch up with coating system according to manufacturer's recommendations.

(c) Insulated parts continuously exposed to condensing water or parts exposed to temperatures

For parts that are provided with insulation on site.

(i) Insulated parts exposed to condensing water**At Works****Surface Preparation**

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.

Prime Coat

Inorganic ethyl Zinc silicate, total dry film thickness 75µm

(ii) Insulated parts exposed to temperatures

Parts exposed to temperatures upto < 400°C

Surface Preparation

Blasting according to Sa 2½ to ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm shall be used.



Parts exposed to temperature above 400°C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and superheaters, reheaters etc)

Temporary Primer

Varnish

(d) Intermittent exposure due to condensing water/ chemicals (Indoors)

(i) At Works

Surface Preparation

Blasting according to Sa 2½ and ISO 8501-1:1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat

Two layers of Zinc phosphate primer, total dry film thickness 75µm.

(ii) At Site

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 50µm.

Total system dry film thickness 205µm.

When exposed o weathering, weather resistance finish coat shall be applied.

(e) Water Exposure

(i) At Site/ Works

Pretreatment

Removal of all welding pearls.



Blasting according to Sa 3 to ISO 8501-1:1988

Coat

4 coats 2 pack coal tar epoxy, dry film thickness 125 µm each.

Total system dry film thickness 500µm

Touch up after erection as required.

6.6 Painting of Pipes

6.6.1 Buried Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

Tests to be carried out after application : Bond/ Adhesion test, Holiday test

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Coal tar primer compatible with coal tar enamel grade. The number of coats shall be two with a DFT of 35 microns each.
- (iii) Coal tar enamel shall be applied. A single spiral inner wrap of glass fibre tissues shall be applied overlapping at least 25 mm ensuring impregnation of glass fibre tissues in the first coat. The second coat of enamel and second outer wrap of glass fibre felt, Type – I to IS: 7193-1974 will be applied in the same way confirming to Table – 10 of IS – 10221 – 1982.

The total thickness of the coating will not be less than 4.0 mm

- (iv) Alternatively Wrapping with coal tar based anticorrosion tape conforming to IS 15337: 2003 is also acceptable in lieu of s.no. (iii) above. Wrapping thickness shall be 4.0 mm.



Tests to be carried out after application : Bond/ Adhesion test, Holiday test

6.6.2 Overground Piping

Internal surfaces

- (i) Surface cleaning by sand blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

The total dry film thickness of 150 microns.

Note : All steel pipes carrying sea water shall be internally coated with corrocoat/ polyurea coating having thickness 1500 DFT.

External surfaces

- (i) Surface cleaning by Sand Blasting.
- (ii) Two (2) coats of epoxy primer coats. The minimum DFT of each coat shall be 35 microns.
- (iii) Finish coat-Two (2) coats of high build epoxy paint. The minimum DFT of each coat shall be 35 microns.

6.7 Internal Coatings

6.7.1 Tanks (Internal surfaces) as specified in relevant sections of specification

Industrial deionised, demineralised and potable water upto 60°C pH range 4.5-9.5

Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry film thickness >75µm.

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.



Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat.

In case of service or potable water tanks, the coating material selected shall not taint the water. The paint system shall conform to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work.

QA/ QC Procedure including pinhole inspection, shall be submitted for approval by Owner/ Owner's representative.

6.6.2 Rubber Lining of Pipes, Valves and Tanks for DM Water**Pretreatment**

Blasting according to Sa 2½ and ISO 8501-1:1988

Rubber Lining

Hard rubber 5 mm for DM water applications as IS – 4682

6.7 Painting for Electrical items

- 6.7.1 All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate/ oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing epoxy paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5/ RAL 7032 for all switchboard/ MCC/ Distribution boards, control panels etc.
- 6.7.2 All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.
- 6.7.3 Painting of I & C equipment : Epoxy coating required for all I & C equipment.

6.8 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2.	Boiler casing, ducting	Nut Brown	413	-	-



SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
3.	Crane				
3.1	Crane structure	Golden Yellow	356	Black	-
3.2	Trolley & hook	Crimson	540	-	-
4.	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.	Switchgear	Light grey (Powder coated)		-	-
8.	Control & relay panels	Light grey (Powder coated)	631/70 78 of IS 1650	-	-
9.	Turbines	Light Grey	631	-	-
10.	Generators & Exciter	Light Grey	631	-	-
11.	Transformers	Aluminum	-	-	-
12.	Machinery guards	Signal red	537	-	-
13.	Piping (without insulation and cladding)				
13.1	Water System				
a	Boiler feed	Sea Green	217	-	-



SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
b	Condensate	Sea Green	217	Light Brown	410
c	DM Water	Sea Green	217	Light Orange	557
d	Soft Water	Sea Green	217	French Blue	166
e	Bearing Cooling Water	Sea Green	217	French Blue	166
f	Potable & filtered Water	Sea Green	217	French Blue	166
g	Service and clarified water	Sea Green	217	French Blue	166
h	Cooling water	Sea Green	217	French Blue	166
l	Sea Water	Sea Green	217	White	-
14.	Ash Transmitting Vessels and pipe lines	Aluminium	-	-	
15.	Air System				
15.1	Station air	Sky blue	101	-	-
15.2	Control air	Sky blue	101	White	-
16.	Oil system				
16.1	Fuel oil	Light brown	410	French	166
16.2	Light oil (HSD)	Light Brown	410	Brilliant green	221
16.3	Lubricating oil	Light brown	410	Light grey	631
16.4	Transformer oil	Light brown	410	Light orange	557
17.	Gas System				
17.1	Carbon dioxide	Canary yellow	309	Light grey	631
17.2	Hydrogen	Canary yellow	309	Signal red	537
18.	Fire services	Fire red	536	-	-
19.	Effluent pipes	Black	-	-	-
20.	Vacuum pipes	Sky blue	101	Black	-

Notes :

1. This colour code basically refers to IS:2379 for piping with necessary modifications



2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.

Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.



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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	QAP GUIDELINES & FORMAT ANNEXURE-7 The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement. Note : 1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval. 2. No deviation to reference document is acceptable.		

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<u>GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN</u> - QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10. - Each page of QAP shall contain the following information. - Vendor's name & address. - Customer: BHEL, Hyderabad. - Project. - BHEL Product Standard Number/revision number as referred in P.O. - BHEL Purchase Order Number & Date. - Product as per P.O. description. - QAP Number (unique and shall not repeat)/revision number/date. - Page number and number of pages - QAP shall contain four parts / stages as follows. - Raw materials and bought out items. - In process Control / Inspection. - Final assembly, Inspection & Testing. - Painting, preservation & packing. - Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc). - Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.) - Under 'Class', indicate minor, major or critical depending on the importance of characteristic. - Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.) - Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.) - Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept. - Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc. - Please refer 'Agency' in QAP format. Under P: Perform, W: Witness, V: Verify Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR 2: (Vendor / Sub vendor)			
Ref. Doc			

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, Under Witness (W) column use 1. Under 'Verify' column, use code 1. 12. Under 'D' please put (☐ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification. 13. Vendor's signature & stamp should be available on each page of QAP. 14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings. 15. The following operations/characteristics/check points may be included (AS APPROPRIATE) a) Visual check b) Dimensional check c) Mechanical and Chemical properties. d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.) e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc. f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc. g) Verification of test certificate for protection class for the enclosures. h) Mechanical functioning of switches. i) Continuity of earthing and provision of earth points. j) Colour coding of wiring, size, tightness & dressing of wiring. k) Review of test certificates of assembled items, raw materials, internal test reports etc. l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc. m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc. n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.) o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non-Destructive Tests. p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating) q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole. r) Packing and Preservation. 16. QAP Format enclosed. 17. Typical Manufacturing QAP(s) is /are attached.		
		Ref. Doc		

VENDOR'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN						QP. NO.:				
			CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:			REV NO:		DATE:		
			PROJECT: PRODUCT:			P.O.DATE: BHEL SPEC:			REV:		PAGE 1 OF 1		
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
2.0	INPROCESS INSPECTION												
3.0	FINAL INSPECTION & TESTING												
4.0	PRESERVATION & PACKING												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP

बी एच डी एल BHEL		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: CENTRIFUGAL PUMP BHEL TECH SPEC:			REV NO:		DATE:			
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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Casing	Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot	Tech Spec/ Approved Datasheet/ Approved Drawing		MTC	√	2	2	1	
1.2		Visual inspection	Major	Visual (MSSP -55)	100%			--	--	2	2	1	
1.3		Solution Annealing (in case of SS casting)	Major	HT chart	100%			HT chart	√	2	2	1	
1.4	Impeller, Diffuser, shaft	Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot			MTC	√	2	2	1	
1.5	Mechanical seal	Material and leakage check (Air test)	Major	OEM's certificate review	100%			MTC / COC	√	2	2	1	
1.6	Bearing and bearing housing	Make and Model	Major	Visual	100%			MTC / COC	√	2	2	1	
1.7	Accessories * (coupling and coupling guards, inter connecting piping, strainers, instruments, JB etc.)	Chemical & Mech. Properties	Major	Chemical & Mech. Analysis	1 per heat/lot			MTC	√	2	2	1	* accessories as per scope of supply
1.8		MOC, hydro test reports, Calibration reports and Type test certificates for instruments.	Major	OEM's certificate review	100%			OEM test certificates or COC	√	2	2	1	

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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.9	Wear rings	Chemical & Mech. Properties	Major	Chemical & Mech. Analysis	1 per heat/lot			MTC	√	2	2	1	
1.10	Gaskets, Flanges, and Fasteners	Chemical & Mech. Properties	Minor	Chemical & Mech. Analysis	1 per heat/lot			MTC	√	2	2	1	
2.0	INPROCESS INSPECTION												
2.1	Fabrication of casing and other components	WPS, PQR and WQR	Major	Document verification	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		WPS, PQR and WQR	--	2	2	1	
2.2	Butt weld joints in casing *	NDE	Major	RT	100%			IR	√	2	2	1	* if any weld in casing
2.3	Casing	Surface finish & NDE	Major	Visual & DPT/MPI	100%			NDE reports	√	2	2	1	
2.4		Leakage	Critical	Hydro test	100%			Test reports	√	2	1	--	
2.5	Impeller, Diffuser and Shaft (if shaft > 50 mm diameter)	NDE	Major	For impeller/ diffuser DPT/MPI and for Shaft UT	100%			NDE reports	√	2	2	1	
2.6	Wear rings	NDE	Major	DPT	100%			DP reports	√	2	2	1	
2.7	Impeller	Dynamic balancing	Critical	Balancing	100%			IR	√	2	2	1	

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								PAGE 3 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
3.0 FINAL INSPECTION & TESTING													
3.1	Pump Assembly with job motor	Overall Dimensions	Major	Measurement	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		IR	√	2	1	--	Only 10% witness by BHEL / BHEL's TPIA, subjective to minimum 1 pump of each size & type.
3.2		Performance test	Critical	Testing	100%			TC	√	2	1	--	
3.3		NPSH (if applicable)	Critical	Testing	100%			TC	√	2	1	--	
3.4		Mechanical run test	Critical	Testing	100%			TC	√	2	1	--	
3.5		Strip Examination	Major	Dismantling	100%			IR	√	2	1	--	
3.6		Complete unit test	Major	Testing	100%			IR	√	2	1	--	
3.7		PMI test (in case of SS parts)	Major	Testing	100%			IR	√	2	1	--	
3.8		Spares (if any)	Major	BOM check	100%			IR	√	2	1	--	
4.0 PRESERVATION & PACKING													
4.1	Pump and its components	Direction of rotation, Stamping and Painting	Major	Visual, Shade & DFT	Random	Tech Spec/ Approved Datasheet/ Approved Drawing		IR	√	2	1	--	

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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
4.2		Pickling and Passivation for SS parts	Major	Visual	100%			TC	√	2	1	--	# Seaworthy packing for export orders
4.3		Packing #	Major	Visual	100%			Packing List	√	2	2	1	

Notes:-

1. This MQP should be read along with specification, approved drawings & approved datasheet. (Latest revisions to be considered as per PO).
2. Specification/Drawing/datasheet shall prevail over quality plan for contradiction if any.
3. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

Abbreviations:-

MTC	-	Material Test certificate	WPS	-	Welding Procedure Specification
IBR	-	Indian Boiler Regulations	PQR	-	Procedure Qualification Record
DFT	-	Dry Film Thickness	WPQ	-	Welder Performance Qualification
TC	-	Test Certificate	NDE	-	Non Destructive Examination
UTS	-	Ultimate Tensile Strength	Appd. Dwg.	-	Approved Drawing
PMI	-	Positive Material Identification	OD	-	Outer Diameter
G.I	-	Galvanized Iron	ID	-	Internal Diameter

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		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032		PROJECT: PACKAGE: LT MOTOR BHEL TECH SPEC:		REV NO:		DATE:					
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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0 RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	<u>COPPER WIRE</u> Enameled Copper Wire	Overall diameter, elongation, Mandrel winding test, Peel test, springiness, Abrasion test, Cut through test, Heat shock test, Continuity test	Major	Measurement and mechanical & electrical testing	One sample per heat/lot	National & international standard (IS or IEC) / technical specification/ approved drawing/ datasheet		IR / supplier test certificate	√	2	2	1	
1.2	<u>STEEL SHAFT</u> Straightened Steel bar in black Finish	Dimensions, surface finish, chemical composition	Major	Visual, measurement and chemical testing	One sample per heat/lot			supplier test certificate	√	2	2	1	
1.3		NDT	Major	UT	100%			supplier test certificate	√	2	2	1	
1.4	<u>ALUMINIUM INGOTS</u>	Chemical properties	Major	Chemical testing	One sample per heat/lot			supplier test certificate	√	2	2	1	
2.0 INPROCESS INSPECTION													
2.1	ASSEMBLY	Completeness and correctness of assembly	Major	Visual verification	100%	MO and manufacturer's internal processes		Log book	--	2	2	2	
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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
3.0	FINAL INSPECTION & TESTING												
3.1	ROUTINE TESTING	Measurement of winding resistance in cold condition	Major	Testing	100%	National & international standard (IS or IEC) / technical specification		TC	√	2	1	--	
3.2		SH heater resistance (if applicable)	Major	Testing	100%			TC	√	2	1	--	
3.3		Insulation resistance (before and after HV test)	Major	Testing	100%			TC	√	2	1	--	
3.4		High voltage test at 1.8 KV for 1 minute and space heater HV test	Major	Testing	100%			TC	√	2	1	--	
3.5		Direction of rotation	Major	Testing	100%			TC	√	2	1	--	
3.6		No load test (measurement of NL A, voltage, NL power and NL RPM)	Major	Testing	100%			TC	√	2	1	--	
3.7		Reduced run up voltage test at (rated volt√3)	Major	Testing	100%100%			TC	√	2	1	--	
3.8		Locked rotor test at full load current	Major	Testing	100%			TC	√	2	1	--	
3.9		Vibration measurement	Major	Testing	100%			TC	√	2	1	--	
3.10		Measurement of noise level	Major	Testing	100%			TC	√	2	1	--	
3.11		120% over speed test	Major	Testing	100%			TC	√	2	1	--	

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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
3.12	TYPE TESTS	Measurement of winding resistance in cold condition	Major	Testing	One /rating	National & international standard (IS or IEC) / technical specification		TC	√	2	--	1	Verification of Identical Type test Report of same Rating
3.13		Temp. rise test at full load (load point for 100%, 75% & 50% load (full load, ¾ and ½ load)	Major	Testing	One /rating			TC	√	2	--	1	
3.14		160% momentary overload test	Major	Testing	One /rating			TC	√	2	--	1	
3.15		Locked rotor amp and torque test	Major	Testing	One /rating			TC	√	2	--	1	
3.16		No load test	Major	Testing	One /rating			TC	√	2	--	1	Identical type test reports for motor ratings (not more than 5 years old) will be provided.
3.17		Reduced voltage running up test	Major	Testing	One /rating			TC	√	2	--	1	
3.18		Insulation resistance test (before and after HV test)	Major	Testing	One /rating			TC	√	2	--	1	
3.19		HV test – 1.8 KV for winding and 1.5 KV for space heater	Major	Testing	One /rating			TC	√	2	--	1	
3.20		Vibration test	Major	Testing	One /rating			TC	√	2	--	1	
3.21		120% over speed test	Major	Testing	One /rating			TC	√	2	--	1	

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SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
4.0	PRESERVATION & PACKING												
		Painting*, (Shade, DFT,) Marking	Major	Visual, Measurement	Random	Technical specification/ approved drawing/datasheet	TC	√	2	--	1		
		Packing*	Major	Visual	Random		Packing List	√	2	--	--		

Notes:-

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2. Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
3. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

Abbreviations:-

MTC	–	Material Test certificate	COC	–	Certificate of Compliance	DFT	–	Dry Film Thickness
TC	–	Test Certificate	NDE	–	Non Destructive Examination	IR	–	Inspection Report
DFT	–	Dry Film Thickness	IBR	–	Indian Boiler Regulations	IS	–	Indian Standards

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		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 1 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Shaft forging, Magnetic Steel sheet, Stator winding copper, Rotor winding copper	Properties as per Specification/ drawing.	Major	Elec./ Mech./ Chem./ NDT	Sample	Tech Spec/ Approved Datasheet/ Approved Drawing		TC/COC	√	2	2	1	
2.0	INPROCESS INSPECTIONS												
2.1	Stator Complete	Measurement of RTD's resistance	Major	Electrical	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		TR	√	2	2	1	
		Inter turn insulation Surge Voltage (Baker) test	Major	Electrical	100%			TR	√	2	2	1	
		HV & IR of stator Winding, Tan delta Test	Major	Electrical	100%			TR	√	2	2	1	>3.3KV, values for information only
2.4	Rotor Complete	HV & IR of rotor winding (For SRIM)	Major	Electrical	100%			TR	√	2	2	1	
		Dynamic Balancing at rated speed	Major	Testing	100%			TR	√	2	2	1	
2.5	Motor Assy.	Dimensional checks (Shaft center height, Key way dimensions, Shaft ext. dimensions)	Major	Measure ment	100%			TR	√		2	2	1

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										P	W	V	
3.0 FINAL INSPECTION AND TESTINGS													
3.1	MOTOR ROUTINE TESTS	Verification of DOR, Name plate, Terminal box location, Phase sequence	Major	Electrical	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		TR	√	2	1	--	
3.2		Measurement of stator winding resistance	Major	Electrical	100%			TR	√	2	1	--	
3.3		Insulation Resistance Test before & after HV Test	Major	Electrical	100%			TR	√	2	1	--	
3.4		High Voltage Test	Major	Electrical	100%			TR	√	2	1	--	
3.5		Polarization Index	Major	Electrical	100%			TR	√	2	1	--	
3.6		No Load running of Motor & Measurement of Current, Voltage, Power Input & Speed	Major	Electrical	100%			TR	√	2	1	--	
3.7		Functional testing of Accessories and auxiliaries (RTD, BTM, Space heater)	Major	Electrical	100%			TR	√	2	1	--	
3.8		Reduced voltage running up test	Major	Electrical	100%			TR	√	2	1	--	
3.9		Open CKT. Voltage test (For SRIM only)	Major	Electrical	100%	Tech Spec/ Approved Datasheet/ Approved Drawing	TR	√	2	1	--		

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3.10		Vibration Test During no load run	Major	Electrical	100%			TR	√	2	1	--	APPLICABLE FOR HORIZONTAL MOTORS
3.11		Shaft Voltage Measurement during No Load Run	Major	Electrical	100%			TR	√	2	1	--	
3.12	MOTOR TYPE TEST	All test covered in routine test	Major	Electrical	1 Motor			TR	√	2	2	1	
3.13		Full load measurement Of voltage, current & Power input , Slip	Major	Electrical	1 Motor			TR	√	2	2	1	
3.14		PF at 50%,75% & 100%	Major	Electrical	1 Motor			TR	√	2	2	1	
3.15		Over Speed Test during No load run	Major	Electrical	1 Motor			TR	√	2	2	1	
3.16		Temperature rise test	Major	Electrical	1 Motor			TR	√	2	2	1	
3.17		Calculation of efficiency (by summation of loss method) at ½,3/4, & full load	Major	Electrical	1 Motor			TR	√	2	2	1	
3.18		Noise Measurement during No Load Run	Major	Electrical	1 Motor	Tech Spec/ Approved Datasheet/ Approved Drawing		TR	√	2	2	1	
3.19		Momentary over load test	Major	Electrical	1 Motor			TR	√	2	2	1	
3.20		Starting torque, starting current, and pullout torque calculation	Major	Electrical	1 Motor			TR	√	2	2	1	Based on no load reading

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
								REV NO:		DATE:			
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR BHEL TECH SPEC:			PAGE 4 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
4.0	PRESERVATIONS AND PACKING												
4.1		Check for Painting (Paint shade & thickness)	Major	Visual, DFT	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		IR	√	2	2	1	
4.2		Check for fitment of all components & accessories	Major	Visual	100%			IR	-	2	2	1	

Notes:-

1. This MQP should be read along with specification (latest revision), approved drawings & approved data sheet.
2. Specifications/drawing/data sheet shall prevail over quality plan for contradiction if any between quality plan and drawing/specification.
3. All test certificates/reports reviewed and certified by TPI/BHEL shall be submitted to BHEL as documentation package.
4. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

ABBREVIATIONS:-

BDV: Break Down Voltage	IP: Ingress Protection	CIMFR: Central Institute of Mining & Fuel Research
OD: Outer Diameter	HV: High Voltage	DGMS: Directorate General of Mines Safety
ID: Internal Diameter	TC: Test Certificate	CCOE: Chief Controller of Explosives
BIS: Bureau of Indian Standards	CPRI: Central Power Research Institute	PESO: Petroleum and Explosives Safety Organisation

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बी एच ई एल BHEL		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PROJECT: PACKAGE: DIESEL ENGINE BHEL TECH SPEC:		REV NO:			DATE:		
								PAGE 1 OF 3					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Piston crown, Connecting rod, Crankshaft, Camshaft	Chem. & mech. properties	Major	Chem. & mech. Testing	1 per lot/heat	Tech Spec/ Approved Datasheet/ Approved Drawing		MTC	√	2	2	1	
1.2		Crack test	Major	NDE	100%			MTC	√	2	2	1	
1.3		Dimensions	Major	Measure ment	100%			MTC	√	2	2	1	
1.4	Cylinder block, Cylinder head, Cylinder liner	Chem. & mech. properties	Major	Chem. & mech. Testing	1 per lot/heat			MTC	√	2	2	1	
1.5		Pressure test	Major	Hydro test	100%			MTC	√	2	2	1	
1.6		Dimensions	Major	Measure ment	100%			MTC	√	2	2	1	
2.0	INPROCESS INSPECTION												
2.1	Crankshaft	Dynamic balancing	Critical	balancing	100%			IR	√	2	2	1	
2.2	Fuel and Lube oil pump	Functional test	Major	Testing	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		TC	√	2	2	1	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
								REV NO:		DATE:			
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PROJECT: PACKAGE: DIESEL ENGINE BHEL TECH SPEC:			PAGE 2 OF 3				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
3.0 FINAL INSPECTION & TESTING													
3.1	Diesel engine	Performance test	Critical	Testing	100%	Tech Spec/ Approved Datasheet/ Approved Drawing	TC	√	2	1	--	Only 10% witness by BHEL / BHEL's TPIA, subjective to minimum 1 engine of each size & type.	
3.2		Overall Dimensions	Major	Measurement	100%		IR	√	2	1	--		
3.3		Spares (if any)	Major	BOM check	100%		IR	√	2	1	--		
4.0 PRESERVATION & PACKING													
4.1	Diesel engine and its components	Stamping and Painting	Major	Visual, Shade & DFT	Random	Tech Spec/ Approved Datasheet/ Approved Drawing	IR	√	2	2	--		
4.2		Packing #	Major	Visual	100%		Packing List	√	2	2	1	# Seaworthy packing for export orders	

Notes:-

- This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
- Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
- Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

Abbreviations:-

MTC	–	Material Test certificate	COC	–	Certificate of Compliance	DFT	–	Dry Film Thickness
TC	–	Test Certificate	NDE	–	Non Destructive Examination	IR	–	Inspection Report
DFT	–	Dry Film Thickness	IBR	–	Indian Boiler Regulations	IS	–	Indian Standards

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भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LIMITED
रामचन्द्रापुरम हैदराबाद - 32
RAMACHANDRAPURAM: HYDERABAD - 502 032.
परियोजना इंजीनियरिंग विभाग
PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : 2 X 660 MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS

विषय / SUB : **PQC format**

The bidder shall be an established manufacturer of Horizontal Centrifugal design pumps for Fire Protection System & having adequate engineering, manufacturing & testing facilities for pumps confirming to the relevant HIS, IS-5120, IS-6595 Part-2/Equivalent Standard & Comply with the regulations of Tariff Advisory Committee (TAC)/LPA India or Oil industry safety directorate (OISD) or any other International reputed authority (like LPC-UK or NFPA, USA). The pump model offered shall be from the existing regular manufacturing range of bidder.

The offered pump model shall meet the minimum service & manufacturing experience specified as below:

Bidder should have engineered, manufactured, tested, supplied and commissioned at least TEN (10) nos. of identical or similar packages (or higher capacity packages) in terms of Flow, Differential Pressure, Material of construction(CS/CI/SS), speed in the last Ten years and at least Three (3) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on 31st October 2016. Vendor to give documentary evidence for the same.

Bidders shall furnish the details as per the below mentioned table along with technical offer for assessment of Bidder with reference to PQC indicated as above.

S.no	Name of Customer	Service	Quantity	Flow (M3/HR)	Differential Head(MLC)	Speed (RPM)	Material of construction	Order ref no & date (copy to be enclosed)	Performance certificate/ Inspection Report/ Dispatch Clearance to be enclosed	Remarks

ANNEXURE-9: Sub-Vendor List
[For Technical Specification, PY-51282, Rev00]

Shall be Furnished Later

MASTER DOCUMENT LIST - Hydrant-Spray Pump: Motor & Diesel Engine driven

	Vendor Name:				PROJECT:											Supplier Doc- No:								
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:						Rev- No.								
	Vendor contact No.				Supplier's Job No.											Date:								
	SYSTEM/PACKAGE:	Hydrant Pump					TODAY-DATE	10/Oct/17			Submission status to BHEL													
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Rev-3			Rev-4		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT
1.0 Mechanical																								
A	MECHANICAL																							
1	Pump Data Sheet -Engine & Motor Driven	Later		A	Y	Y	Within 2 weeks after PO placement																	
2	Pump Performance curve-Motor Driven	Later		I	Y	Y	Within 2 weeks after PO placement																	
3	Pump Performance curve-Engine Driven	Later		I	Y	Y	Within 2 weeks after PO placement																	
4	Pump & Motor assembly GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																	
5	Pump & Engine assembly GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																	
6	Pump Cross Sectional Drawing	Later		I	Y	N	Within 2 weeks after PO placement																	
7	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																	
8	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																	
9	Motor Curves	Later		I	Y	Y	Within 2 weeks after PO placement																	
10	T-S Curve	Later		I	N	N	Within 2 weeks after PO placement																	
11	Diesel engine GA Drawing	Later		A	Y	N	Within 2 weeks after PO placement																	
12	Diesel engine Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																	
13	Control Panel GA Drawing & Wiring Diagram	Later		A	Y	Y	Within 2 weeks after PO placement																	
14	Battery Charger & Battery Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																	
15	Fuel tank Drawing	Later		A	Y	N	Within 2 weeks after PO placement																	
16	P&ID/Schematic of Diesel Engine	Later		I	N	N	Within 2 weeks after PO placement																	
17	Coupling GA Drawing for Motor Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																	
18	Coupling GA Drawing for Engine Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																	
19	Mechanical Seal GA Drawing and details	Later		I	Y	N	Within 2 weeks after PO placement																	
B	INSTRUMENTAION																							
1	Data Sheet of Level Switch	Later		I	N	N	Within 4 weeks after PO placement																	
2	Datasheet of Motor Bearing & Winding RTDs	Later		I	N	N	Within 4 weeks after PO placement																	
3	Datasheet of Motor Bearing TGs	Later		I	N	N	Within 4 weeks after PO placement																	
4	Data Sheet of Level Gauge	Later		I	N	N	Within 4 weeks after PO placement																	
5	Data Sheet of Junction Box	Later		I	N	N	Within 4 weeks after PO placement																	
6	GAD of Junction Box	Later		I	N	N	Within 4 weeks after PO placement																	
C	MISCELLANEOUS																							
1	Performance Test Procedure	Later		A	Y	N																		
2	NPSH test procedure	Later		I	N	N	Within 8 weeks after PO placement																	
3	Vibration test procedure	Later		I	N	N	Within 8 weeks after PO placement																	
4	Temperature rise test procedure	Later		I	N	N	Within 8 weeks after PO placement																	
5	Hydro Test Procedure	Later		I	N	N	Within 8 weeks after PO placement																	

MASTER DOCUMENT LIST - Hydrant-Spray Pump: Motor & Diesel Engine driven																								
	Vendor Name:				PROJECT:											Supplier Doc- No:								
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:						Rev- No.								
	Vendor contact No.				Supplier's Job No.											Date:								
	SYSTEM/PACKAGE:	Hydrant Pump				TODAY-DATE	10/Oct/17			Sumission status to BHEL														
Sl.No	DRG/DOC. NAME	DRG/DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Rev-3			Rev-4		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT
6	NDE Test Procedure	Later		I	N	N	Within 8 weeks after PO placement																	
7	Balancing_LP test & ultrasonic test procedure	Later		I	N	N	Within 8 weeks after PO placement																	
8	Painting proccedure	Later		A	N	N	Within 10 weeks after PO placement																	
9	Packing List	Later		I	N	N	Before Despatach																	
10	BILL OF MATERIAL	Later		A	N	N	Within 10 weeks after PO placement																	
11	BILLING BREAKUP	Later		A	N	N	Before Despatach																	
12	QUALITY ASSURANCE PLAN	Later		A	N	Y	Within 4 weeks after PO placement																	
13	SUB VENDOR LIST	Later		I	N	N	Within 4 weeks after PO placement																	
14	COMMISSIONING SPARES LIST	Later		A	N	N	Within 4 weeks after PO placement																	
15	Mandatory Spares List	Later		A	N	N	Within 4 weeks after PO placement																	
16	LUBE OIL SCHEDULE	Later		I	N	N	Within 8 weeks after PO placement																	
17	STARTUP PROCEDURE	Later		I	N	N	Within 8 weeks after PO placement																	
18	ERECTION PROCEDURE & Comissioing procedure	Later		I	N	N	Within 8 weeks after PO placement																	
19	INSPECTION/TESTS REPORTS/CERTIFICATE	Later		I	N	N	Within 8 weeks after PO placement																	
20	O& M Manuals(Soft Copies)	Later		A	N	N	After Approval of all engineering drawings/documents																	
21	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.	Later		I	N	N	After Approval of all engineering drawings/documents																	
							TOTAL	0		*APP.CAT														
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved							Approved By:							
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments							Sign :							
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.														
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.							Date :							
		OD-Overdue					TOTAL "OD"		0															
		" " - Not yet Due.							5															

Vendor documentation status										
Total No of Docs	Due as on Date	Submitt ed by vendor as on Dt.	Approve d by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/ Remarks	
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)/- (If Y) put Dt.		
0	0	0	0	0	0	#DIV/0!	0.00%	Y		

Annexure-10B: MASTER DOCUMENT LIST - Jockey pump

[illegible]

Annexure-10B: MASTER DOCUMENT LIST - Jockey pump																				
	Vendor Name:				PROJECT:												Supplier Doc- No:			
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:							Rev- No.			
	Vendor contact No.				Supplier's Job No.												Date:			
	SYSTEM/PACKAGE:	Condenser Cooling Water Pump				TODAY-DATE	10/Oct/17			Submission status to BHEL										
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Final Rev-(R)	REMARKS
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	Date	
10	BILL OF MATERIAL	Later		A	N	N	Within 10 weeks after PO placement													
11	BILLING BREAKUP	Later		A	N	N	Before Despatch													
12	QUALITY ASSURANCE PLAN	Later		A	N	Y	Within 4 weeks after PO placement													
13	SUB VENDOR LIST	Later		I	N	N	Within 4 weeks after PO placement													
14	COMMISSIONING SPARES LIST	Later		A	N	N	Within 4 weeks after PO placement													
15	Mandatory Spares List	Later		A	N	N	Within 4 weeks after PO placement													
16	LUBE OIL SCHEDULE	Later		I	N	N	Within 8 weeks after PO placement													
17	STARTUP PROCEDURE	Later		I	N	N	Within 8 weeks after PO placement													
18	ERECTION PROCEDURE & Comissioing procedure	Later		I	N	N	Within 8 weeks after PO placement													
19	INSPECTION/TESTS REPORTS/CERTIFICATE	Later		I	N	N	Within 8 weeks after PO placement													
20	O& M Manuals(Soft Copies)	Later		A	N	N	After Approval of all engineering drawings/documents													
21	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.	Later		I	N	N	After Approval of all engineering drawings/documents													
							TOTAL	0		AAPP.CAT										
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved							Approved By:			
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments						Sign :				
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.										
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.						Date :				
		" " - Not yet Due.																		
		OD-Overdue					TOTAL "OD"		0											
		" " - Not yet Due.																		

Vendor documentation status									
Total No of Docs	Due as on Date	Submited by vendor as on Dt.	Approve d by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/ Remarks
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N).-/ (if Y) put Dt.	
0	0	0	0	0	0	#DIV/0!	0.00%	Y	

Annexure-10C: MASTER DOCUMENT LIST - Booster Pump: Motor & Diesel Engine driven

[illegible]

Annexure-10C: MASTER DOCUMENT LIST - Booster Pump: Motor & Diesel Engine driven																				
	Vendor Name:				PROJECT:											Supplier Doc- No:				
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:						Rev- No.				
	Vendor contact No.				Supplier's Job No.											Date:				
	SYSTEM/PACKAGE:	Hydrant Pump				TODAY-DATE	10/Oct/17			Submission status to BHEL										
Sl.No	DRG/DOC. NAME	DRG/DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1			Rev-2			Final Rev-(R)	REMARKS
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" */PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	SD	AD	APP.CAT	Date	
6	NDE Test Procedure	Later		I	N	N	Within 8 weeks after PO placement													
7	Balancing_LP test & ultrasonic test procedure	Later		I	N	N	Within 8 weeks after PO placement													
8	Painting procedure	Later		A	N	N	Within 10 weeks after PO placement													
9	Packing List	Later		I	N	N	Before Despatch													
10	BILL OF MATERIAL	Later		A	N	N	Within 10 weeks after PO placement													
11	BILLING BREAKUP	Later		A	N	N	Before Despatch													
12	QUALITY ASSURANCE PLAN	Later		A	N	Y	Within 4 weeks after PO placement													
13	SUB VENDOR LIST	Later		I	N	N	Within 4 weeks after PO placement													
14	COMMISSIONING SPARES LIST	Later		A	N	N	Within 4 weeks after PO placement													
15	Mandatory Spares List	Later		A	N	N	Within 4 weeks after PO placement													
16	LUBE OIL SCHEDULE	Later		I	N	N	Within 8 weeks after PO placement													
17	STARTUP PROCEDURE	Later		I	N	N	Within 8 weeks after PO placement													
18	ERECTION PROCEDURE & Comissioing procedure	Later		I	N	N	Within 8 weeks after PO placement													
19	INSPECTION/TESTS REPORTS/CERTIFICATE	Later		I	N	N	Within 8 weeks after PO placement													
20	O& M Manuals(Soft Copies)	Later		A	N	N	After Approval of all engineering drawings/documents													
21	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.	Later		I	N	N	After Approval of all engineering drawings/documents													
							TOTAL	0		^APP.CAT										
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved							Approved By:			
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments							Sign :			
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.										
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.							Date :			
		OD-Overdue					TOTAL "OD"		0											
		" " - Not yet Due.							5											

Vendor documentation status									
Total No of Docs	Due as on Date	Submitted by vendor as on Dt.	Approved by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/Remarks
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)./(If Y) put Dt.	
0	0	0	0	0	0	#DIV/0!	0.00%	Y	

ANNEXURE-11: DEVIATION FORMAT
[For Technical Specification, PY-51282, Rev00]

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification Requirement	Bidder's Deviation

Notes:

1. Bidder to furnish duly filled format along with SEAL & SIGN along with their offer.
2. All the pre-bid queries (if any) shall be raised before submission of the offer as per pre-bid query format (Annexure- 12).

3. Deviations, which are impractical, and the same were raised during pre-bid stage as per pre-bid query format (Annexure-12), but still purchaser's reply/clarifications could not be met shall only be raised in this format.
4. If there are no deviations, bidders shall indicate as "No deviation" and submit the same along with their offer.
5. Deviations indicated elsewhere in bidders offer except raised through this format shall not be considered and reviewed during technical evaluation of their offer.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

ANNEXURE-12: PRE-BID QUERIES FORMAT
[For Technical Specification, PY-51282, Rev00]

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification Doc. No. PY-51282 (along with all Annexures) shall also be referred.

Accuracy	:	$\pm$ One (1) percent or better
Repeatability	:	$\pm$ 0.5(half) percent or better
Setting & Differential	:	Adjustable
Contact		
- Number	:	DPDT /2 SPDT
- Type	:	Auto reset with internal Adjustable snap action micro switch
- Rating	:	5 Amp, 240V AC / 0.2 Amp, 220V DC
Connection - instrument	:	Half (1/2) inch NPT Male Process
Electrical	:	Suitable for Plug in type connection. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.
- Over range protection	:	One Fifty (150) percent of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
Accessories		
- 3 / 5 valve manifold	:	As applicable for all switches
- Self cleaning type pulsation dampners/Snubber (Material SS316)	:	Pump and compressor discharge lines
- Syphon	:	For all steam lines
- Protective separating diaphragm	:	For fuel oil & corrosive liquid lines.
Mounting	:	Local (in LIE/LIR for BTG package).

3.03.03 PRESSURE & DIFFERENTIAL PRESSURE GAUGES (PG & DPG)

Applicable standard	:	IS:3602-1966, IS/3624, ASME B 40.1
Type/Construction	:	
-760 mm to 1.0Kg/cm2	:	Bellows/Diaphragm
-Above1.0Kg/cm2	:	Bourdon Tube
- Suction side of pumps	:	Compound gauge
Materials		
- Bourdon tube	:	316 SS
- Bellows	:	316 SS
- Movement	:	316 SS
- Case	:	SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating



		shall be provided for corrosive atmosphere.
- Protective Diaphragm	:	Teflon
Dial size	:	150mm with shatter proof glass
Scale Details	:	Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
Accuracy	:	$\pm$ One (1) percent or better
Connection - Instrument Process	:	1/2 inch NPT Male Bottom
Mounting	:	Local
	:	1/2 inch NPT Male (Back entry) mounted on local gauge board.
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

Accessories

- 3 way needle valve/manifolds	:	For all gauges
- Self cleaning type	:	Pump and compressor discharge lines
Pulsation dampener/snubber (S316)	:	
- Syphon	:	For all steam lines
- Protective separating	:	For fuel oil and corrosive liquid lines

Other particulars

- External Zero adjustment	:	For all gauges
- Safety device	:	
Ranges 5 to 20 Kg/cm ²	:	Rubber blow out disc with open front construction.
Ranges above 20 Kg/cm ²	:	Neoprene safety diaphragm at the back with solid front construction.
- Over range protection	:	One Fifty (150) percent of full scale

Other Requirments

	:	Movement mechanism shall be glycerin filled for oil services & vibration prone area.
	:	For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Fuel oil & Corrosive liquid service.



- : Contact type pressure gauges are not acceptable for interlock & protection.
- : For condensate storage tank the pressure gauge in terms of 0-10000 mm wc or suitable range having **dial size of 300mm or bigger size** shall be provided.

3.03.04 TEMPERATURE TRANSMITTERS

Type	:	SMART type configurable from control room through HART protocol (HMS System).
Display type	:	Indicating type (5 digit LCD Display),
Accuracy	:	$\pm 0.10\%$,
Ambient temperature error	:	0.1% per 10°C change
Output	:	4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC.
Protection class	:	NEMA 4/IP66 or equivalent degree of protection for enclosure/ (Explosion/Flame proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable).
Material of accessories	:	SS316.
Stability	:	$\pm 0.1\%$ or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs.
Operating Voltage	:	16 – 48 V DC
Calibration	:	as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD .
Ref. Junction compensation	:	Provided
Span/zero adjustment	:	Locally adjustable, Non interacting
Auto calibration	:	Provided
Burn out protection upscale	:	Provided
Input - output isolation	:	Provided
Circuit ungrounded	:	Provided

Any RTD & Thermocouples shall be directly wired to DDCMIS/DCS/PLC for metal temperature application, bearing & winding temp application only.

The Temperature transmitter shall accept Universal dual inputs of all types of thermocouples & RTD, 0-5V input signals etc.



Temp. Transmitter shall be extremely stable against Ambient temp variation, The accuracy figure shall be inclusive of effect due to ambient temperature variation.

Considering the application & distance involved for monitoring parameters **wireless technology** shall be adopted by interfacing with DDCMIS through OPC connectivity. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner.

3.03.05 RESISTANCE TEMPERATURE SENSORS WITH THERMOWELLS

Applicable Standard	:	ASME PTC 19.3 - Latest Revision DIN EN 60751:1996, BS EN/IEC60751:2008
Element	:	Platinum, R0=100 ohm 4-wire Duplex for Process Temp. Measurement Platinum, R0=100 ohm 3-wire Duplex for Bearing & Winding Temp. Measurement
Sheath Material/ Insulation	:	316SS/Compacted Magnesium Oxide
Sheath O D	:	8 MM
- Gauge	:	18 AWG
Terminals	:	Spring loaded high temperature ceramic base with silver plated brass for high vibrating locations.
Calibration	:	As per DIN Standard – 43760, Class A
Head	:	Hex Head, Die Cast Aluminum (Screwed) with galvanized SS chain
Response Time	:	6-10 Sec bare & 30 Sec. With protective sheath/thermowell
Accuracy	:	± 0.35 degree C or Class-A whichever is better.
Electrical connection	:	Gold plated Plug in type. Double entry – one unused entry with blind plug
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

THERMOWELL

Applicable Standard	:	ASME PTC 19.3 TW - 2010
- Construction	:	Tapered drilled from Bar stock (Straight for Air & Gas systems)
- Material	:	- 316 SS/F11/F22/F91 - water and steam Services depending upon process parameters. - Inconel for air & flue gas services For furnace zone, impervious ceramic protecting tube of suitable material along



with Incoloy supporting tubes and adjustable flanges.

For Mill classifier outlet long life solid sintered tungsten carbide material or better of high abrasion resistance.

Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 2010. "All Thermowells in high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safer size and design of Thermowells".

- Process Connection	:	(i) M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
- Extension	:	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Immersion length	:	Within ± 10 mm of center line of pipe and as per ASME – PTC-19.3 - 2010
Extension neck length	:	Minimum 100 mm above insulation of pipe and Minimum 160 mm when there is no insulation on pipe.
IBR Certification	:	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations
Note	:	Extension /Compensating/paired cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB.

3.03.06 THERMOCOUPLES WITH THERMOWELLS

Applicable standard	:	ASME PTC 19.3- Latest Revision ANSI-MC 96.1 – 1982, IEC 584-2
Element	:	Duplex
- Sheath	:	8 MM OD
- Sheath Material	:	316 SS
- Spring Loaded	:	Yes
- Nipple/Union	:	Yes
- Packed connector	:	Compacted magnesium Oxide ungrounded



- Type : i. Type K (Chromel - Alumel)
 ii. Type S/R (Platinum Rhodium-Platinum)
 iii. Type T (Cu-CuNi)
 with special limits of error according to ANSI-96.1 - 1982.
- Gauge : 16 AWG
- Head : Die Cast Aluminum
- Electrical connection : Gold plated Plug in type. Double entry – one unused entry with blind plug
- Enclosure Class : IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

Thermowell

- Construction : Tapered Drilled from Bar stock
 (Straight for Air & Gas systems)
- Material : - 316 SS/F11/F22/F91 - water and steam Services depending upon process parameters.
 - Inconel for air & flue gas services
 For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.
- For Mill classifier outlet long life solid sintered tungsten carbide material or better of high abrasion resistance.
 Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 2010.
 “All Thermowells in high velocity steam service shall be checked for Strouhal’s frequency limit to arrive at a safer size and design of Thermowells”.
- Process Connection : (i) M 33 x 2
 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, gaskets, fasteners etc.
- Extension : Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends

Accuracy (Special Class as per IEC-751/ANSI-C-96.1)

- (For Type K T/C) : ± 1.1 deg.C (for 0 to 277 deg.C)
 ± 0.4 percent (for 277 to 1280 deg.C) Class-A



For Type S & R T/C	:	± 0.6 deg.C or $\pm 0.1\%$
For Type T T/C	:	± 0.5 deg.C or $\pm 0.4\%$
Accessories	:	Bolts, nuts and gaskets for flanged connections.

Response Time (Bare Thermocouple)

- For SH & RH Temp. Control	:	4-6 Sec.
- All other applications	:	10 Sec.
Immersion length	:	Within ± 10 mm of center line of pipe and as per ASME – PTC-19.3 - 2010
Extension neck length	:	minimum 100 mm above insulation of Pipe and minimum 160 mm when there is no insulation on pipe.
IBR Certification	:	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations.
Note	:	Extension/ Compensating cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of mill or due to coal burning. Hence The terminals of temperature sensors shall not be at the top of mills itself. The temperature sensors wires are to be laid up to JB though SS tube of required diameter and the head shall be placed nearer to the JB.

Thermocouples provided for steam services like super heater / de super heater area, where the process pipe is inside the insulation of boiler penthouse, Thermowells are inaccessible and terminal head and connecting cable cannot withstand high temperature, for such services thermocouples shall be provided with flexible extension SS316 Sheath of 10-15 meters.

3.03.07 Metal Temperature Thermocouples

Measuring Medium	:	Metal Temperature
Material of Thermocouple.	:	Chromel Alumel Type K
Type of Thermocouple	:	Duplex with separate hot junctions, ungrounded
Insulation	:	Mineral Insulation Magnesium Oxide.
Thermocouple wire gauge	:	16 AWG
Protective sheath	:	SS 321
Protective sheath dia	:	8 mm O.D



Characteristics of Thermocouple	:	Special limits of error as in ANSI thermocouple MC 96.01.1975
Mounting accessories	:	1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310.
Cold end sealing	:	SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin.
Minimum bending radius	:	30 mm
Length of T/C	:	30 Mtr. (minimum)
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

3.03.08 TEMPERATURE SWITCHES (TS)

Type/Construction

- Switch : Industrial type inert gas filled with capillary and separable thermowell and contacts directly connected to Bourdon element/vapor pressure sensing, gas filled bellows type preferred.

- Thermowell : Bar stock

Material

- Bulb : 316 SS
 - Capillary : Armored Stainless Steel
 - Bourdon : 316 SS
 - Bourdon Movement : SS 316
 - Casing : Die-cast aluminum with stoved enamel black finish Epoxy coating shall be provided for corrosive atmosphere.

Setting and Differential : Adjustable
 Accuracy : $\pm$ One (1) percent of setting and differential
 Repeatability : One half(1/2) percent of setting.

Contacts
 - Number : DPDT/2 SPDT
 - Type : Auto reset with internal Adjustable snap action micro switch
 - Rating : 5 Amp, 240V AC / 0.2 Amp, 220V DC
 Connection
 Pipe : M33 x 2
 - Extension : Threaded union (SS316) 1/2" NPT (F)



with two nipples of SS 316 having 1/2"NPT(M) threads at both ends

Thermowell : To suit Temp. switch with same design criteria as specified for RTDs.
Electrical : Suitable for Plug in type.

All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldered in connector and to be inserted for easy maintenance.

Other Particulars

- Capillary length : As per requirement (min 10 meters)
- Immersion Length : Within + ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length : Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Packing glands : Yes
IBR Certification : For high pressure service, Steam Temp, Fuel oil temp. measurement as per IBR rules and regulations
N.B : Switches designed for cross ambient operation shall be used in applications where the ambient temperature will approximate or exceed the switch set point.

3.03.09 TEMPERATURE GAUGES (TG)

Applicable standard : IS : 3602,BS:5235 ISA:RP:8.1 except as modified in this specification

Type/Construction

- Thermometer : Industrial type, Gas in Filled type with separable thermowell
- Thermowell : Bar stock

Material

- Bulb : 316 SS
- Capillary : Armoured SS (Applicable for capillary Type)
- Casing : SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating



		shall be provided for corrosive atmosphere
Dial Size	:	150mm with shatter proof glass
Scale Details	:	270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges
Accuracy	:	$\pm$ One (1) percent or better
Response time	:	Maximum 15 seconds without thermowell and 30 seconds with thermowell
Connection		
- Pipe	:	M33 x 2
- Thermowell	:	To suit instrument with same design criteria specified for RTDs.
- Process Connection	:	(i) M 33 x 2 (ii) SS316 Flanged, for Air & Gas systems, with mating flanges, fasteners, gaskets etc.
- Extension	:	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends
Other Particulars		
- Capillary length	:	5Meters/10 Meters as required
- Immersion Length	:	Within + ten (10) mm of center line of pipe with adjustable nuts.
- Extension neck length	:	Minimum 50 mm above insulation of pipe /As per approved hookup drawings.
- Stop at Maximum value	:	For all gauges of scale
- Pointer	:	Externally adjustable
	:	In general, Contact type Temp. gauges are not acceptable for interlock & protection.
		Contact type Temp. gauges are acceptable for interlock & protection in case of bearing temp. only.
- Over range protection	:	150 percent (%) of full scale
Enclosure Class	:	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)
IBR Certification	:	For high pressure service, Steam



Temp., Fuel oil temp. measurement
as per IBR rules and regulations

3.03.10 TEST THERMOWELLS (TW)

Applicable Standard	:	ASME PTC 19.3 TW - 2010
Type/Construction	:	Machined from Bar Stock
Material	:	316 SS/F11/F22/F91
Connection	:	
- Pipe	:	M33 x 2
- Test Instrument	:	To suit test instruments
Accessories	:	Plug with chain
IBR Certification	:	For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations Bidder shall provide calculation for thermowell as per ASME – PTC- 19.3 TW - 2010.

Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

3.03.11 DIRECT MOUNTED LEVEL TRANSMITTERS (LT)

Displacer type level transmitter shall not be used in the process anywhere in the plant.

3.03.12 Ultrasonic Level Transmitter (for Water sump/Tank level, Raw water reservoir level, Cooling water fore bay level measurements)

Principle of Operation	:	Detection of reflected ultrasonic pulse
Measuring Ranges	:	Up to 30 meters (typical)
Signal Processing	:	Microprocessor Controlled Signal Processing
Operating Freq.	:	10 KHz to 50 KHz (typical)
Display	:	Head mounted alpha-numeric back lit LCD/LED
Calibration & Configuration	:	Accessible from front of panel & HART calibrator.
Diagnosis	:	On-line
Status	:	For power, Hi / Lo / V. Hi / V. Lo- level indication, fault etc.
Construction	:	Plug-on board
Power supply	:	240 V AC 50 Hz / 24V DC
Signal Output	:	4-20 mA DC with HART (isolated) - 600 Ohm load.
Hysteresis	:	Fully adjustable preferred
Output contacts	:	2SPDT Potential free changeover contacts @ 8A 230V AC.
Accuracy & Repeatability	:	$\pm 0.25\%$ of span or better
Resolution	:	$\pm 0.1\%$ of span
Temperature Compensation: To be provided with Transducer.		



Electrode assembly shall have blow out and leakage proof sealing arrangement. Field proven ceramic/zirconia probes with insulation suitable for design pressure and temperature are to be provided.

The system design shall be such that it shall ensure that failure of one probe circuit shall not affect another probe circuit and failure of any electrode will not hamper the system function and operation. Further the entire system shall be of proven fail-safe design.

The logic shall be such that the trip and alarm relay circuits shall be independent for each for Low, Low-Low, High and High-High levels of tank. Monitoring of set time for trip generation and provision of setting time delay shall be available in the system. Trip logic shall be independent and separate from faultfinding logic.

The system shall have fault diagnostic features such as process fault, system hardware fault, probe failure, circuit board failure, shorted wire etc. Further the system shall be able to distinguish between a cable fault and an electrode fault.

The necessary relays and relay modules for the Output Contacts shall be of proven design and each contact shall be rated for 5A, 240V AC/0.25A 220V DC rating. All these contacts shall be 2SPDT type. The **vessel** holding electrodes **shall be IBR certified**. The system shall be proven and approved by Factory mutual, USA of equivalent, IBR etc.

3.03.17 LEVEL SWITCHES (LS)

Type/Construction	:	a) External float cage type with magnetic switch actuator for tanks and vessels. b) Electrode/Capacitance (for oil tanks) c) Displacer -Top mounted for all clean water sumps. d) Conductivity type for high Pressure and high temperature enclosed vessel like drain pot, HP heaters etc.
Materials		
- Body	:	Cast Carbon Steel/Die cast Aluminum suitable for specified pressure and temperature ratings
	:	For corrosive liquids suitable anti-corrosive coat/lining shall be provided.
- Float/Displacer	:	316 SS
- Wire rope	:	316 SS
Differential	:	± 12 mm minimum (Adjustable)
Contacts		
- Number	:	DPDT/2 SPDT
- Type	:	Snap action micro switch Auto reset with internal Adjustable
- Rating	:	5 Amp 240V AC 0.2 Amp 220V DC
Connection - Process	:	One (1) inch SCRD NPT Female Or One (1) inch ANSI Flanged Four(4) inch ANSI Flange for sump services.
Electrical	:	Suitable for Plug in type connection



Temperature/pressure rating : As per service conditions
 Accessories : Counter flanges, still pipe of requisite length with anticorrosive coating for sump services.

Nuclear, capacitance, or ultrasonic type level switch for bulk material applications shall be provided.

3.03.17.01 Conductivity Type Level Switch

Type	:	Conductivity discrimination.
Mounting	:	Flanged – on standpipe.
Probe MOC	:	Stainless steel with high purity ceramic.
Probe rating	:	> Maximum design pressure of vessel.
Input	:	Four independent channel with selectable switching threshold for water conductivity.
Relay Output	:	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
Contact type & rating	:	2SPDT or 1 DPDT @ 5A 30V DC.
Faults Detection	:	Power Fail/Electrode Connection Open circuit/short circuit to ground, Ground failure. In built Fail Safe Logic.
Indicator	:	One Red LED for steam/ one Green LED for water/ Two no. LED one each for Process & system fault.
Power supply	:	Dual 240V AC, 50 Hz, 1Ph. From UPS
Enclosure	:	IP-65, corrosion resistant & wall mounting type.
Accessories	:	i. PTFE cable from probe to electronics unit. Electronic unit shall be separate. Head mounted electronic unit is not preferred. ii. Mounting accessories iii. standpipe iv. Washer & gasket
Test pressure	:	Two times rated pressure

3.03.17.02 Capacitance Type Level Switch

Type	:	Capacitance type
Probe	:	a) Rod or suspended electrode b) Rope type probes may be used only where required probe length is greater than 3 meters.
Probe Mounting	:	Stainless steel 1-1/2 ANSI RF Flange / 3/4" NPT (M)
Material of construction	:	316 SS
Insulation	:	PTFE Part/Full as per service.



Enclosure	:	Powder/Epoxy coated Die cast Aluminium. with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
Ambient temperature	:	0-60 °C.
Mounting	:	On Top
Supply voltage	:	240V AC, 50Hz from UPS/ 24V DC
Relay output	:	2SPDT
Contact rating	:	5A min. at 240V AC on resistive load
Response time	:	100 m sec or better
Cable connection	:	¾" ET
Accessories	:	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.

3.03.17.03 RF TYPE LEVEL SWITCH

A. Electronic Controller

1.	Input Supply	:	240 V AC from UPS
2.	Construction	:	Cast Aluminum Housing
3.	Relay Output	:	2 Nos. Relay Changeover Potential Free Contacts(2SPDT)
4.	Contact Rating :	:	5A at 240 V AC & 0.25 at 220 V DC
5.	Class of Protection	:	IP-66
6.	Ambient Temperature	:	55 Deg. C(Max)
7.	Local Indication	:	Local LED Indications
	Green	:	Normal Level
	Red	:	Alarm Level
	Yellow	:	Probe Healthy
8.	Cable Connection	:	¾" ET(2 Nos.) for Supply and Output 5/8" ET(1 No.) for Probe Connection
9.	Repeatability	:	100%

B. Sensing Probe

1.	Type of Probe	:	Rigid
2.	Material	:	Stainless steel SS 316
3.	Probe Head Housing	:	Cast Aluminum
4.	Insulation (B/W Active & Shield And Shield & Ground)	:	PTFE
5.	Probe Head Protection	:	IP-66
6.	Mounting	:	Side Mounted
7.	Cable Connection	:	5/8" ET(1No.)
8.	Process Connection	:	40 NB BSP THREADED
C.	Signal Cable	:	Coaxial cable for Connection Between Sensing probe and electronic Controller(@ 10 Mtrs. Per Level Probe)



D. Application : Ash Silos

3.03.18 LEVEL INDICATORS (Gauge Glass) (LI)

Type/Construction	:	a) Reflex b) Tubular (For tanks open to atmosphere only)
Material:		
a) Glass	:	Tempered borosilicate resistant to thermal shock
b) Case	:	Carbon steel
c) Integral cocks and	:	i) Forged carbon steel with drain valves stainless steel internals ii) Rubber lined corrosion resistant 316 stainless steel (for Demineralised and Osmosis water service)
d) Fittings	:	i) Forged carbon steel ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralised and Osmosis water service) iii) 304 Stainless Steel for non-corrosive liquids
e) Packing	:	Teflon
Dial size/scale	:	150 mm /1.5 Meters maximum length with
Scale details	:	Aluminum/SS316 scale Graduated in mmwc
Connection	:	25 Nb/40 Nb ANSI Flanged
Accessories	:	a) Integral cocks b) Drain valves c) Bolts, nuts and gaskets d) Illuminating lamps as required e) Periscope as required
Tests	:	Tested at two hundred (200) percent of the maximum process pressure
Other details	:	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

3.03.19 FLOAT & BOARD TYPE LEVEL GAUGE

Type of Instrument	:	Mechanical Type (Float Operated)
Service/ Application	:	As per service requirement
Measuring Range	:	as per requirement
Material Specification		
a) Float Material	:	SS316 having 2 nos. Guide wires
b) Float Wire Pulley	:	Shall comprise of 2 nos. Cast Aluminum Pulley hosing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be



		SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative length as per P&ID
c) Guide wire Assembly	:	CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
d) Counter Weight	:	MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
e) Scale	:	SS 316/Aluminum material in mm with 1 % accuracy.
Nozzle Details	:	For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
Process Connection	:	Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
Accessories (to be supplied with the instrument)		
a) Counter flange	:	All mating Flanges, Nozzle
b) Mounting Accessories	:	All mounting accessories
c) Tag Plate	:	To be provided (material SS316)

3.03.20**MASS FLOW METER****Sensor**

Measuring Principle	:	Coriolis Mass flow.
Primary Element	:	Flow Tube of 316SS or better
Heating Arrangement	:	Integral with Flow meter.
Temperature Control For Heating	:	To be provided.
Process Connection	:	ANSI RF Flanged and rating as per process requirement.
Drain	:	Self-draining facility
Accessories	:	Counter flanges, Mounting nuts, bolts, gaskets etc.

Transmitter

Measured quantities	:	Mass Flow rate, Total Mass Flow, Density, Temperature as minimum.
Input Signal Processing	:	Digital Processing.
Display	:	Digital Display (LCD).
Output	:	2 Nos. isolated output of 4-20mA DC selectable from four measured quantities.
Load	:	< 750 ohms.
Power supply	:	240V AC, 50 Hz. From UPS
Accuracy	:	0.15% of measured value for Liquid 0.5% of measured value for Gas
Repeatability	:	0.05%
Housing	:	IP 65 (Explosion proof for NEC Class-1, Division 1 area)
Hazardous duty Version	:	FM Standards.



- Failure Diagnostics
- Long Term Stability
- Fast Response
- IP 66 / NEMA4X Protection
- Supplied with Calibration Certificate Traceable to National & International Humidity Standards
- Sensor protection with sintered filter
- Local LCD Display for Dew Point

3.03.42

Junction Boxes

v.	Type	:	Flame proof/weather proof
vi.	Enclosure	:	IP-65/Explosion/Flame Proof as per area classification.
vii.	Material	:	FRP with protective Coating
viii.	Cable entry	:	Bottom or Side
ix.	Cable glands	:	Double compression type – Nickel plated brass with PVC hoods.
x.	Mounting	:	Indoor/Outdoor
xi.	No. of terminals	:	As required with standardization with 20% spare of each size & type.
xii.	Terminals	:	Phoenix/Wago (screw less cage clamp type spring loaded)
xiii.	Grounding	:	Two terminals for body and shield ground
xiv.	Door	:	Hinged, lockable type.
xi.	Suitable mounting clamps and other accessories shall be in scope of bidder.		
xii	The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.		
Xiii	M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)		
xiv	Gasket (Normal)- Neoprene thickness 6.0 mm		

3.03.43

Interposing Relays (IPR)

Electro magnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.5A 220 V DC/8 A 240 V AC. Free wheeling diode across relay copper coil and self reset type status LED indicator flag (electronic) shall be provided. Manual forcing/override facility is required. The test voltage for relay shall not be less than 4 KV with operating temperature from –20 deg. C to 60 deg. C. The relay shall have the necessary approvals like V0 inflammability class in accordance with UL94”, IEC60664/IEC60664A/DIN VDE 0110. Facility to stimulate IPR manually shall be provided. The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only.

3.03.44

RECORDERS (CHARTLESS)

Type	:	Micro-processor based, Digital TFT display type
- No. of Channels	:	Forty Eight (48) point).



Input over range/open sensor	:	All digits to flash
Mounting	:	Panel mounting
Zero and Span	:	Adjustable by digital calibration
Serial communication communication	:	Isolated RS232/485 for modbus-RTU
Memory Capacity	:	5MB Flash
Alarm output	:	Required
Contact rating	:	2A at 220 V AC
Power supply	:	240 V AC/24 V DC
Properties	:	i. Any channel shall be configured for Data Logging
		ii. Channel to Channel online Isolation shall be provided
		iii. Real Time RTC Interface for Printer shall be provided
Operation Modes	:	Auto/manual mode, Run mode, Verify mode, Calibration Mode, Program mode.

3.03.48 AMMETERS (AMM)

Input	:	4-20 mA DC
Mounting	:	Flush panel, compatible for mounting on mosaic grid panel
Face Dimensions	:	96 x 96 mm
Scale/Type	:	Moving coil, circular, FSD 240 deg. With six times suppression scale
Zero adjustment	:	Screw on meter face
Accuracy	:	± 1 percent (class 1)
Indication	:	Pointer with scale
Magnetic Shield	:	Shielded Case
Quantities	:	For all HT Motors & LT motor with rating ≥ 30 KW and other critical application motors/drives.

3.03.49 VOLTMETER:

Input	:	4 - 20 mA DC
Mounting	:	Flush Panel, compatible for mounting on mosaic grid panel
Face Dimension	:	96x96 mm
Range	:	As per requirement
Accuracy	:	$\pm < 0.5$ %
Indication	:	Digital type 4 1/2 digit
Magnetic Shield	:	Shielded Case
Connection	:	Plug in type
Quantities	:	For 230 V AC input power supply, UPS power supply, 24 V DC interrogation voltage & 220 V DC.

3.03.50 FREQUENCY METER/MW METER (DIGITAL)

Size of tapping point stub, number and size of root valves for different types of measurements are as follows:

Sl. No.	Quantity of root valves	Size of stub and root valve	Service Condition
Pressure and Differential Pressure Measurement			
(i)	2	25NB	≥ 40 bar(g) OR 425°C
(ii)	1	15NB	< 40 bar(g) AND 425°C .
Level Measurement			
(a)	Level Gauge & Switch		
(i)	2	25NB	≥ 40 bar(g) OR 425°C
(ii)	1	25NB	< 40 bar(g) AND 425°C
(b)	Level transmitter (displacement type)		
(i)	2	40NB	≥ 40 bar(g) OR 425°C
(ii)	1	40NB	< 40 bar(g) AND 425°C
(c)	Stand pipe for level measuring instrument		
(i)	2	80 NB	≥ 40 bar(g) OR 425°C
(ii)	1	80 NB	< 40 bar(g) AND 425°C
Flow Measurement			
(i)	2	25NB	≥ 40 bar(g) OR 425°C
(ii)	1	25NB	< 40 bar(g) AND 425°C
Sampling system measurement (Steam and Water Service)			
(i)	2	25 NB	≥ 40 bar(g) OR 425°C
(ii)	1	25 NB	< 40 bar(g) AND 425°C



4.05.08 RELAY BASED LOCAL CONTROL PANEL/DESK

Local control panel shall be of 2.5 mm steel construction, free standing type, totally enclosed dust and vermin proof with enclosure protection class of IP-55 as per IS: 13947 and colour shall be as per shade no. RAL 7032/7035. Panel shall be mounted on vibration dampers secured to steel frame on to the floor. Equipment and relays mounted on the panel shall be easily accessible. The panel shall be supplied completely wired upto terminal blocks for connecting external cables entering the panel from the bottom. Blank removable gland plate shall be provided with double compression type cable glands/conduits knockout along with the panel.

Terminal block shall be rated 600 volts minimum and shall have strap cage clamp type screw less terminals suitable for connection with 2x2.5 sq mm copper conductors on each side. Terminal block shall be provided with white marking strips. Fuses shall not be mounted on terminal blocks. At least 20 percent spare unused terminals shall be provided on terminal block.

Contactors, Relays, timers and other devices mounted on the panel shall have clearly visible identification marking. Separate contactors shall be provided for start & stop command. Common contactor for start & stop command are not acceptable. All fuses shall be HRC semiconductor type of AC supply. HRC link & fuse shall be of removable type having 45 kA rupturing capacity (min) for protection of various circuits.

The panel shall be provided with a 50x6 mm tinned copper earthing strip running throughout the length of the panel at the bottom. Panel shall be provided with space heaters with isolating DPN MCB, and thermostats. LED based illuminating lamps, complete with door switches; and 1 no. 6 pin 5/15amps sockets with DPN MCB.

Panel shall be provided with LED illuminating lamps with door switch and 6 point 5/15A, 240V AC socket with switch for maintenance purposes. Panel shall have removable lifting eye bolts for safe lifting from top during handling. Control power supply shall be provided from dual redundant feeders with auto change over scheme, surge protection devices and Power/Volt/AM meter.

The panel shall be provided with push buttons, indicating lamps, annunciators, indicating instruments, interlock/ deinterlock switches etc., required for the complete system. General details as specified in chapter 6 shall also be referred for engineering and design of relay panel/desk.

Coloured Mimic with 6mm thickness sheet for respective plant lay out shall be provided as specified in Annexure A, control system philosophy.



20% spare relays of each type and rating shall be mounted and wired in relays control panel/Desk. All contacts of relays shall be terminated in terminal blocks of relay control panel/Desk, Additionally in the relay control panel/Desk, 20% spare terminal blocks shall be 'provided so that additional relays can be mounted and wired.

The annunciation system shall consist of panel mounted audio-visual windows of 50x75 mm provided with plug-in-type solid-state logic 16 nos. high intensity LEDs in parallel. EACH relay based control panel shall be provided with 30 nos min. facia windows. Initiating contacts may be either NO or NC; a jumper or switch shall be provided in each card to make it suitable for either type of contact. A set of acknowledge, reset and test push buttons shall be provided on the panel. All printed circuit boards shall be of epoxy fibre glass construction.

The sequence of annunciation shall be as follows:

Condition	Visual	Audible
Normal	OFF	OFF
Alarm	Flashing	ON
Acknowledge	Steady	OFF

Return to Normal:

a.	Before acknowledge	Flashing	ON
b.	After acknowledge	Steady	OFF

Reset:

a.	Alarm condition	No change	No change
b.	Return to normal	OFF	OFF

