

ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032	Std. / Doc. Number	
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**TECHNICAL SPECIFICATION
FOR
FIRE WATER PUMPS**

PROJECT	PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)
OWNER	M/s NTPC LIMITED
OWNER CONSULTANT	M/s NTPC LIMITED, NEW DELHI

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	 RATISH KUMAR	 GIRISH PRASAD PALO	 M. SIVA PRASAD BABU	20.08.19



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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.

- i. Duly filled in Pump-Motor-Diesel Engine datasheet (**Annexure-2A, 2B, 2C & 2D**)
- ii. Tentative GAD for Pump with Motor & Engine
- iii. Performance curves for pump
- iv. Un-priced copy of price in attached BHEL price bid formats (**Annexure-4A, 4B, 4C & 4D**) indicating quoted/ not quoted against each row & column.
- v. Equipment qualification criteria / PTR / Reference Lists
- vi. Checklist as per (**Annexure-5A, 5B, 5C & 5D**)
- vii. Bidder shall submit **NO DEVIATION certificate** 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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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 Pump, Spray Pump, Hydrant Booster Pump, Spray Booster Pump and Jockey Pump]** 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-participation by the bidder is attributable to reasons other than any specification requirements.

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3. PROJECT INFORMATION

Sl. No.	Owner	M/s NTPC LIMITED		
1.	Project	PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)		
2.	Owner's consultant	M/s NTPC LIMITED, NEW DELHI		
3.	Location	Patratu Thermal Power station (PTPS) is located just outside the coal belt of South Karanpura in Ramgarh District of Jharkhand State		
4.	Nearest Airport	Ranchi		
5.	Nearest Railway Station	Patratu which is at a distance of about 4 km on Barkakhana-Barwadih Railway line		
6.	Co-ordinates	Corner name	Latitude	Longitude
		Top Corner	23° 38 ' 60'' N	85° 17' 51.5" E
		Bottom Corner	23° 38 ' 12.5'' N	85° 17' 27" E
		Left Corner	23° 38 ' 22.5'' N	85° 17' 10.6" E
		Right Corner	23° 38 ' 40'' N	85° 17' 57" E
7.	Maximum outside Ambient Air Temperature (deg. C)	50		
8.	Minimum outside Ambient Air Temperature (deg. C)	10		
9.	Elevation	405 m		
10.	Relative humidity	45 %		
11.	Design Ambient for Electrical equipment / system (deg. C)	50		

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

4. APPLICATION OF SYSTEM

3 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.

1 No of Diesel Engine driven Hydrant Water Pump (Centrifugal, Horizontal type) is envisaged for supplying water to Hydrant header from the fire water storage sump.

2 Nos of motor driven Spray water Pump (Centrifugal, Horizontal type) are 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) are envisaged for supplying the water to the spray water system from the Fire water storage sump.

1 No of motor driven Hydrant Booster Pump is envisaged for circulating water from outlet of main Fire water Pump to Fire Protection System Elevated Structures (Such as Boiler, Towers etc...)

1 No of Diesel Engine driven Hydrant Booster Pump is envisaged for circulating water from outlet of main Fire water Pump to Fire Protection System Elevated Structures (Such as Boiler, Towers etc...)

1 No of motor driven Spray Booster Pump is envisaged for circulating water from outlet of main Fire water Pump to Fire Protection System Elevated Structures (Such as Boiler, Towers etc...)

1 No of Diesel Engine driven Spray Booster Pump is envisaged for circulating water from outlet of main Fire water Pump to Fire Protection System Elevated Structures (Such as Boiler, Towers etc...)

2 Nos of Electric motor driven Jockey Pump (Centrifugal, Horizontal type) for Pressurization of Hydrant/Spray System by supplying water from Firewater storage sump.

5. TECHNICAL DETAILS/REQUIREMENTS

5.1. Design Parameters of the Hydrant/Spray Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature of Fluid	Deg. C	Ambient
3	Capacity of each pump	m ³ /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
6	NPSHA at pump suction flange	mlc	10.0
7	Margin between NPSH _A & NPSH _R		1 m at rated condition & NPSHR shall be less than NPSHA up to end of the curve condition.

5.2. Design Parameters of the Hydrant booster Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature of Fluid	Deg. C	Ambient
3	Capacity of each pump	m ³ /hr	171
4	Pump Differential Head(At Discharge Flange)	mWC	45
5	Available Pressure at Center line of Suction nozzle of Pump	Kg/cm ² (a)	15.8 kg/cm ² [max]*
6	NPSHA at pump suction flange	mlc	80 m to 120.0
7	Margin between NPSH _A & NPSH _R		1 m at rated condition & NPSHR shall be less than NPSHA up to end of the curve condition.

* Indicative value, However Available pressure at center line of suction nozzle= (Shut off head + 5% Positive tolerance on shut off head) + Pump suction pressure.

5.3. Design Parameters of the Spray booster Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature of Fluid	Deg. C	Ambient
3	Capacity of each pump	m ³ /hr	410
4	Pump Differential Head(At Discharge Flange)	mWC	45
5	Available Pressure at Center line of Suction nozzle of Pump	Kg/cm ² (a)	15.8 kg/cm ² [max]*
6	NPSHA at pump suction flange	mlc	80 m to 120.0
7	Margin between NPSH _A & NPSH _R		1 m at rated condition & NPSHR shall be less than NPSHA up to end of the curve condition.

* Indicative value, However Available pressure at center line of suction nozzle= (Shut off head + 5% Positive tolerance on shut off head) + Pump suction pressure.

5.4. Design Parameters of the Jockey Pump

Sl. No.	Description	Unit	Rated Condition
1	Temperature of Fluid	Deg. C	Ambient
3	Capacity of each pump	m ³ /hr	75
4	Pump Differential Head (At Discharge Flange)	mWC	125
5	Available Pressure at Center line of Suction nozzle of Pump	Kg/cm ² (a)	1.0
6	NPSHA at pump suction flange	mlc	10.0
7	Margin between NPSHA & NPSHR		1 m at rated condition & NPSHR shall be less than NPSHA up to 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 Pump, Spray Pump, Hydrant Booster Pump, Spray Booster Pump and Jockey Pump (Annexure-1A and 1B) for general clarity on scope of supply. The system shall be provided as per Annexure-1A and 1B 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 [3 Nos. of Motor Driven & 1 No. for Engine Driven]
3 Nos of Motors are excluded from bidders scope of supply. These motors shall be free issued to vendor and directly supplied to vendor works by BHEL for pump testing.
- ii. 3 Nos. of Spray Water Pump [2 Nos. of Motor Driven & 1 No. for Engine Driven]
2 No of Motors is excluded from bidders scope. These motors shall be free issued to vendor and directly supplied to vendor works by BHEL for pump testing.
- iii. 2 Nos. of Hydrant Booster Pump [1 No. of Motor Driven & 1 No. for Engine Driven]
- iv. 2 Nos. of Spray Booster Pump [1 No. of Motor Driven & 1 No. for Engine Driven]
- v. 2 Nos. of Jockey Pump [Motor Driven]

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

6.1. Pump- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant booster pump, Spray Booster and Jockey 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/2D for more details).

Elevation of vent nozzle of pump from the bottom of the base plate shall not be more than 1450 mm.

6.2. Drives for pumps [Motor/Diesel Engine]

6.2.1. Motor – Applicable for Each Motor driven Hydrant Pump, Spray Pump, Hydrant booster pump, Spray Booster Pump and Jockey pump

HT Motor: 5 Nos of HT Motors (3 Nos. for Hydrant pump & 2 Nos. for Spray pump) are excluded from bidders scope of supply. These motors shall be free issued to vendor and directly supplied to vendor works by BHEL for pump testing. However, bidder shall consider canopy with legs and other fixing accessories. Also suitable common base frame for pump and motor assembly shall be provided by bidder for mounting the HT motor.

Even though HT motor is not in bidder scope of supply Bidder to provide suitable Power cable gland and lugs for HT motor. Cable details shall be furnished during detail engineering stage.

Bidder to recommend suitable motor rating duly meeting TAC and customer requirement and furnish TS curve mandatorily.

LT Motor: Suitable drive motor complete with terminal box, canopy, space heater, cable glands and lugs, earthing lugs and all other accessories required shall be provided for motor driven Hydrant booster Pump, Spray booster Pump and Jockey Pump.

Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30

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/2D and Annexure-3 for more details on Voltage Level & Technical Details of Motor).

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

Starting current shall be as per IS 12615.

Note: The Supply voltage level is 415 V

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Selection of HT and LT motor:

Continuous drive motor rating (at 50 degree C ambient) for all the pump shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.

Bidder to furnish not to exceed motor rating for motor driven Hydrant Pump and Spray pump.

6.2.2. Diesel Engine- Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

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 for more details).

- i. 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.
- ii. Deaerating factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than as mentioned in NFPA [latest revision, 2010] which is as mentioned below:
 - a. Three percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m).
 - b. One Percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 25 °C.
- iii. 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.

6.2.3. Diesel Engine Control Panel – Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

PLC based Diesel Engine Control panel meeting to the requirements of TAC for each engine shall be included in bidder scope of supply. Panel shall be operated on DC Supply, suitably converted by dedicated rectifier bank, redundant transformers from mains A.C supply (415 V/230 V). Further, Battery backup shall also be provided along with auto-change over from normal to Battery supply in case of non-availability of Mains supply. 6 Nos [1 first time and 5 Repeat starts] of Kick Starts of Diesel Engine shall be envisaged in the panel.

The Control panel shall be Stand mounted. Bidder to provide suitable stand and all fixing accessories for mounting control panel.

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Bidder to submit Soft copy and hard copy of logics executed in PLC for uploading the same by end customer later.

All cabling [control/signal/power] between Engine, Battery, Battery charger, Battery selector switch, DECP, Engine Panel and all required cable glands, Battery lugs etc shall be in bidder scope of supply

Control panel, battery charger and battery selector switch is located within 5 m radius of pump skid. However, Pump house layout shall be provided during detail engineering stage. Accordingly, bidder to consider suitable margin on required cabling based on their experience. Bidder to furnish cable BOQ, electrical load list, cable schedule and cable interconnection diagram. 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**.

6.2.4. Diesel Engine Fuel Tank - Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

Fuel oil tank having storage capacity sufficient to run the engine at full load for at least twelve (12) hours, Level switch and Level indicator and required piping [5 m length minimum], pipe connector, valves [from tank to engine and engine to tank] for 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.

Tanks shall be securely mounted on noncombustible supports. Accordingly, bidder to supply Fuel Tank mounting structure, all fixing accessories. Bidder to ensure sufficient leg height for flow of fuel from tank to Engine up to minimum level of fuel and ensuring engine Manufacturer's fuel pump static head pressure limits not be exceeded when the level of fuel in the tank is at a maximum.

6.2.5. Diesel Engine Fuel Pump - Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster 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 fuel pump to the fuel tank along with valve (If any) to be supplied by Bidder.

6.2.6. Instrumentation & Control - Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

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

- i. Temperature indicator (contact type) in cooling water inlet and outlet.

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- ii. Temperature indicator in lubricating oil outlet from the oil cooler.
- iii. Pressure gauges (contact type) for lubricating oil system.
- iv. Differential pressure gauges (contact type) across strainers/ filters.
- v. Speed indicator.
- vi. Running hour meter.
- vii. Dip. Stick type lubricating oil sump level indicator.
- viii. Gauge glass type Fuel Oil Tank level indicator.
- ix. Voltmeter & Ammeter in dynamo type battery-charging circuit.
- x. Level indicator for lube oil system for diesel engine.
- xi. Temperature indicators & switches as required for generating safety interlock/alarm for diesel engine.

Instrument hook-up materials (root valves, connectors, elbow and etc.) for the instruments supplied by bidder shall be in bidder scope of supply.

6.2.7. Diesel Engine Exhaust System- Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

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

6.2.8. Battery & Battery Charger - Applicable for Each Engine driven Hydrant Pump, Spray Pump, Hydrant Booster pump, Spray Booster Pump

- i. Two (2) sets (1 working & 1 standby, 100% capacity) of 24 Volt (or 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 battery units as per IS. All batteries shall be tubular type having capacity 2 x 100% along with 2 x 100% float cum boost charger. Battery shall be sized to Cater for the following without any charging in between
 - a. Crank the engine twelve (12) times successively, each for a duration of 10 sec.
 - b. Control panel stand by load requirements (auxiliaries & other loads of Local control Panel) 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.

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- v. Storage batteries shall be rack supported above the floor, secured against displacement, and located where they will not be subject to excessive temperature, vibration, mechanical injury, or flooding with water. Accordingly, bidder to provide suitable stand/structure for mounting the battery.

For further details Pl. refer Annexure -14

For All other details shall be as per TAC guidelines.

6.3. Coupling Between Pump and Drives- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

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

- i. Coupling shall be as per as per manufacturer's standard
- ii. Couplings shall be of metallic, non-lubricated, flexible element type (i.e. either diaphragm or discs) with spacer [The spacer length shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping].
- iii. All coupling models shall be selected for a minimum service factor of 1.5 over driver rating.
- iv. Removable coupling guard shall be provided which shall be fabricated from non-sparking material, and shall be open at the bottom to permit manual shaft rotation.
- v. DBSE shall be more than the seal cartridge length.

6.4. Base Frame- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

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.

6.5. Mechanical Seal- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

Cartridge type Mechanical seal as per manufacturer's standard.

Note:

If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.

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6.6. Interconnecting Piping & Instrumentation- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

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. Suction Reducer/expander shall be eccentric type. All counter flanges shall be of weld neck type.

Pipes: Mild steel as per IS:1239 (Part-I) medium grade (upto 150 NB) & as per IS:3589 Gr.410 (above 200 NB) or Equivalent and galvanised as per IS:4736 for pipes normally empty and periodically charged with water and foam system application.

Flanges: All the flanges and counter flanges shall conform to ANSI B 16.5 CI 150.

Fittings: The material shall conform to ASTM A 234 Gr WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings). Fabricated fittings shall not acceptable up to pipe size to 300 NB. For sizes 350 NB and 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. for Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

6.8. Supply of Accessories and Services – Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

Following accessories shall be included in bidder scope:

- i. Base Plate
- ii. Priming connection with 3 way SS isolating valve
- iii. Vent with 3 way SS isolating valve
- iv. Pump-motor coupling and guard
- v. Drain connection with valve
- vi. Eyebolts, lifting tackle etc.
- vii. Canopy with legs for Motors

6.9. Provision For Vibration Probes- Applicable for Each Motor/Engine driven Hydrant Pump, Spray pump, Hydrant Booster Pump, Spray Booster Pump and Jockey pump

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

6.10. BEARING & WINDING INSTRUMENTS & JB

Not applicable

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6.11. First Fill of Lubricant & consumables

Excluded from bidder scope of supply. However, bidder to furnish detailed requirement of first fill of lubricants and consumables.

6.12. All Other Items Necessary for Safe And Smooth Running of Pump & Accessories Required to Make The Supplied Equipment Complete in All Respect.

6.13. Commissioning Spares

6.13.1. For Hydrant Pump and Spray Pump & Drives Assembly:

- i. 5 set (One set for each pump & motor assembly) of commissioning spares for Hydrant/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.
- ii. 2 set (One set for each pump & Diesel Engine assembly) of commissioning spares for Hydrant/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.

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

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

Commissioning spares required for HT Motors are excluded from bidder's scope of supply

6.13.2. For Hydrant Booster Pump & Drives Assembly:

- i. 1 set (One set for each pump & motor assembly) of commissioning spares for Hydrant 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.
- ii. 1 set (One set for each pump & Diesel Engine assembly) of commissioning spares for Hydrant 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.

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

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6.13.3. For Spray Booster Pump & Drives Assembly:

- i. 1 set (One set for each pump & motor assembly) of commissioning spares for Hydrant 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.
- ii. 1 set (One set for each pump & Diesel Engine assembly) of commissioning spares for Hydrant 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.

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

6.13.4. For Jockey Pump & Motor Assembly:

2 Set (One set for each pump & motor assembly) 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.

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

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

6.14. MANDATORY SPARES

6.14.1. FOR HYDRANT/SPRAY PUMP DRIVE ASSEMBLY

1) For Pump- Motor/Engine driven Hydrant Pump and Spray Pump

Sl. No.	Description	Quantity	Unit
i)	Impeller	2	Sets
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	2	Sets
iii)	Pump shaft	2	Sets
iv)	Wearing rings	4	Sets
v)	Shaft Sleeve	2	Sets
vi)	Bushings	4	Sets
vii)	Bearing housing (if provided)	2	Sets
viii)	Coupling bolts & nuts (with bushes)	2	Sets

Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.

2) For Engine – Engine driven Hydrant Pump and Spray pump

Sl. No.	Description	Quantity	Unit
i)	Piston rings & sealing rings	2	Sets
ii)	Exhaust valve assembly	2	Sets
iii)	Springs	2	Sets
iv)	Packings and gaskets	2	Sets
v)	Fuel oil filter elements with seals	4	Sets
vi)	Fuel oil filter assy	2	Sets
vii)	Lub. oil filter elements with seals	4	Sets
viii)	Scrapper rings	2	Sets
ix)	Solenoid coil for fuel valve	2	Nos.
x)	Corrosion inhibitor (if provided)	2	Sets
xi)	Big end & small end bearing of connecting rod	2	Sets
xii)	Speedometer	2	Nos.
xiii)	Speedometer wire	2	Nos.
xiv)	Rubber hoses of water line with mounting clamps	2	Sets
xv)	Cranking starter assembly complete	2	Sets
xvi)	Lub. oil and fuel oil hoses with end connectors	2	Sets
xvii)	Water pump belts	4	Sets

Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract.

3) For Control and instrumentation-Motor/Engine driven Hydrant and Spray Pump

I. Measuring Instruments:

Sl. No.	Description	Quantity
i)	All types of Local indicators	2 Nos. of each make, model and type
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure, flow, temperature, level switch devices).	2 Nos. of each type and model
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.

II. Cable

Sl. No.	Description	Quantity
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.

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ii)	Pre-fabricated cable connector	1 No. of each type and model.
iii)	Other cables (including core cable, short term fire proof cable, fiber optic cables, etc.)	5% of each type, pai/core and size of actual installed quantity.

6.14.2. FOR HYDRANT BOOSTER PUMP DRIVE ASSEMBLY

1) For Pump-Motor/Engine driven Hydrant booster pump

Sl. No.	Description	Quantity	Unit
i)	Impeller	1	Set
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	1	Set
iii)	Pump shaft	1	Set
iv)	Wearing rings	2	Sets
v)	Shaft Sleeve	1	Set
vi)	Bushings	2	Sets
vii)	Bearing housing (if provided)	1	Set
viii)	Coupling bolts & nuts (with bushes)	1	Set

Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.

2) For Engine- Engine driven Hydrant booster pump

Sl. No.	Description	Quantity	Unit
i)	Piston rings & sealing rings	1	Set
ii)	Exhaust valve assembly	1	Set
iii)	Springs	1	Set
iv)	Packings and gaskets	1	Set
v)	Fuel oil filter elements with seals	2	Sets
vi)	Fuel oil filter assy	1	Set
vii)	Lub. oil filter elements with seals	2	Sets
viii)	Scrapper rings	1	Set
ix)	Solenoid coil for fuel valve	1	No.
x)	Corrosion inhibitor (if provided)	1	Set
xi)	Big end & small end bearing of connecting rod	1	Set
xii)	Speedometer	1	No.
xiii)	Speedometer wire	1	No.
xiv)	Rubber hoses of water line with mounting clamps	1	Set
xv)	Cranking starter assembly complete	1	Set
xvi)	Lub. oil and fuel oil hoses with end connectors	1	Set
xvii)	Water pump belts	2	Sets

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Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract

3) For Control and instrumentation- Motor/Engine driven Hydrant booster pump

I. Measuring Instruments:

Sl. No.	Description	Quantity
i)	All types of Local indicators	2 Nos. of each make, model and type
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure, flow, temperature, level switch devices).	2 Nos. of each type and model
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.

II. Cable

Sl. No.	Description	Quantity
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.
ii)	Pre-fabricated cable connector	1 No. of each type and model.
iii)	Other cables (including core cable, short term fire proof cable, fiber optic cables, etc.)	5% of each type, pair/core and size of actual installed quantity.

6.14.3. FOR SPRAY BOOSTER PUMP DRIVE ASSEMBLY

1) For Pump-Motor/Engine driven Spray booster pump

Sl. No.	Description	Quantity	Unit
i)	Impeller	1	Set
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	1	Set
iii)	Pump shaft	1	Set
iv)	Wearing rings	2	Sets
v)	Shaft Sleeve	1	Set
vi)	Bushings	2	Sets
vii)	Bearing housing (if provided)	1	Set
viii)	Coupling bolts & nuts (with bushes)	1	Set

Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.

2) For Engine- Engine driven Spray booster pump

Sl. No.	Description	Quantity	Unit
i)	Piston rings & sealing rings	1	Set
ii)	Exhaust valve assembly	1	Set
iii)	Springs	1	Set
iv)	Packings and gaskets	1	Set
v)	Fuel oil filter elements with seals	2	Sets
vi)	Fuel oil filter assy	1	Set
vii)	Lub. oil filter elements with seals	2	Sets
viii)	Scraper rings	1	Set
ix)	Solenoid coil for fuel valve	1	No.
x)	Corrosion inhibitor (if provided)	1	Set
xi)	Big end & small end bearing of connecting rod	1	Set
xii)	Speedometer	1	No.
xiii)	Speedometer wire	1	No.
xiv)	Rubber hoses of water line with mounting clamps	1	Set
xv)	Cranking starter assembly complete	1	Set
xvi)	Lub. oil and fuel oil hoses with end connectors	1	Set
xvii)	Water pump belts	2	Sets

Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract

3) For Control and instrumentation- Motor/Engine driven Spray booster pump

I. Measuring Instruments:

Sl. No.	Description	Quantity
i)	All types of Local indicators	2 Nos. of each make, model and type
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure, flow, temperature, level switch devices).	2 Nos. of each type and model
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.

II. Cable

Sl. No.	Description	Quantity
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.
ii)	Pre-fabricated cable connector	1 No. of each type and model.

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iii)	Other cables (including core cable, short term fire proof cable, fiber optic cables, etc.)	5% of each type, pai/core and size of actual installed quantity.
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6.14.4. FOR JOCKEY PUMP DRIVE ASSEMBLY

1) For Pump -Jockey Pump

Sl. No.	Description	Quantity	Unit
i)	Impeller	1	Set
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	1	Set
iii)	Pump shaft	1	Set
iv)	Wearing rings	2	Sets
v)	Shaft Sleeve	1	Set
vi)	Bushings	2	Sets
vii)	Bearing housing (if provided)	1	Set
viii)	Coupling bolts & nuts (with bushes)	1	Set

Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.

2) For Control and instrumentation- Motor/Engine driven Spray booster pump

I. Measuring Instruments:

Sl. No.	Description	Quantity
i)	All types of Local indicators	2 Nos. of each make, model and type

Special notes for Mandatory spares:

- The word "set" means the quantity required for full replacement of that part in one machine.
- The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
- Wherever % age is identified, bidder shall supply next rounded figure.
- Part Description is the commonly used name of the part and may vary from manufacturer to manufacturer.
- Mandatory spares as indicated above do not cover commissioning spares.
- Mandatory spares as indicated above do not cover two year O&M spares.
- All Mandatory spares should be supplied separately with green color painted box.
- Loose items sent by Vendor to sites shall be quantified/numbered/tagged and not merely mentioned as ONE lot of loose items.
- A packing list covering items having shelf life are to be intimated to site. In addition, shelf life items shall be packed separately in black color painted box for easy identification at site.

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- x. Spare rotors shall be boxed in a metal containers for vertical storage with nitrogen purging. Storage container shall be property of the owner.

6.15. 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.

6.16. Special Tools And Tackles

6.16.1. For Hydrant and Spray pump with drives:

The bidder shall furnish a complete 7 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 and Spray 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.

Special Tools and tackles required for HT Motors (for Hydrant/Spray Pump) are excluded From bidder scope of supply.

6.16.2. For Hydrant 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 Booster 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.

6.16.3. For Spray 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 Booster 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.

6.16.4. For Jockey pump with drives:

The bidder shall furnish a complete Two (2) 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.

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6.16.5. Supervision of Erection & Commissioning:

Supervision of erection, commissioning of the supplied system shall be included in bidder's scope of service.

Bidder to note that the supervision charges for erection & commissioning shall consists of the following:

- Per day supervision charges of an Engineer including all other expenses like boarding, lodging, local travel, insurance etc.
- Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from to vendor works to site.

Per diem charges shall be applicable from the day bidder's representative reports to site, up to the day certified by BHEL's site.

For the purpose of tender following to be considered: [for details pl. refer price bid format].

1) For Hydrant and Spray Pump Drive assembly:

Per Diem charges for 1 service engineer for 1 visit

Note: Above charge includes Per day supervision charges of an Engineer and all other expenses like boarding, lodging, local travel, insurance, Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from to vendor works to site.

2) For Hydrant Booster Pump Drive assembly:

Per Diem charges for 1 service engineer for 1 visit

Note: Above charge includes Per day supervision charges of an Engineer and all other expenses like boarding, lodging, local travel, insurance, Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from to vendor works to site.

3) For Spray Booster Pump Drive assembly:

Per Diem charges for 1 service engineer for 1 visit

Note: Above charge includes Per day supervision charges of an Engineer and all other expenses like boarding, lodging, local travel, insurance, Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from to vendor works to site.

4) For Jockey Pump Drive assembly:

Per Diem charges for 1 service engineer for 1 visit

Note: Above charge includes Per day supervision charges of an Engineer and all other expenses like boarding, lodging, local travel, insurance, Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from to vendor works to site.

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Notes:

- i. However, either or both of the number of man days or number of visits may change on either side based on the actual site requirement.
- ii. All payments towards supervision of E&C shall be made only after BHEL-site certification.
- iii. Bidder to mobilize concerned competent person for supervision of Erection & commissioning activities within a period of 7 days of receipt of intimation in this regard by BHEL.
- iv. Bidder to quote supervision of erection and commissioning activities strictly as per BHEL's price format.

6.16.6. 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:

7.1. 2 year recommended spares:

Bidder to furnish optional prices for 2 year recommended spares as per equipment manufacturer's recommendations. [The Bidder shall quote separately with optional price for the recommended list of spare parts for operation, with recommended quantities for the equipment covered under this specification. Bidder shall furnish such a list along with offer. The list of spares shall be as per Bidder's experience].

7.2. Engine Revalidation spares:

Revalidation spares are those spares, which are required at the time of commissioning of Engine, in case the scheduled commissioning of engine is delayed beyond the permissible duration as recommended OEM.

Bidder to quote revalidation spares required for Engine as per OEM practice under optional prices as indicated in price bid format, sl no II-A.

Bidder shall furnish list of revalidation spares along with their offer.

8. EQUIPMENT QUALIFICATION CRITERIA (EQC)

8.1. For Hydrant/Spray Pump

Bidder to submit the Equipment Qualification Criteria for centrifugal Horizontal type of Hydrant/Spray 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

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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 four (4) 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 (10) and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on the bid due date.. 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.

8.2. For Hydrant Booster Pump

Bidder to submit the Equipment Qualification Criteria for centrifugal Horizontal type of Hydrant booster 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 four (4) 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 (10) and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on the bid due date.. 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.

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8.3. For Spray Booster Pump

Bidder to submit the Equipment Qualification Criteria for centrifugal Horizontal type of Hydrant booster 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 four (4) 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 (10) and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on the bid due date.. 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.

8.4. For Jockey Pump

Bidder to submit the Equipment Qualification Criteria for centrifugal Horizontal type of Jockey 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 four (4) 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 (10) and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on the bid due date.. Vendor to give documentary evidence for the same.

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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 guidelines & format: Refer **Annexure-7**.

9.2. Complete Unit Test, Performance test , Strip test, Vibration & Noise test for all the pump:

1) Complete Unit Test:

Complete unit test is in bidder scope of supply for all the pumps. All the offered pumps shall be tested and witnessed by BHEL/TPI/Customer. Testing on sample basis is not acceptable.

2) Performance Test:

a) Motor driven pump:

All the ordered pumps performance test shall be done with Job motor, Job coupling and Job Base plate. Testing with shop motor/lab motor is not acceptable.

It may be noted that, since HT motors for main Hydrant & Spray pumps are excluded from bidder scope of supply, motor shall be free issued to vendor from BHEL for pump testing at bidder works.

b) Engine driven pump:

All the ordered pumps performance test shall be done with Job engine, Job coupling, Job Gear Box and Job base plate. Power Vs Flow need not to be drawn considering the limitation of estimating the power absorbed.

3) Strip test:

It will be done only if any abnormality is observed during testing of the pump.

4) Vibration and Noise test:

During performance testing of pump vibration and noise, values shall be recorded on test bed for both pump and driver (Engine/Motor) at each point of performance test.

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For guidelines & format: Refer **Annexure-7**.

9.3. Inspection Agency

BHEL/Third Party appointed by BHEL/Customer.

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.

9.4. 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:

- i. Rated head at rated flow: Zero negative tolerance
- ii. Shut-off head: Zero negative tolerance. 5% Positive tolerance permitted.
- iii. Rated BkW: Zero positive tolerance. Positive tolerance permitted till motor rating meets end of the curve condition .
- iv. Permissible tolerance in efficiency at rated capacity (%) : No negative tolerance
- v. Range of operation : As per IS-6595 Part-2.

10. PAINTING

Painting for Pump, Motor, Engine and all other accessories shall be as per annexure -6.

Final shade for Pump, Motor and Engine shall be informed during detail engineering stage.

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. For details Pl. refer Annexure -15.

12. SUB VENDORS

HT Motors: BHEL-Bhopal [Free issue to vendor at vendor works]

Other items as per attached Annexure-9.

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.

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13. DOCUMENTATIONS

Please refer to enclosed Master Documentation List [MDL] for the list of DOCUMENTS / DRAWINGS to be submitted by the bidder as part of documentation. Bidder shall ensure submission of all documentation as per the MDL, Annexure: 10.

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.

DEFINITION OF VENDOR DOCUMENT REVIEW STATUS ASSIGNED BY BHEL

The guidelines listed below are followed in assigning the document status code to the vendor documents: Final submittal of vendor documents will not be required as long as the document status code is 1 or 4 and the "AS-BUILT" condition of the component agrees with the current document.

Permission to proceed does not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the vendor and does not relieve the vendor from full compliance with contractual obligations.

Code-1: Work may proceed

The document conforms to procurement document requirements. The document requires no changes or additions. Matters remaining to be resolved do not require document change and will be handled by correspondence. Where it is known that the design information on a vendor document is not complete and re-submittals will be required, e.g., due to "hold" areas, the document is assigned another status code.

Code-2: Revise and resubmit

Work may proceed subject to resolution of indicated comments. The document is in basic conformance with procurement document requirements. Minor deviations from procurement document requirements have been noted or other minor technical or physical changes in the equipment are required. The vendor shall resolve comments and resubmit documents prior to shipment of commodity.

Code-3: Rejected. Revise and resubmit

The document:

- Does not conform to the procurement requirements,
- Is of a design that is technically unacceptable without significant changes,
- Does not meet project requirements, i.e., orientation of equipment, nozzles, conduit connections, etc.,
- Does not conform to project criteria or with proposal documents or data, or
- Does not meet minimum submittal requirements.

This submittal rejection does not relieve vendor of any schedule commitments.

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Code-4: Review not required

The document is not subject to BHEL review. Typical uses for this status are in the review of items that are vendor standard products, small internal parts of major equipment, or vendor standardized data.

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.

NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED:

All the documents shall be submitted as given below:

SL NO.	DESCRIPTION	NO. OF COPIES / PIECES TO BE SUBMITTED	WHEN TO SUBMIT
1)	Initial drawings/documents under approval and information	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

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Referring to sl. no 2 as mentioned above, please note that BHEL shall furnish code-1 or 2, if the drawing submitted by the vendor meeting specification requirement.

3)	*Revised drawings/documents along with compliance sheet incorporating all BHEL comments. <i>*Vendor to incorporate all BHEL comments so that further revisions can be minimized.</i>	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	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 erection to be furnished in 5 no's of folders
7)	Draft O & M Manuals for BHEL review. <i>Note: Bidder to furnish final hard copy of O&M only after getting concurrence on soft copy.</i>	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 (Hyderabad)	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 BHEL concurrence on soft copy.

Notes:

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

- 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.
- Brief description of the system.
- All approved documents [Drawings, documents & test procedures as per MDL]

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- d) Bill of material, BBU, LO schedule, sub vendor list, Mandatory & commissioning spares list etc.
- e) Operation, Instruction & maintenance manuals of all equipments / items for the complete package
- f) System unloading, storage erection, start up, commissioning, shut down requirements.
- g) Operational & environmental safety instructions.
- h) Test reports and certificates.
- i) 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

- 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.
- 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 & deviation shall be clear bring as per annexure- 11 and 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 FOR PY51590:**

<u>Variant</u>	<u>Item</u>	<u>Material Code</u>
01	MD HYD & SPR PUMP ASSY	PY9751590019
02	ED HYD & SPR PUMP ASSY	PY9751590027
03	MAND SPARES-MD & ED HYD & SPR PUMP	PY9751590035
04	Supervision Charges for E& C	PY9851590045
05	MD HYD BOOSTER PUMP ASSY	PY9751590019
06	ED HYD BOOSTER PUMP ASSY	PY9751590027
07	MAND SPARES-HYD BOOSTER PUMP ASSY	PY9751590035
08	Supervision Charges for E& C	PY9851590045
09	MD SPR BOOSTER PUMP ASSY	PY9751590094
10	ED SPR BOOSTER PUMP ASSY	PY9751590108
11	MAND SPARES-SPR BOOSTER PUMP ASSY	PY9751590116

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12	Supervision Charges for E& C	PY9851590126
13	JOCKEY PUMP ASSY	PY9751590132
14	MAND SPARES-JOCKEY PUMP ASSY	PY9751590140
15	Supervision Charges for E& C	PY9851590150

**RECORD OF REVISIONS**

Rev. No.	Date	Revision Details	Revised By	Approved By
00	20.08.19	First Issue	-----	M.Siva Prasad Babu



ANNEXURE – 01

(P&ID for Pump and drive assembly and Piping specification details)

- 1A) P&ID for Hydrant/Spray and Jockey Pump
- 1B) P&ID for Hydrant/Spray Booster Pump
- 1C) Piping Specification details

SCOPE OF SUPPLY FOR HYDRANT/SPRAY PUMP.

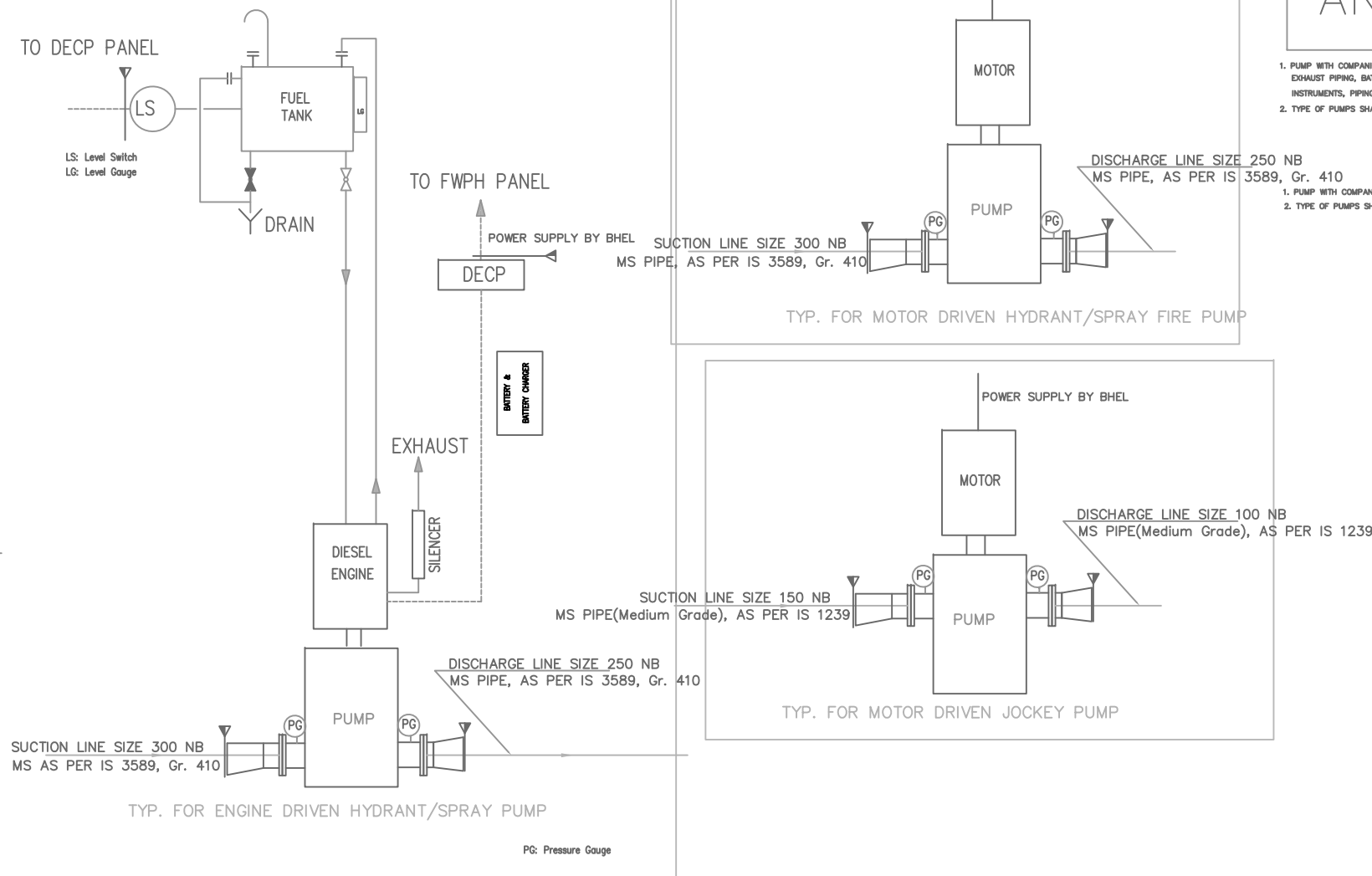
1. PUMP WITH COMPANION FLANGES, REDUCER/EXPANDERS, COUPLING, PG, DIESEL ENGINE, EXHAUST PIPING, BATTERY AND BATTERY CHARGER, DIESEL ENGINE CONTROL PANEL, FUEL TANK WITH INSTRUMENTS, PIPING FROM FUEL TANK TO ENGINE ETC. AS PER SPECIFICATION
2. TYPE OF PUMPS SHALL BE HORIZONTAL CENTRIFUGAL TYPE.

SCOPE OF SUPPLY FOR JOCKEY PUMP.

1. PUMP WITH COMPANION FLANGES, REDUCER/EXPANDERS , COUPLING, MOTOR, PG
2. TYPE OF PUMPS SHALL BE HORIZONTAL CENTRIFUGAL TYPE.

SCOPE OF SUPPLY FOR JOCKEY PUMP.

1. PUMP WITH COMPANION FLANGES, REDUCER/EXPANDERS , COUPLING, MOTOR, PG
2. TYPE OF PUMPS SHALL BE HORIZONTAL CENTRIFUGAL TYPE.

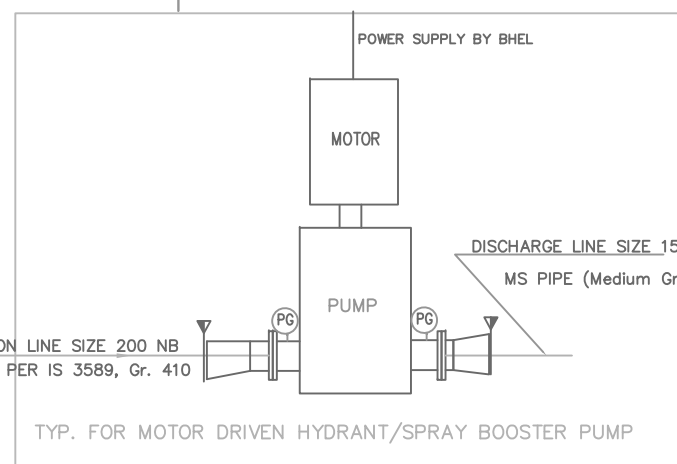


PESD INT SCOPE DEMARCATION

CUSTOMER: M/S NTPC LIMITED

PROJECT: PATRATU SUPER THERMAL POWER PROJECT
EXPANSION, PHASE-I(3X800 MW)

		BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME DRN. RATISH CHD. GIRISH APPT. MSPB		SIGN. —SD— —SD— —SD—		DATE 21.08.19 21.08.19 21.08.19		NO. OF V.A. N.A.	
DEPT. PE&SD CODE 450		UNTOL. DIMS. GR. 9/11/1		 SCALE N.T.S.		WEIGHT (KG) N.A.		REF. TO ASSY. DRG. N.A.		ITEM NO. N.A.	
TITLE SCHEME FOR HYDRANT/ SPRAY AND JOCKEY PUMPS				CARD CODE NA		DRG. NO. PESP/PATRATU/001 CUST. DRG. NO.				REV. 00	
				SHT. No 01		NO. OF SHT. 01					



SCOPE OF SUPPLY FOR HYDRANT/SPRAY BOOSTER PUMP.

1. PUMP WITH COMPANION FLANGES, REDUCER/EXPANDERS , COUPLING, PG, MOTOR, DIESEL ENGINE, EXHAUST PIPING, BATTERY AND BATTERY CHARGER, DIESEL ENGINE CONTROL PANEL, FUEL TANK WITH INSTRUMENTS, PIPING FROM FUEL TANK TO ENGINE ETC.
2. TYPE OF PUMPS SHALL BE HORIZONTAL CENTRIFUGAL TYPE.

CUSTOMER: M/s NTPC LIMITED

E	 BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		NAME	SIGN.	DATE	NO.OF VAR.
		DRN.	RATISH	—SD—	21.08.18	
		CHD.	GIRISH	—SD—	21.08.18	N.A.
		APPD.	MSPB	—SD—	21.08.18	

DEPT. PE&SD CODE 450	UNTL. DIMS. GR. 9/11/1		SCALE N.T.S	WEIGHT (KG) N.A.	REF. TO ASSY. DRG. N.A.	ITEM NO. N.A.	NO. OF ITEMS N.A.
TITLE SCHEME FOR HYDRANT/ SPRAY BOOSTER PUMPS				CARD CODE NA	DRG. NO. PESD/PATRATU/002		REV. 00
				CIR. DRG. NO.		NO. OF SHT. 01	
				SHT. No 01		NO. OF SHT. 01	

[illegible]



ANNEXURE – 02

(Datasheet for Pump, Motor and Engine)

2A) Pump Motor Engine Datasheet for Hydrant and Spray Pump

2B) Pump Motor Engine Datasheet for Hydrant Booster Pump

2C) Pump Motor Engine Datasheet for Spray Booster Pump

2D) Pump Motor Datasheet for Jockey Pump

ANNEXURE-2A : DATA SHEET FOR HYDRANT/SPRAY PUMP -MOTOR-DIESEL ENGINE			
Sl.no.	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	Hydrant Pump : For supplying water to the Hydrant header/spray water system 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	4 No. of Hydmat pump [3 motor driven +1 Diesel Engine driven] 3 No. of Spray pump [2 motor driven +1 Diesel Engine driven] Total : 7 Nos. [5 Nos. Motor driven+ 2 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/ IS 6595/ 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 a head of not less than 65 % of the rated head.		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be interchangeable 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 mlc	1.0 kg/cm2 (a)	
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 upto 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 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	Bidder To Furnish	
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	
35	Material of Construction: Casing : IS:210 Gr. FG 260 (2.5% Ni), Impeller : Bronze IS:318 Gr.II Shaft: SS316 Coupling: SS316 Base plate : Carbon steel as per IS-2062 Fasteners: stainless steel Companion Flange : MS All hardware underground: SS316 **Bidder to confirm that the casing material mentioned above shall cater to the max. discharge pressure(i.e Pressure at shut off condition) including all tolerance.If Not, bidder to consider superior material of casing.		

Sl.no.	Description	BHEL Requirement	DETAILS
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
37	Flushing Plan	Bidder To Furnish	
38	Cooling Plan	Bidder To Furnish	
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media [for pump/motor/engine] by tapping of the water from the pump discharge (before the pump discharge valve), the capacity of the pump shall be increased, so that the net capacity meets the specification requirement.. All piping, valves, strainer, instruments etc. required for this purpose shall be provided by the vendor.		
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 or cartridge length of the mechanical seal, whichever is higher 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: 100% ordered pump shall be tested and witnessed by BHEL/TPI/Customer. 1) Motor driven pump: All Ordered pumps performance test shall be done with Job motor, Job coupling and Job Base plate. It may be noted that, since HT motors for main Hydrant & Spray pumps are excluded from bidder scope of supply, motor shall be free issued to vendor from BHEL for pump testing at bidder works. 2) Engine driven pump: All ordered pumps performance test shall be done with Job engine, Job coupling, Job Gear Box and Job base plate. Power Vs Flow need not to be drawn considering the limitation of estimating the power absorbed. 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.	
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	Pressure Gauge at suction and Discharge	
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	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	

Sl.no.	Description	BHEL Requirement	DETAILS
62	BKW at the rated point	Bidder To Indicate	
63	BKW at end of curve	Bidder To Indicate	
64	Selected drive rating in kW: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.	Bidder to mention motor kW rating for the motor duly taking care of requirements.	
65	Design Standard of Motor	IS 325	
66	Manufacturer	BHEL - BHOPAL	
67	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with ambient temperature of 50 Deg C.	
68	Area classification for motor	Safe Area	
69	Rated Voltage & Frequency	3.3 KV & 50 Hz	
70	Permissible variations in Voltage/Frequency/Combined	Voltage: (+/-)6% Frequency: +3% & -5% Combined: 10% combined variation of voltage and frequency	
71	Quantity and Scope of supply	5 Nos of HT Motors (for 3 Nos Hydrant pump & 2 No. Spray pump) are excluded from bidder scope supply. However, bidder shall consider canopy with legs and other fixing accessories. Also suitable common base frame for pump and motor assembly shall be provided by bidder for mounting the HT motor at site.	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS			
72	Drive	Diesel Engine	
73	Type	The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).	
74	Location	Indoor	
75	BKW at the rated point	As per TAC / Factory Mutual	
76	BKW at end of curve		
77	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 as mentioned in NFPA [latest revision, 2010] which is as mentioned below: a) 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m). b) 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.	Bidder to mention engine HP rating for the motor duly taking care of the requirements.	
78	Drive Standard	IS -10000, BS- 5514, ISO-3046, ISO-8528 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.	
79	Name of Manufacturer	Bidder to furnish.	
80	Model No	Bidder to furnish.	
81	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
82	Speed	1500 rpm	
83	Type of cooling	Bidder to Furnish	
84	Noise	105 DBA at 1 m distance, in any direction	
85	Vibration	As per IS standard	

ANNEXURE-2B : DATA SHEET FOR HYDRANT BOOSTER PUMP-MOTOR-DIESEL ENGINE			
Sl.no.	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	For circulating water from outlet of main Fire water Pump to Fire Protection Syatem Elevated Structures (Such as Boiler, Towers etc.)	
2	Number of Pumps	2 Nos. for Hydrant Booster Pump[1W+1S][1 No. Motor + 1 No. Diesel Engine driven]	
3	Location	Pump House,Indoor/Outdoor	
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/ IS 6595/ 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 head of not less than 65 % of the rated head.		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be interchangeable 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	15.8 kg/cm2 (a) [max]*	
*Indicative value, However Available pressure at center line of suction nozzle = (Shut off head + 5% Positive tolerance on shut off head) + Pump suction pressure			
22	NPSH(A) at pump suction nozzle (mlc)	80 m to 120.0	
23	NPSH(R) (mlc)	Bidder to furnish.	
24	NPSH(A) - NPSH(R)	1 m at rated condition & NPSHR shall be less than NPSHA upto 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 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	Bidder To Furnish	
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	
35	Material of Construction: Casing : IS:210 Gr. FG 260 (2.5% Ni), Impeller : Bronze IS:318 Gr.II Shaft: SS316 Coupling: SS316 Base plate : Carbon steel as per IS-2062 Fasteners: stainless steel Companion Flange : MS All hardware underground: SS316 **Bidder to confirm that the casing material mentioned above shall cater to the max. discharge pressure(i.e Pressure at shut off condition) including all tolerance.If Not, bidder to consider superior material of casing.		

Sl.no.	Description	BHEL Requirement	DETAILS
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
37	Flushing Plan	Bidder To Furnish	
38	Cooling Plan	Bidder To Furnish	
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media [for pump/motor/engine] by tapping of the water from the pump discharge (before the pump discharge valve), the capacity of the pump shall be increased, so that the net capacity meets the specification requirement.. All piping, valves, strainer, instruments etc. required for this purpose shall be provided by the vendor.		
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 or cartridge length of the mechanical seal, whichever is higher 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: 100% pump shall be tested and witnessed by BHEL/TPI/Customer. 1) Motor driven pump: All ordered pumps performance test shall be done with Job motor, Job coupling and Job Base plate. 2) Engine driven pump: All ordered pumps performance test shall be done with Job engine, Job coupling, Job Gear Box and Job base plate. Power V Flow need not to be drawn considering the limitation of estimating the power absorbed. 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.	
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	Pressure Gauge at suction and Discharge	
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	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	Bidder To Indicate	
63	BKW at end of curve	Bidder To Indicate	

Sl.no.	Description	BHEL Requirement	DETAILS
64	Selected drive rating in kW: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.	Bidder to mention motor kW rating for the motor duly taking care of requirements.	
65	Design Standard of Motor	IS 325	
66	Manufacturer	As per attached subvendor 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	Voltage: (+/-)6% Frequency: +3% & -5% Combined: 10% combined variation of voltage and frequency	
71	No of poles / synchronous speed	4/1500 rpm	
72	Energy efficient class	IE3	
73	Starting Current as % of FLC	Starting current shall be as per IS 12615.	
74	Method of Starting	AC squirrel cage industrial motors shall be fed at 415V, 3 phase, 50 Hz, with DOL start as applicable.	
75	Method of cooling	Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type	
76	Winding and Insulation	Thermal Class (B) or better	
77	Temp. rise	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor. The winding insulation process shall be total vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC- 60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.	
78	Space Heater	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.	
79	Degree of protection/Canopy Required	IP 55/Yes	
80	TB Short time-Current & Short time-Time	40 kA , 0.25 Sec	
81	Cable, Cable glands & Lugs	Suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
82	No. of Starts	Two hot starts in succession, with motor initially at normal running temperature.	
83	Bearing RTDs, Winding RTDs & TGs	Not Applicable	
84	Noise	85 DBA at 1 m distance from motor body, in any direction	
85	Vibration	As per IS 12075	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS			
86	Drive	Diesel Engine	
87	Type	The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).	
88	Location	Indoor	
89	BKW at the rated point	As per TAC / Factory Mutual	
90	BKW at end of curve		

Sl.no.	Description	BHEL Requirement	DETAILS
91	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 as mentioned in NFPA [latest revision, 2010] which is as mentioned below: a) 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m). b) 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.	Bidder to mention engine HP rating for the motor duly taking care of the requirements.	
92	Drive Standard	IS -10000, BS- 5514, ISO-3046, ISO-8528 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.	
93	Name of Manufacturer	Bidder to furnish.	
94	Model No	Bidder to furnish.	
95	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
96	Speed	1500 rpm	
97	Type of cooling	Bidder to Furnish	
98	Noise	105 DBA at 1 m distance, in any direction	
99	Vibration	As per IS standard	

ANNEXURE-2C : DATA SHEET FOR SPRAY BOOSTER PUMP-MOTOR-DIESEL ENGINE			
Sl.no.	Description	BHEL Requirement	DETAILS
GENERAL DATA			
1	Service	For circulating water from outlet of main Fire water Pump to Fire Protection Syatem Elevated Structures (Such as Boiler, Towers etc.)	
2	Number of Pumps	2 Nos. for Spray Booster Pump[1W+1S][1 No. Motor + 1 No. Diesel Engine driven]	
3	Location	Pump House,Indoor/Outdoor	
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/ IS 6595/ 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)	45	
12	Inline with TAC requirement,Pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head.		
13	Temperature of pumping fluid	Ambient	
14	Pump Model No.	Pump model shall be interchangeable 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	15.8 kg/cm ² (a) [max]*	
*Indicative value, However Available pressure at center line of suction nozzle = (Shut off head + 5% Positive tolerance on shut off head) + Pump suction pressure			
22	NPSH(A) at pump suction nozzle (mlc)	80 m to 120.0	
23	NPSH(R) (mlc)	Bidder to furnish.	
24	NPSH(A) - NPSH(R)	1 m at rated condition & NPSHR shall be less than NPSHA upto 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 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	Bidder To Furnish	
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	
35	Material of Construction: Casing : IS:210 Gr. FG 260 (2.5% Ni), Impeller : Bronze IS:318 Gr.II Shaft: SS316 Coupling: SS316 Base plate : Carbon steel as per IS-2062 Fasteners: stainless steel Companion Flange : MS All hardware underground: SS316 ***Bidder to confirm that the casing material mentioned above shall cater to the max. discharge pressure(i.e Pressure at shut off condition) including all tolerance.If Not, bidder to consider superior material of casing.		

Sl.no.	Description	BHEL Requirement	DETAILS
36	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
37	Flushing Plan	Bidder To Furnish	
38	Cooling Plan	Bidder To Furnish	
39	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media [for pump/motor/engine] by tapping of the water from the pump discharge (before the pump discharge valve), the capacity of the pump shall be increased, so that the net capacity meets the specification requirement.. All piping, valves, strainer, instruments etc. required for this purpose shall be provided by the vendor.		
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 or cartridge length of the mechanical seal, whichever is higher 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: 100% pump shall be tested and witnessed by BHEL/TPI/Customer. 1) Motor driven pump: All ordered pumps performance test shall be done with Job motor, Job coupling and Job Base plate. 2) Engine driven pump: All ordered pumps performance test shall be done with Job engine, Job coupling, Job Gear Box and Job base plate. Power Vs Flow need not to be drawn considering the limitation of estimating the power absorbed. 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.	
55	Noise level for Pump	85 DBA at 1 m distance, in any direction	
56	Vibration for Pump	As ISO 10816	
57	Pump Instruments	Pressure Gauge at suction and Discharge	
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	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	Bidder To Indicate	

Sl.no.	Description	BHEL Requirement	DETAILS
63	BKW at end of curve	Bidder To Indicate	
64	Selected drive rating in kW: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.	Bidder to mention motor kW rating for the motor duly taking care of requirements.	
65	Design Standard of Motor	IS 325	
66	Manufacturer	As per attached subvendor 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	Voltage: (+/-)6% Frequency: +3% & -5% Combined: 10% combined variation of voltage and frequency	
71	No of poles / synchronous speed	4/1500 rpm	
72	Energy efficient class	IE3	
73	Starting Current as % of FLC	Starting current shall be as per IS 12615.	
74	Method of Starting	AC squirrel cage industrial motors shall be fed at 415V, 3 phase, 50 Hz, with DOL start as applicable.	
75	Method of cooling	Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type	
76	Winding and Insulation	Thermal Class (B) or better	
77	Temp. rise	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor. The winding insulation process shall be total vacuum Pressure Impregnated i.e. resin pour method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.	
78	Space Heater	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.	
79	Degree of protection/Canopy Required	IP 55/Yes	
80	TB Short time-Current & Short time-Time	40 kA , 0.25 Sec	
81	Cable, Cable glands & Lugs	Suitable double compression Nickel plated brass cable glands and Tinned copper lugs to be provided by the bidder.	
82	No. of Starts	Two hot starts in succession, with motor initially at normal running temperature.	
83	Bearing RTDs, Winding RTDs & TGs	Not Applicable	
84	Noise	85 DBA at 1 m distance from motor body, in any direction	
85	Vibration	As per IS 12075	
DIESEL ENGINE DETAILS FOR ENGINE DRIVEN PUMPS			
86	Drive	Diesel Engine	
87	Type	The engine shall be naturally aspirated, super charged or turbo-charged as recommended by the manufacturer. (Ref. Fire Protection Manual by TAC).	
88	Location	Indoor	
89	BKW at the rated point	As per TAC / Factory Mutual	
90	BKW at end of curve		

Sl.no.	Description	BHEL Requirement	DETAILS
91	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 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 as mentioned in NFPA [latest revision, 2010] which is as mentioned below: a) 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m). b) 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.	Bidder to mention engine HP rating for the motor duly taking care of the requirements.	
92	Drive Standard	IS -10000, BS- 5514, ISO-3046, ISO-8528 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.	
93	Name of Manufacturer	Bidder to furnish.	
94	Model No	Bidder to furnish.	
95	Duty	Intermittent. However, same shall be capable of operating continuously on full load at the site elevation for a period of six hours.	
96	Speed	1500 rpm	
97	Type of cooling	Bidder to Furnish	
98	Noise	105 DBA at 1 m distance, in any direction	
99	Vibration	As per IS standard	

ANNEXURE-2D : DATA SHEET FOR JOCKEY PUMP and DRIVE (MOTOR)			
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/ IS 6595/ Equivalent standard The pumps shall comply with the regulations of Tariff Advisory Committee (TAC).	
10	Rated Flow (m ³ /hr)	75	
11	Rated Differential Head (mlc)	125	
12	Inline with TAC requirement,Pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head.		
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)	Upto 3000	
18	Rated speed of Motor (rpm)	Upto 3000	
19	Pump Efficiency in %	Bidder To Furnish	
20	Available Pressure at centre line of Suction nozzle of Pump mlc	1.0 kg/cm ² (a)	
21	NPSH(A) at pump suction nozzle (mlc)	10.0 m	
22	NPSH(R) (mlc)	Bidder to furnish.	
23	NPSH(A) - NPSH(R)	1 m at rated condition & NPSHR shall be less than NPSHA upto end of the curve condition.	
24	Pump shut off head.	Flow vs Head curve shall be continuously rising towards shut-off head.	
25	Pump shut off head/rated head.	Shall not be exceed 120% of rated head as per TAC.	
26	BEP of the offered pump, m3/Hr	Bidder To Furnish	
27	Thermal minimum flow , m3/Hr	Bidder To Furnish	
28	Stable minimum flow, m3/Hr	Bidder To Furnish	
29	Pump End of the curve flow, m3/hr	Bidder To Furnish	
30	Impeller type	Bidder To Furnish	
31	Pump rated impeller dia, mm	Bidder To Furnish	
32	Pump max. impeller dia, mm	Bidder To Furnish	
33	Pump minimum impeller dia., mm	Bidder To Furnish	
34	Material of Construction: Casing : IS:210 Gr. FG 260 (2.5% Ni), Impeller : Bronze IS:318 Gr.II Shaft: SS316 Coupling: SS316 Base plate : Carbon steel as per IS-2062 Fasteners: stainless steel Companion Flange : MS All hardware underground: SS316 **Bidder to confirm that the casing material mentioned above shall cater to the max. discharge pressure(i.e Pressure at shut off condition) including all tolerance.If Not, bidder to consider superior material of casing.		

Sl.no.	Description	BHEL Requirement	DETAILS
35	Sealing arrangement	Cartridge type Mechanical seal as per Manufacturer's Standard Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
36	Flushing Plan	Bidder To Furnish	
37	Cooling Plan	Bidder To Furnish	
38	Vendor shall clearly indicate the type of cooling system adopted. In case water is used as a cooling media [for pump/motor] by tapping of the water from the pump discharge (before the pump discharge valve), the capacity of the pump shall be increased, so that the net capacity meets the specification requirement.. All piping, valves, strainer, instruments etc. required for this purpose shall be provided by the vendor.		
39	Type of axial thrust balancing arrangement	Vendor shall clearly indicate the type of cooling system adopted. In case	
40	Type of main bearings for pump	Bidder To Furnish	
41	Main bearings lubrication	Bidder To Furnish	
42	Type of thrust bearings for pump	Bidder To Furnish	
43	Thrust bearing lubrication	Bidder To Furnish	
44	Direction of rotation of Pump	Bidder To Furnish	
45	Direction of rotation of Motor	Bidder To Furnish	
46	Direction of rotation of Engine	Bidder To Furnish	
COUPLING			
47	Coupling standard	Manufacturer Standard	
48	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 or cartridge length of the mechanical seal, whichever is higher shall permit removal of the coupling, bearings, seal and rotor, as applicable, without disturbing the driver or the suction and discharge piping.]	
49	Non sparking type couplign guard	Yes	
50	Service factor for the coupling	1.5	
PERFORMANCE TEST STANDARD FOR PUMPS			
51	Performance Test: 100% pump shall be tested and witnessed by BHEL/TPI/Customer. 1) Motor driven pump: All ordered pumps performance test shall be done with Job motor, Job coupling and Job Base plate. 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		
52	Maximum Allowed Working Pressure (MAWP) in Kg/cm ² g	Bidder To Indicate	
53	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.	
54	**Bidder to confirm that the casing material mentioned in sl no 34 shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in sl no 53..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	Pressure Gauge at suction and Discharge	
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	

Sl.no.	Description	BHEL Requirement	DETAILS
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	Bidder To Indicate	
63	BKW at end of curve	Bidder To Indicate	
64	Selected drive rating in kW: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.	Bidder to mention motor kW rating for the motor duly taking care of requirements.	
65	Design Standard of Motor	IS 325	
66	Manufacturer	As per attached subvendor 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	Voltage: (+/-)6% Frequency: +3% & -5% Combined: 10% combined variation of voltage and frequency	
71	No of poles / synchronous speed	Bidder to furnish	
72	Energy efficient class	IE3	
73	Starting Current as % of FLC	Starting current shall be as per IS 12615.	
74	Method of Starting	AC squirrel cage industrial motors shall be fed at 415V, 3 phase, 50 Hz, with DOL start as applicable.	
75	Method of cooling	Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type	
76	Winding Insulation	Thermal Class (B) or better	
77	Temp. rise	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor. The winding insulation process shall be total vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.	
78	Space Heater	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.	
79	Degree of protection/Canopy Required	IP 55/Yes	
80	TB Short time-Current & Short time-Time	40 kA , 0.25 Sec	
81	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.	
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	
83	Bearing RTDs, Winding RTDs & TGs	Not Applicable	
84	Noise	85 DBA at 1 m distance from motor body, in any direction	
85	Vibration	As per IS 4729	



ANNEXURE – 03

(Motor Specification)

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	MOTORS			
1.00.00	GENERAL REQUIREMENTS			
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.			
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.			
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.			
1.04.00	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.			
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.			
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.			
1.07.00	Degree of Protection Degree of protection for various enclosures as per IEC60034-05 shall be as follows:- i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 iii) Cable box-indoor area - IP 54 iv) Cable box-Outdoor area - IP 55			
2.00.00	CODES AND STANDARDS			
	1) Three phase induction motors : IS/IEC:60034 2) Single phase AC motors : IS/IEC:60034 3) Crane duty motors : IS:3177, IS/IEC:60034 4) DC motors/generators : IS/IEC:60034 5) Energy Efficient motors : IS 12615, IEC: 60034-30			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 1 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.			
6.00.00	OPERATIONAL REQUIREMENTS			
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 3 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB 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 : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)
7.03.00	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) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2
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CLAUSE NO.	TECHNICAL REQUIREMENTS				
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.				
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.				
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.				
7.08.00	Motor body shall have two earthing points on opposite sides.				
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.				
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. 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.				
7.11.00	The spacing between gland plate & center of terminal stud shall be as per Table-I.				
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.				
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.				
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.				
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.				
<table><tr><td>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2</td><td>SUB-SECTION-B-07 MOTORS</td><td>PAGE 5 OF 10</td></tr></table>		EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 5 OF 10
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 5 OF 10		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.			
	(a) Below 110KW	:	11.0	
	(b) From 110 KW & upto 200 KW	:	9.0	
	(c) Above 200 KW & upto 1000KW	:	10.0	
	(d) From 1001KW & upto 4000KW	:	9.0	
	(e) Above 4000KW	:	6 to 6.5	
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.			
10.00.00	TYPE TEST			
10.01.00	HT MOTORS			
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.			
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.			
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.			
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2		SUB-SECTION-B-07 MOTORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.05	the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval. LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test (subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.			
10.01.06	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 7 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.02.00	LT Motors			
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.			
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip. 5. Temperature rise test. 6. Momentary excess torque test. 7. High voltage test. 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Over speed test.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2	SUB-SECTION-B-07 MOTORS	PAGE 8 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS																				
12.	Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1																				
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.																				
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.																				
TABLE - I DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS <table><thead><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr><tr><th>UP to 3 KW</th><th>As per manufacturer's practice.</th></tr></thead><tbody><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>203</td></tr></tbody></table> For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm. PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE: NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:		Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203
Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm																				
UP to 3 KW	As per manufacturer's practice.																				
Above 3 KW - upto 7 KW	85																				
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Above 13 KW - upto 24 KW	167																				
Above 24 KW - upto 37 KW	196																				
Above 37 KW - upto 55 KW	249																				
Above 55 KW - upto 90 KW	277																				
Above 90 KW - upto 125 KW	331																				
Above 125 KW-upto 200 KW	203																				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO. : CS-9585-001-2																				
SUB-SECTION-B-07 MOTORS																					
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Motor MCR in KW	Clearance		
	UP to 110 KW	10mm		
	Above 110 KW and upto 150 KW	12.5mm		
	Above 150 KW	19mm		



ANNEXURE – 04

(Price Bid format)

- 4A) Price Bid format for Hydrant/Spray Pump with Drives
- 4B) Price Bid format for Hydrant Booster Pump with Drives
- 4C) Price Bid format for Spray Booster Pump with Drives
- 4D) Price Bid format for Jockey pump with Drives

Annexure-4A

 	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032					
	PROJECT ENGINEERING & SYSTEMS DIVISION					
	PRICE FORMAT (R00) FOR HYDRANT AND SPRAY PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)					
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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 AND SPRAY PUMP WITHOUT MOTOR ALONG WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES[Material Code: PY9751590019]			40.44		
A.1	Hydrant Pump and Spray Pump without motor along with all accessories as per specification including commissioning spare and special tool and tackles. Note: i)Hydrant Pump and Spray Pump along with all accessories as per specification. Hydrant pump and Spray Pump drive (HT Motors) are excluded from bidder scope of supply. These motors shall be free issued to vendor and directly supplied to vendor works by BHEL. However, bidder shall consider canopy with legs and other fixing accessories. Also suitable common base frame for pump and motor assembly shall be provided by bidder for mounting the HT motor. ii) Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump. 1 set stands for requirement for one no. of pump/drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7) Commissioning Spares for HT Motors are excluded from Bidder Scope of Supply. iii) Special tools & tackles for Hydrant pump and Spray Pump 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. Special Tools and Tackles for HT Motors are excluded from Bidder Scope of Supply.	5	Sets			
B	MATERIAL SUPPLY: HYDRANT AND SPRAY PUMP WITH DIESEL ENGINE ALONG WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: PY9751590027]			47.06		
B.1	Hydrant and spray pump along with Diesel Engine Complete with all accessories as per specification including Commissioning Spares and Special tool tackles. Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of Comissioning spares for engine 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	Sets			
C	MATERIAL SUPPLY: HYDRANT AND SPRAY PUMP WITH DRIVE[MOTOR AND DIESEL ENGINE] [Material Code: PY9751590035]			11.77		
C.1	Mandatory spare for Pump- Motor/Engine driven Hydrant and spray pump					
i)	Impeller	2	Sets			
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	2	Sets			
iii)	Pump shaft	2	Sets			
iv)	Wearing rings	4	Sets			
v)	Shaft Sleeve	2	Sets			
vi)	Bushings	4	Sets			
vii)	Bearing housing (if provided)	2	Sets			
viii)	Coupling bolts & nuts (with bushes)	2	Sets			
Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.						
C.2	Mandatory spare for Engine- Engine driven Hydrant and spray pump					
i)	Piston rings & sealing rings	2	Sets			
ii)	Exhaust valve assembly	2	Sets			
iii)	Springs	2	Sets			
iv)	Packings and gaskets	2	Sets			
v)	Fuel oil filter elements with seals	4	Sets			
vi)	Fuel oil filter assy	2	Sets			
vii)	Lub. oil filter elements with seals	4	Sets			
viii)	Scrapper rings	2	Sets			
ix)	Solenoid coil for fuel valve	2	Nos.			
x)	Corrosion inhibitor (if provided)	2	Sets			

Annexure-4A

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT AND SPRAY PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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>					
xi)	Big end & small end bearing of connecting rod	2	Sets			
xii)	Speedometer	2	Nos.			
xiii)	Speedometer wire	2	Nos.			
xiv)	Rubber hoses of water line with mounting clamps	2	Sets			
xv)	Cranking starter assembly complete	2	Sets			
xvi)	Lub. oil and fuel oil hoses with end connectors	2	Sets			
xvii)	Water pump belts	4	Sets			
Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract						
C.3	Mandatory spare For Control and instrumentation- Motor/Engine driven Hydrant and spray pump					
C.3.1	Measuring Instruments					
i)	All types of Local indicators	2 Nos. of each make, model and type				
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure, flow, temperature, level switch devices).	2 Nos. of each type and model				
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.				
C.3.2	Cable					
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.				
ii)	Pre-fabricated cable connector	1 No. of each type and model.				
iii)	Other cables (including core cable, short term fire proof cable, fiber optic cables, etc.)	5% of each type, pair/core and size of actual installed quantity.				
Note: i) The word "set" means the quantity required for full replacement of that part in one machine. ii) The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable iii) Above Quantity/Items are required for each type and rating of Pump/ diesel engine being supplied under the contract						
D	Supervision charges for erection & commissioning at site[Material Code: PY9851590045]			0.73		
D.1	Per day charge of an Engineer for supervision of erection & commissioning of Pump/Motor/Diesel Engine/ etc Note: Charge include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 12]	1	Day			
TOTAL				100		
3 TAXES AND DUTIES: (Packing and Forwarding, Frieght, Insurance, Taxes & Duties as applicable to be quoted below separately for both Supply and E&C)						
(A) For Supply:						
(i) Packing & Forwarding :	In bidder scope	Included in basic price				
(ii) Frieght:	In bidder scope	Included in basic price				
(iii) Insurance:	Not in bidder scope					
(iv) Taxes and Duties	Extra at actuals					
(v) Any other:	shall be included in basic price of pumps					
(B) For E&C:						
(i) Service Tax:	Extra at actuals					
(ii) Any other:	Included in basic price					
Notes: 1) Bidders should quote the Total Bid Value in both in figures & words in the specified place. 2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items. 3) Bidders shall not fill/edit/modify anything else in the Price Bid Format. 4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value (G) quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) paisa. 5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates and transit insurance is in BHEL Scope 6) Evaluation shall be done on the basis of total bid value i.e. the total landed cost to BHEL for this enquiry. Loading (if applicable) shall be added to the Total Bid Value for evaluation purpose. 7) The bidders will also provide un-priced price format strictly in the BHEL price format given above, in the techno commercial part of their offers. Bid will be rejected if any other price format is used. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies. 8) Bidder to quote strictly as per BHEL's NIT requirements.						

Annexure-4A

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT AND SPRAY PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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>					
92) 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.						
10) Main offer (Annexure-4A) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-4A-1) 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.						
11) Prices quoted by bidders for items under main offer : SL No. 1 [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.						
12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against sl no A, B, C, D shall be Weightage w.r.t Overall Prices mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12.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. 12.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.						
13) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.						
14.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. 14.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.						
15) 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.						
16) Reference document: BHEL Tender Specification (PY51590) & all its annexures.						
17) 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.						
18) 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.						
19) With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. Referring to Sl no D.1 - Supervision charges for Hydrant pump /Motor/Engine, For the purpose of Quotation, total no of 1 man days for Pump will be covered in 1 visits have been considered and payment against Sl.No D.1 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 C) shall be placed by BHEL- PE&SD Hyderabad. For Supervision of E&C, LOI shall be placed by PE&SD and PO By BHEL-Power sector region.						

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT AND SPRAY PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Lumsum price	HSN/SAC Code	GST (%)
	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	Optional Items	--	--			
A	REVALIDATION SPARE FOR ENGINE Bidder to quote revalidation spares required for Engine as per OEM practice.	1	Set			
B	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)	1	Set			

Annexure-4B

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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 BOOSTER PUMP WITH MOTOR, COMPLETE WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: PY9751590051]			22.53		
A.1	Hydrant Booster Pump with motor complete with all accessories as per specification including commissioning spare and special tool and tackles. Note: i) 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 and drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7 ii) 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			
B	MATERIAL SUPPLY: HYDRANTBOOSTER PUMP WITH DIESEL ENGINE COMPLETE WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: PY9751590060]			63.38		
B.1	Hydrant Booster pump with Diesel Engine Complete with all accessories as per specification including commissioning spare and special tool and tackles. Note: i) Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of comissioning spares for engine 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). ii) 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			
C	MATERIAL SUPPLY: MANDATORY SPARE FOR HYDRANT BOOSTER PUMP [MOTOR AND ENGINE DRIVEN] [Material Code: PY9751590078]			10.57		
C.1	Mandatory spare for Pump- Motor/Engine driven Hydrant Booster pump					
i)	Impeller	1	Set			
ii)	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	1	Set			
iii)	Pump shaft	1	Set			
iv)	Wearing rings	2	Sets			
v)	Shaft Sleeve	1	Set			
vi)	Bushings	2	Sets			
vii)	Bearing housing (if provided)	1	Set			
viii)	Coupling bolts & nuts (with bushes)	1	Set			
Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.						
C.2	Mandatory spare for Engine- Engine driven Hydrant booster pump					
i)	Piston rings & sealing rings	1	Set			
ii)	Exhaust valve assembly	1	Set			
iii)	Springs	1	Set			
iv)	Packings and gaskets	1	Set			
v)	Fuel oil filter elements with seals	2	Sets			
vi)	Fuel oil filter assy	1	Set			
vii)	Lub. oil filter elements with seals	2	Sets			
viii)	Scrapper rings	1	Set			
ix)	Solenoid coil for fuel valve	1	No.			
x)	Corrosion inhibitor (if provided)	1	Set			
xi)	Big end & small end bearing of connecting rod	1	Set			
xii)	Speedometer	1	No.			
xiii)	Speedometer wire	1	No.			
xiv)	Rubber hoses of water line with mounting clamps	1	Set			
xv)	Cranking starter assembly complete	1	Set			
xvi)	Lub. oil and fuel oil hoses with end connectors	1	Set			
xvii)	Water pump belts	2	Sets			

Annexure-4B

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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>					
Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract						
C.3	Mandatory spare For Control and instrumentation- Motor/Engine driven Hydrant Booster pump					
C.3.1	Measuring Instruments					
i)	All types of Local indicators	2 Nos. of each make, model and type				
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure,	2 Nos. of each type and model				
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	10% or 1 No. of each type and model whichever is more.				
C.3.2	Cable					
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.				
ii)	Pre-fabricated cable connector	1 No. of each type and model.				
iii)	Other cables (including core cable, short term fire proof cable, fiber optic cables, etc.)	5% of each type, pair/core and size of actual installed quantity.				
Note: i) The word "set" means the quantity required for full replacement of that part in one machine. ii) The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable. iii) Above Quantity/Items are required for each type and rating of pumps/Engine being supplied under the contract.						
D	Supervision charges for erection & commissioning at site [Material Code:PY9851590088]			3.52		
D.1	Per day charge of an Engineer for supervision of erection & commissioning of Pump/Motor/Diesel Engine/ etc Note: Charges include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 12]	1	Day			
TOTAL				100		
3 TAXES AND DUTIES: (Packing and Forwarding, Freight, Insurance, Taxes & Duties as applicable to be quoted below separately for both Supply and E&C)						
(A) For Supply:						
(i) Packing & Forwarding :	In bidder scope	Included in basic price				
(ii) Freight:	In bidder scope	Included in basic price				
(iii) Insurance:	Not in bidder scope					
(iv) Taxes and Duties	Extra at actuals					
(v) Any other:	shall be included in basic price of pumps					
(B) For E&C:						
(i) Service Tax:	Extra at actuals					
(ii) Any other:	Included in basic price					
Notes: 1) Bidders should quote the Total Bid Value in both in figures & words in the specified place. 2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items. 3) Bidders shall not fill/edit/modify anything else in the Price Bid Format. 4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value (G) quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) paisa. 5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates and transit insurance is in BHEL Scope 6) Evaluation shall be done on the basis of total bid value i.e. the total landed cost to BHEL for this enquiry. Loading (if applicable) shall be added to the Total Bid Value for evaluation purpose. 7) The bidders will also provide un-priced price format strictly in the BHEL price format given above, in the techno commercial part of their offers. Bid will be rejected if any other price format is used. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies. 8) Bidder to quote strictly as per BHEL's NIT requirements. 9) 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. 10) Main offer (Annexure-4B) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-4B-1) 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. 11) 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. 12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against sl no A, B, C, D shall be Weightage w.r.t Overall Prices mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12.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. 12.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection. 13) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.						

Annexure-4B

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Lumsum price	HSN/SAC Code	GST (%)
	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>					
14 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. 14.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.						
15)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.						
16) Reference document: BHEL Tender Specification (PY51590) & all its annexures.						
17) 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.						
18) 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.						
19) With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. Referring to Sl no D.1 - Supervision charges for Hydrant pump /Motor/Engine, For the purpose of Quotation, total no of 1 man days for Pump will be covered in 1 visits have been considered and payment against Sl.No D.1 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 C) shall be placed by BHEL- PE&SD Hyderabad. For Supervisionof E&C, LOI shall be placed by PE&SD and PO By BHEL-Power sector region..						

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR HYDRANT BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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	Optional Items	--	--			
A	REVALIDATION SPARE FOR ENGINE Bidder to quote revalidation spares required for Engine as per OEM practice.	1	Set			
B	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)	1	Set			

Annexure-4C

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
		PROJECT ENGINEERING & SYSTEMS DIVISION				
		PRICE FORMAT (R00) FOR SPRAY BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)				
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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: SPRAY BOOSTER PUMP WITH MOTOR, COMPLETE WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: PY9751590094]			25		
A.1	Spray Booster Pump with motor complete with all accessories as per specification including commissioning spare and special tool and tackles. Note: i) 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 and drive assembly Bidder to furnish the list along with the offer. (Ref. Note-7 ii) 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			
B	MATERIAL SUPPLY: SPRAYBOOSTER PUMP WITH DIESEL ENGINE COMPLETE WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: 'PY9751590108]			62.5		
B.1	Spray Booster pump with Diesel Engine Complete with all accessories as per specification including commissioning spare and special tool and tackles. Note: i) Commissioning spares as per manufacturer's recommendation. Minimum 1 Set of O rings & gaskets, for each pump & 1 Set of comissioning spares for engine 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). ii) 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			
C	MATERIAL SUPPLY: MANDATORY SPARE FOR SPRAY BOOSTER PUMP [MOTOR AND ENGINE DRIVEN] [Material Code: 'PY9751590116]			9.37		
C.1	Mandatory spare for Pump- Motor/Engine driven Spray Booster pump					
i)	Impeller	1	Set			
ii)	Pump bearing (Incl. thrust brg., journal brg., line shaft brg.)	1	Set			
iii)	Pump shaft	1	Set			
iv)	Wearing rings	2	Sets			
v)	Shaft Sleeve	1	Set			
vi)	Bushings	2	Sets			
vii)	Bearing housing (if provided)	1	Set			
viii)	Coupling bolts & nuts (with bushes)	1	Set			
Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.						
C.2	Mandatory spare for Engine- Engine driven Spray Booster pump					
i)	Piston rings & sealing rings	1	Set			
ii)	Exhaust valve assembly	1	Set			
iii)	Springs	1	Set			
iv)	Packings and gaskets	1	Set			
v)	Fuel oil filter elements with seals	2	Sets			
vi)	Fuel oil filter assy	1	Set			
vii)	Lub. oil filter elements with seals	2	Sets			
viii)	Scrapper rings	1	Set			
ix)	Solenoid coil for fuel valve	1	No.			
x)	Corrosion inhibitor (if provided)	1	Set			
xi)	Big end & small end bearing of connecting rod	1	Set			
xii)	Speedometer	1	No.			
xiii)	Speedometer wire	1	No.			
xiv)	Rubber hoses of water line with mounting clamps	1	Set			
xv)	Cranking starter assembly complete	1	Set			
xvi)	Lub. oil and fuel oil hoses with end connectors	1	Set			

Annexure-4C

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR SPRAY BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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>					
xvii)	Water pump belts	2	Sets			
Note: Above Quantity/Items are required for each type and rating of diesel engine being supplied under the contract						
C.3	Mandatory spare For Control and instrumentation- Motor/Engine driven Spray Booster pump					
C.3.1	Measuring Instruments					
i)	All types of Local indicators	2 Nos. of each make, model and type				
ii)	Process Actuated Switch Devices : (All types of Pressure, diff. pressure,	2 Nos. of each type and model				
iii)	All type of Electronic Transmitters and Ultrasonic Transmitters including	10% or 1 No. of each type and model				
C.3.2	Cable					
i)	Pre-fabricated cable of each type	1 No. of each type, class, size and model.				
ii)	Pre-fabricated cable connector	1 No. of each type and model.				
iii)	Other cables (including core cable, short term fire proof cable, fiber optic	5% of each type, pai/core and size of				
Note: i) The word "set" means the quantity required for full replacement of that part in one machine. ii) The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable iii) Above Quantity/Items are required for each type and rating of pumps/Engine being supplied under the contract.						
D	Supervision charges for erection & commissioning at site [Material code: PY9851590126]			3.13		
D.1	Per day charge of an Engineer for supervision of erection & commissioning of Pump/Motor/Diesel Engine/ etc Note: Charges include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 12]	1	Day			
TOTAL				100		
3 TAXES AND DUTIES: (Packing and Forwarding, Frieght, Insurance, Taxes & Duties as applicable to be quoted below separately for both Supply and E&C)						
(A) For Supply:						
(i) Packing & Forwarding :	In bidder scope	Included in basic price				
(ii) Frieght:	In bidder scope	Included in basic price				
(iii) Insurance:	Not in bidder scope					
(iv) Taxes and Duties	Extra at actuals					
(v) Any other:	shall be included in baisc price of pumps					
(B) For E&C:						
(i) Service Tax:	Extra at actuals					
(ii) Any other:	Included in basic price					
Notes: 1) Bidders should quote the Total Bid Value in both in figures & words in the specified place. 2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items. 3) Bidders shall not fill/edit/modify anything else in the Price Bid Format. 4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value (G) quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) paisa. 5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates and transit insurance is in BHEL Scope 6) Evaluation shall be done on the basis of total bid value i.e. the total landed cost to BHEL for this enquiry. Loading (if applicable) shall be added to the Total Bid Value for evaluation purpose. 7) The bidders will also provide un-priced price format strictly in the BHEL price format given above, in the techno commercial part of their offers. Bid will be rejected if any other price format is used. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies. 8) Bidder to quote strictly as per BHEL's NIT requirements. 9) 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. 10) Main offer (Annexure-4C) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-4C-1) 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. 11) 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. 12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against sl no A, B, C, D shall be Weightage w.r.t Overall Prices mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12.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. 12.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.						

Annexure-4C

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR SPRAY BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
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>						
13) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.						
14 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. 14.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.						
15)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..						
16) Reference document: BHEL Tender Specification (PY51590) & all its annexures.						
17) 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.						
18) 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.						
19) With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. Referring to Sl no D.1 - Supervision charges for SPRAY pump /Motor/Engine, For the purpose of Quotation, total no of 1 man days for Pump will be covered in 1 visits have been considered and payment against SL.No D.1 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 C) shall be placed by BHEL- PE&SD Hyderabad. For Supervisionof E&C, LOI shall be placed by PE&SD and PO By BHEL-Power sector region..						

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR SPRAY BOOSTER PUMP WITH DRIVES (MOTOR & DIESEL ENGINE)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Lumsum price	HSN/SAC Code	GST (%)
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>						
II	Optional Items	--	--			
A	REVALIDATION SPARE FOR ENGINE Bidder to quote revalidation spares required for Engine as per OEM practice.	1	Set			
B	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)	1	Set			

Annexure-4D

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR JOCKEY PUMP WITH DRIVES (MOTOR)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)
	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: JOCKEY PUMP WITH MOTOR COMPLETE WITH ALL ACCESSORIES AS PER SPECIFICATION, COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [Material Code: PY9751590132]			81.49		
A.1	Jockey Pump along with drive motor assembly complete with all accessories as per specification including commissioning spare and special tool and tackles. Note: i) 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). ii) 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.	2	Sets			
B	MATERIAL SUPPLY: MANDATORY SPARE FOR JOCKEY PUMP [MOTOR DRIVEN] [Material Code: PY9751590140]			12.34		
B.1	Mandatory spare for Pump- Jockey pump					
i)	Impeller	1	Set			
ii)	Pump bearing (Incl. thrust brg., journal brg., line shaft brg.)	1	Set			
iii)	Pump shaft	1	Set			
iv)	Wearing rings	2	Sets			
v)	Shaft Sleeve	1	Set			
vi)	Bushings	2	Sets			
vii)	Bearing housing (if provided)	1	Set			
viii)	Coupling bolts & nuts (with bushes)	1	Set			
Note: Above Quantity/Items are required for each type and rating of pumps being supplied under the contract.						
B.2	Mandatory spare For Control and instrumentation- Jockey Pump					
B.2.1	Measuring Instruments					
i)	All types of Local indicators	2 Nos. of each make, model and type				
Note: i) The word "set" means the quantity required for full replacement of that part in one machine. ii) The word "TYPE" means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable iii) Above Quantity/Items are required for each type and rating of pumps/Engine being supplied under the contract.						
C	Supervision charges for erection & commissioning at site [Material Code: PY9851590150]			6.17		
C.1	Per day charge of an Engineer for supervision of erection & commissioning of Pump/Motor/Diesel Engine/ etc Note: Charge include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 12]	1	Day			
TOTAL				100		
3 TAXES AND DUTIES:						
(Packing and Forwarding, Freight, Insurance, Taxes & Duties as applicable to be quoted below separately for both Supply and E&C)						
(A) For Supply:						
(i) Packing & Forwarding :	In bidder scope	Included in basic price				
(ii) Freight:	In bidder scope	Included in basic price				
(iii) Insurance:	Not in bidder scope					
(iv) Taxes and Duties	Extra at actuals					
(v) Any other:	shall be included in basic price of pumps					
(B) For E&C:						
(i) Service Tax:	Extra at actuals					
(ii) Any other:	Included in basic price					
Notes:						
1) Bidders should quote the Total Bid Value in both in figures & words in the specified place.						
2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items.						

Annexure-4D

 	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032						
PROJECT ENGINEERING & SYSTEMS DIVISION							
PRICE FORMAT (R00) FOR JOCKEY PUMP WITH DRIVES (MOTOR)							
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	HSN/SAC Code	GST (%)	
	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>						
3) Bidders shall not fill/edit/modify anything else in the Price Bid Format.							
4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value (G) quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) paisa.							
5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates and transit insurance is in BHEL Scope							
6) Evaluation shall be done on the basis of total bid value i.e. the total landed cost to BHEL for this enquiry. Loading (if applicable) shall be added to the Total Bid Value for evaluation purpose.							
7) The bidders will also provide un-priced price format strictly in the BHEL price format given above, in the techno commercial part of their offers. Bid will be rejected if any other price format is used. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies.							
8) Bidder to quote strictly as per BHEL's NIT requirements.							
9) 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.							
10) Main offer (Annexure-4D) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-4D-1) 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.							
11) Prices quoted by bidders for items under main offer : Sl. No. 1 [A to C] 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.							
12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against sl no A, B, C, shall be Weightage w.r.t Overall Prices mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12.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. 12.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.							
13) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.							
14 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. 14.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.							
15) 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.							
16) Reference document: BHEL Tender Specification (PY51590) & all its annexures.							
17) 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.							
18) 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.							
19) With respect to Supervision charges, prices quoted by bidder shall be considered for L1 bidder evaluation. Referring to Sl no C.1 - Supervision charges for Hydrant /Spray pump/Motor/Engine, For the purpose of Quotation, total no of 1 man days for Pump will be covered in 1 visits have been considered and payment against Sl.No D.1 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 B) shall be placed by BHEL- PE&SD Hyderabad. For Supervision of E&C, LOI shall be placed by PE&SD and PO By BHEL-Power sector region.							

 		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR JOCKEY PUMP WITH DRIVES (MOTOR)						
SL NO	ITEM DESCRIPTION	QTY	UNIT	Lumsum price	HSN/SAC Code	GST (%)
	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	Optional Items	--	--			
A	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)	1 Set	Set			

d



ANNEXURE – 05

(Checklist Format)

5A) Checklist Format for Hydrant/Spray Pump

5B) Checklist Format for Hydrant Booster Pump

5C) Checklist Format for Spray Booster Pump

5D) Checklist Format for Jockey Pump

ANNEXURE-5A to BHEL Tender Specification:

CHECKLIST FOR OFFER FOR HYDRANT AND SPARY 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.	Bidder to confirm that Elevation of vent nozzle of pump from the bottom of the base plate shall not be more than 1450 mm	
5.	Refer Annexure-2A of Tender Specification: Datasheet of Hydrant/Spray Pump-Motor & Engine Datasheet. Duly filled Annexure-2A is enclosed with bidder's offer as indicated Tender Specification, Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
6.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
7.	<u>Cable Glands & Lugs:</u> Engine Driven Pump: All cabling [control/signal/power] from engine to control panel, panel to battery and engine to battery selector switch and gland, lugs, battery lugs shall be in bidder scope of supply. Control panel, battery charger and battery selector switch is located within 5 m radius of pump skid. However, Pump house layout shall be provided during detail engineering stage. Motor Driven Pump: Cable Glands, & Lugs are in bidder scope of supply. However, cable size shall be provided during detail engineering stage. Deviation in this is not acceptable. Bidder to Confirm.	
8.	HT motor Power cable gland and lugs: Even though HT motor is not in bidder scope of supply Bidder to provide suitable Power cable gland and lugs for HT motor. Cable details shall be furnished during detail engineering stage. Bidder to confirm.	
9.	1 No. of suitable motor (ex-proof type) operated and 1No. of hand operated barrel pumps are considered by the bidder. Deviation in this is not acceptable. Bidder to Confirm.	
10.	Minimum instrumentations indicated in Tender Specification, bidder to include it in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	

11.	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.	
12.	<u>Mechanical Seal:</u> Bidder to confirm that quoted Mechanical seal is Cartridge type as per manufacturing standard. Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
13.	<u>Battery & Battery Charger:</u> 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.	
14.	<u>Coupling between pump and drives [Motor/Engine] :</u> Coupling between pump and drives, [Motor/Engine] shall be as per BHEL Tender Specification. Accordingly coupling mandatory spares to be considered as per BHEL Tender Specification. Deviation in this is not acceptable. Bidder to Confirm.	
15.	<u>Motor Canopy:</u> <u>Bidder to provide suitable canopy for each motor. Bidder to confirm.</u>	
16.	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.	
17.	All the list of commissioning spares indicated in price bid format 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.	
18.	<u>Auxiliaries Equipment/Spares:</u> 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.	
19.	All the special tools and tackles indicated in tender specification are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	

20.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4 (Price Bid Format). Bidder to Confirm.	
21.	Bidder to meet 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.	
22.	Painting schedule shall be as per Annexure-6 of Tender Specification, Bidder to Confirm.	
23.	<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.	
24.	Make of all the items shall be as per Annexure-9 (Sub-Vendor List). Bidder to confirm.	
25.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, wrt list of documents, schedule of submission.	
26.	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.	
27.	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.	
28.	Bidder to quote as per Annexure-4, 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.	
29.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
30.	Refer Annexure-2 of Tender Specification. The casing material mentioned in shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in Annexure 2..If Not, bidder to consider superior material of casing. Bidder to confirm.	
31.	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 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 (Annexure-8A) f) Checklist as per (Annexure-5A) g) Pre-bid clarification format [Indicating as No Deviation] as per (Annexure-12)	
32.	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.	

33.	Structural steel and fixing accessories supporting structures: Bidder to provide suitable stand/structure and all fixing accessories for mounting control panel, battery and diesel engine fuel tank. Bidder to confirm.	
34.	Pressure Gauge: Suitable Pressure gauge at suction and discharge of Hydrant/Spray pump is considered by Bidder. Bidder to confirm the same.	
35.	RTD for Pump: Bidder to provide RTD for bearing (DE and NDE) of each Pump. Bidder to confirm.	
36.	PLC Control panel: Bidder to provide PLC control Panel for each diesel engine driven pump. Bidder to confirm.	
37.	Motor KW rating selection: Bidder to confirm the selected motor rating meeting the below mention criteria: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump	
38.	Engine rating: Bidder to confirm the selected Engine rating meeting the below mention criteria: Drive Unit Power rating for the fire water pumps shall be selected such that it is higher of the below conditions. i) 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. ii) Deaerating Factors considered by the manufacturer to arrive at the shaft power of the diesel engine at site, shall not be less than as mentioned in NFPA [latest revision, 2010] which is as mentioned below: a. 3% from engine horsepower rating at standard SAE condition shall be made for diesel engines for each 1000 ft (300m) of altitude above 300 ft (91 m). b. 1% for each 5.6° C rise in air temperature above 25° C	
39.	Offered pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. Bidder to confirm.	

ANNEXURE-5B to BHEL Tender Specification

CHECKLIST FOR OFFER FOR HYDRANT 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-2B of Tender Specification: Datasheet of Hydrant Booster Pump -Motor & Engine Datasheet. Duly filled Annexure-2B is enclosed with bidder's offer as indicated Tender Specification, Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
5.	Bidder to confirm that Elevation of vent nozzle of pump from the bottom of the base plate shall not be more than 1450 mm	
6.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
7.	<u>Mechanical Seal:</u> Bidder to confirm that quoted Mechanical seal is Cartridge type as per manufacturing standard. Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace the mechanical seal without any cost to BHEL/End customer.	
8.	<u>Cable Glands & Lugs:</u> Engine Driven Pump: All cabling [control/signal/power] from engine to control panel, panel to battery and engine to battery selector switch and gland, lugs, battery lugs shall be in bidder scope of supply. Control panel, battery charger and battery selector switch is located within 5 m radius of pump skid. However, Pump house layout shall be provided during detail engineering stage. Motor Driven Pump: Cable Glands, & Lugs are in bidder scope of supply. However, cable size shall be provided during detail engineering stage. Deviation in this is not acceptable. Bidder to Confirm.	

9.	<u>Motor Canopy:</u> Bidder to provide suitable canopy for each motor. Bidder to confirm.	
10.	1 No. of suitable motor (ex-proof type) operated and 1No. of hand operated barrel pumps are considered by the bidder. Deviation in this is not acceptable. Bidder to Confirm.	
11.	Minimum instrumentations indicated in Tender Specification, bidder to include it in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
12.	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.	
13.	<u>Battery & Battery Charger:</u> 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.	
14.	<u>Coupling between pump and drives [Motor/Engine] :</u> 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.	
15.	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.	
16.	All the list of commissioning spares indicated in price bid format 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.	
17.	<u>Auxiliaries Equipment/Spares:</u> 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.	
18.	All the special tools and tackles indicated in tender specification are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
19.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4 (Price Bid Format). Bidder to Confirm.	

20.	Bidder to meet 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.	
21.	Painting schedule shall be as per Annexure-6 of Tender Specification, Bidder to Confirm.	
22.	<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.	
23.	Make of all the items shall be as per Annexure-9 (Sub-Vendor List). Bidder to confirm.	
24.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, wrt list of documents, schedule of submission.	
25.	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.	
26.	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.	
27.	Bidder to quote as per Annexure-4, 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.	
28.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
29.	Refer Annexure-2 of Tender Specification. The casing material mentioned in shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in Annexure 2..If Not, bidder to consider superior material of casing. Bidder to confirm.	
30.	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-2B) b) Tentative GAD 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 (Annexure-8B) f) Checklist as per (Annexure-5B) g) Pre-bid clarification format [Indicating as No Deviation] as per (Annexure-12)	
31.	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.	
32.	Structural steel and fixing accessories supporting structures: Bidder to provide suitable stand/structure and all fixing accessories for mounting control panel, battery and diesel engine fuel tank. Bidder to confirm.	

33.	Pressure Gauge: Suitable Pressure gauge at suction and discharge of Hydrant booster pump is considered by Bidder. Bidder to confirm the same.	
34.	PLC Control panel: Bidder to provide PLC control Panel for each diesel engine driven pump. Bidder to confirm.	
35.	Motor rating: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump Bidder to confirm the same.	
36.	Engine 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 as mentioned below: a) 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m). b) 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 25°C	
37.	Offered pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. Bidder to confirm	

ANNEXURE-5C to BHEL Tender Specification

CHECKLIST FOR OFFER FOR HYDRANT 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 Hydrant Booster Pump -Motor & Engine Datasheet. Duly filled Annexure-2B is enclosed with bidder's offer as indicated Tender Specification, Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
5.	Bidder to confirm that Elevation of vent nozzle of pump from the bottom of the base plate shall not be more than 1450 mm	
6.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
7.	<u>Mechanical Seal:</u> Bidder to confirm that quoted Mechanical seal is Cartridge type as per manufacturing standard. Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace the mechanical seal without any cost to BHEL/End customer.	
8.	<u>Cable Glands & Lugs:</u> Engine Driven Pump: All cabling [control/signal/power] from engine to control panel, panel to battery and engine to battery selector switch and gland, lugs, battery lugs shall be in bidder scope of supply. Control panel, battery charger and battery selector switch is located within 5 m radius of pump skid. However, Pump house layout shall be provided during detail engineering stage. Motor Driven Pump: Cable Glands, & Lugs are in bidder scope of supply. However, cable size shall be provided during detail engineering stage. Deviation in this is not acceptable. Bidder to Confirm.	

9.	<u>Motor Canopy:</u> Bidder to provide suitable canopy for each motor. Bidder to confirm.	
10.	1 No. of suitable motor (ex-proof type) operated and 1No. of hand operated barrel pumps are considered by the bidder. Deviation in this is not acceptable. Bidder to Confirm.	
11.	Minimum instrumentations indicated in Tender Specification, bidder to include it in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
12.	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.	
13.	<u>Battery & Battery Charger:</u> 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.	
14.	<u>Coupling between pump and drives [Motor/Engine] :</u> 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.	
15.	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.	
16.	All the list of commissioning spares indicated in price bid format 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.	
17.	<u>Auxiliaries Equipment/Spares:</u> 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.	
18.	All the special tools and tackles indicated in tender specification are included in bidder's scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
19.	2 year recommended spares list is enclosed with bidder's offer whose optional price is indicated in Annexure-4 (Price Bid Format). Bidder to Confirm.	

20.	Bidder to meet 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.	
21.	Painting schedule shall be as per Annexure-6 of Tender Specification, Bidder to Confirm.	
22.	<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.	
23.	Make of all the items shall be as per Annexure-9 (Sub-Vendor List). Bidder to confirm.	
24.	Bidder to confirm compliance with Annexure-10, Master Document List enclosed with Tender Specification, wrt list of documents, schedule of submission.	
25.	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.	
26.	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.	
27.	Bidder to quote as per Annexure-4, 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.	
28.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
29.	Refer Annexure-2 of Tender Specification. The casing material mentioned in shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned in Annexure 2..If Not, bidder to consider superior material of casing. Bidder to confirm.	
30.	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-2C) b) Tentative GAD 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 (Annexure-8C) f) Checklist as per (Annexure-5C) g) Pre-bid clarification format [Indicating as No Deviation] as per (Annexure-12)	
31.	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.	
32.	Structural steel and fixing accessories supporting structures: Bidder to provide suitable stand/structure and all fixing accessories for mounting control panel, battery and diesel engine fuel tank. Bidder to confirm.	

33.	Pressure Gauge: Suitable Pressure gauge at suction and discharge of Hydrant booster pump is considered by Bidder. Bidder to confirm the same.	
34.	PLC Control panel: Bidder to provide PLC control Panel for each diesel engine driven pump. Bidder to confirm.	
35.	Motor rating: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump Bidder to confirm the same.	
36.	Engine 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 as mentioned below: a) 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft (300 m) of altitude above 300 ft (91 m). b) 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 25°C	
37.	Offered pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. Bidder to confirm	

ANNEXURE-5D to BHEL Tender Specification

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.	Refer Annexure-2 of Tender Specification: Datasheet of Jockey Pump-Motor Driven. Duly filled Annexure-2 is enclosed with bidder's offer as indicated in Tender Specification. Bidder to Confirm. <u>Datasheets in other formats are strictly not accepted.</u>	
4.	Bidder to confirm that Elevation of vent nozzle of pump from the bottom of the base plate shall not be more than 1450 mm	
5.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Further offer submitted by bidders shall not be reviewed w.r.t scope.</u>	
6.	<u>Mechanical Seal:</u> Bidder to confirm that quoted Mechanical seal is Cartridge type as per manufacturing standard. Note: If bidder offered pump model is not suitable for cartridge type mechanical seal, bidder may quote non cartridge type seal also. In this case, if any mechanical seal issues such as seal damage, leakage etc. will happen within five years of dispatch of the pump, bidder to send their service engineer to site for replace of mechanical seal without any cost to BHEL/End customer.	
7.	<u>Cable Glands & Lugs:</u> Cable Glands, & Lugs are in bidder scope of supply. However, cable size shall be provided during detail engineering stage. Deviation in this is not acceptable. Bidder to Confirm.	
8.	LT Motors shall be of IE-3 type in-line with IS-12615. Deviation in this is not acceptable. Bidder to Confirm.	

9.	Minimum instrumentations indicated in Tender Specification, bidder to include it in their scope of supply. Deviation in this is not acceptable. Bidder to Confirm.	
10.	<u>Motor Canopy:</u> <u>Bidder to provide suitable canopy for each motor. Bidder to confirm.</u>	
11.	<u>Coupling between pump and drives [Motor] :</u> As per of Tender Specification, Coupling between pump and drives, [Motor] shall be BHEL Tender Specification. Bidder to Confirm.	
12.	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.	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> 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.	All the special tools and tackles indicated tender specification 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-4C (Price Bid Format). Bidder to Confirm.	
17.	As per Tender Specification, 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 Annexure -6 of Tender Specification, 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, 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.	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-4, Price Bid Format for Jockey Pump 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.	The casing material mentioned pump data sheet shall cater to the Hydraulic test pressure of casing Kg/cm ² (g) as mentioned. 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 for jockey pump (Annexure-2D) b) Tentative GADP&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 for Jockey Pump (Annexure-4D) indicating quoted/ not quoted against each row & column. e) Equipment qualification criteria / PTR / Reference Lists (Annexure-8D) f) Checklist for Jockey Pump as per (Annexure-5D) g) Pre-bid clarification format [Indicating as No Deviation] as per (Annexure-12)	
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.	Pressure Gauge: Suitable Pressure gauge at suction and discharge of Hydrant/Spray pump is considered by Bidder. Bidder to confirm the same.	
30.	Offered pumps shall be capable of furnishing not less than 150 % of rated capacity at a head of not less than 65 % of the rated head. Bidder to confirm	
31.	Motor rating: Continuous drive motor rating (at 50 degree C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump. Bidder to confirm the same.	



ANNEXURE – 06

(Painting Procedure)

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	viii) Pipe Fittings 1) The material shall conform to ASTM A 234 Gr WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be. Further, galvanised malleable cast iron fittings as per IS:1879 in Cast iron fitting as per BS-1641 are also acceptable. 2) Grooved couplings: Vendor may also use mechanical grooved couplings type fittings in GI pipe lines for HVW / MVW spray system. All materials and products shall be either Underwriters Laboratories (UL) Listed or Factory Mutual (FM) Approved and installed in accordance with NFPA Standard 13 / equivalent Standard. 3) The fittings shall be galvanised as per IS: 4736 for galvanised pipe application. In case of branching connections from GI mains for spray piping network, socket may be welded for more than two pipe reduction instead of standard tees. 4) Fabricated fittings shall not acceptable up to pipe size to 300 NB. For sizes 350 NB and above, fittings may be fabricated as per BS: 2633/BS: 534. ix) Welding of galvanised iron pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by Employer. After, welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further, the Contractor shall provide proper zinc paint at the point of welding.			
10.00.00	PAINTING			
10.01.00	All the Equipments shall be protected against external corrosion by providing suitable painting.			
10.02.00	The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting.			
10.03.00	Fire Water Storage Tanks: i) The Contractor shall clean the tank plates and structure steel before erection by wire brushing and air blowing. After erection of tank and hydro testing, tanks are subjected to surface preparation and painting as per procedure detailed below: ii) Surface Preparation: Outside/inside surface preparation shall be carried out by shot blasting as per SA2 ½. iii) Inside surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 23 of 27

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC									
10.04.00	iv)	Outside surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.											
	v)	Outside bottom surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of coal tar epoxy paint with 25 micron as thickness of each coat.											
10.05.00	All Steel Surfaces (external) exposed to atmosphere (outdoor installation)												
	(i)	Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.											
10.06.00	(ii)	Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.											
	All Steel Surfaces (external) inside the building (indoor installation)												
10.06.00	(i)	Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.											
	(ii)	Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with two (2) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.											
10.06.00	Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc.												
	Painting of all equipments /components of FDPS package shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality.												
		<table><tr><th>Environment</th><th>Paint scheme</th><th>Total DFT</th></tr><tr><td>Normal / Mild Corrosive Environment</td><td>Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)</td><td>Min 125 microns</td></tr><tr><td>Corrosive Environment (as in coastal areas)</td><td>Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)</td><td>Min 200 microns</td></tr></table>	Environment	Paint scheme	Total DFT	Normal / Mild Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 125 microns	Corrosive Environment (as in coastal areas)	Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 200 microns		
Environment	Paint scheme	Total DFT											
Normal / Mild Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 125 microns											
Corrosive Environment (as in coastal areas)	Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 200 microns											
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 24 of 27									

SUB – SECTION – A-12

SURFACE PREPARATION & PAINTING

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2**

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	SPECIFICATION OF SURFACE PREPARATION & PAINTING			
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.			
1.05.00	SURFACE PREPARATION			
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.			
1.06.00	APPLICATION OF PRIMER/PAINT			
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING	Page 1 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.			
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected.Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.			
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminium paint to IS 2339. PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1 PS13 - Rust preventive fluid by spray, dip or brush. PS14 - weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15' . PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.) PS-20 - Epoxy based finish paint			
1.06.06	All weld edge preparation for site welding shall be applied with one coat of wieldable primer.			
1.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.			
1.06.08	SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.			
1.06.09	a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner: - Primer coat – Epoxy based zinc phosphate - Intermediate - Epoxy based TiO2 pigmented coat - Finish coat - Epoxy based finish coat b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron. c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING	Page 2 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.06.10	A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polyimide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener. Total thickness of primer and paint should not be less than 400 microns.			
	B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns. (d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard. (b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.			
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1.06.11 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painti ng DFT (Micr ons)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	Design temperature < or equal to 60°C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 \$	35 \$	155 \$	
		Design temperature above 60°C- 200°C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200°C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	

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4	Piping hangers/ supports (other than (3) above. (un-insulated)		SP4 (SP6 - for cleaning of weld joints after erection,)	PS 5	1	40	PS 4	1	40	PS 17	1	40	120
	Valves												
5.	Cast/Forge d	Design temperature < or equal to 60 degC	SP1/SP2/S P3	PS4/P S9	1	40	Polya mide Epoxy	1	100	PS17	1	40	180
		Design temperature above 60 degC and up to 200 degC	SP1/SP2/S P3	PS 9*	1	20	-	-	-	PS9*	1	20	40
		Design temperature above 200 degC	SP1/SP2/S P3	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorga nic Ethyl Zinc Silicat e	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250

		Within building	TG	SP4*	-do-	1	35	PS18	1	35	a)Epoxy coat b)Final coat of paint PS17	2 1	25 30	150	
7.	Weld Edges			SP6 (Hand cleaning by wire brushing)	PS13 (Weld able primer)	1	25	-	-	-	-	-	-	25	
1. \$ The first 2 finished coats (total min. DFT of 70 microns) shall be done at shop and the 3rd finish coat (min. DFT 35 Microns) shall be applied at site. 2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint. 3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable. 4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content > 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme. 5. For corrosion protection for all inner parts of the hangers shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.															
B) Steam Generator & Auxiliaries:															
1	All surfaces with temperature 95°C or less and which are insulated			SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 \$	20 \$	100 \$	
2	All surfaces with temperature above 95°C and which are insulated			SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	

Note: 1) SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) For valves below 65NB and temperature upto & including 545 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.

C) LOW PRESSURE PIPING

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

D) Fire Detection & Protection System, Compressed air system, Hydrogen generation plant and Air-conditioning & Ventilation System

For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System

For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System.

For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-30, Ventilation System.

For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section-A-16 compressed air system.

For hydrogen generation plant, Surface preparation and painting should be as per the Part-B, Sub-Section-A-19 hydrogen generation plant.

E) ESP

1	All surfaces with surface temperature 95°C or less (with insulation)	SP3/SP4	PS3/ PS5	1	25	-	-	-	PS 4	1	30	55
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60

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

- i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

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- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System

- (i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard.
- (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.
- (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.
- (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

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ANNEXURE – 07

(QAP Guide Line and Format)

TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 7 Rev No. 00 Page 1 of 3
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.				

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 7
			Rev No. 00
			Page 2 of 3
<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)			
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		Page 3 of 3		
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			REMARKS
										P	W	V	
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

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: CENTRIFUGAL PUMPS 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 P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Casing	Visual check	Major	Visual	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		--	--	2	2	--	
1.2		Dimensional check	Major	Measurements	100%			--	--	2	2	--	
1.3		Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot			MTC	√	2	2	1	
1.4		Heat treatment for all castings	Major	HT	100%			HT chart	√	2	2	1	
1.5	Impeller, Diffuser and Shaft	Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot			MTC	√	2	2	1	
1.6	Mechanical seal	Material and leakage check (Air test)	Major	OEM's certificate review	100%			OEM's certificate	√	2	2	1	
1.7	Bearing and bearing housing	Make and Model	Major	OEM's certificate review	100%			OEM's certificate	√	2	2	1	
1.8	Coupling	Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot			MTC	√	2	2	1	
1.9	Strainer (as applicable)	Chemical & Mech. Properties and hydro test	Major	OEM's certificate review	100%			OEM's certificate	√	2	2	1	
1.10	Instruments and JB (as applicable)	MOC, hydro test reports, Calibration reports and Type test certificates	100%	OEM's certificate review	100%			OEM's certificate	√	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.

बी एच ई एल BHEL		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: CENTRIFUGAL PUMPS BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 2 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	
1.11	Interconnecting pipes and fittings (as applicable)	Chemical & Mech. Properties	Major	Chemical & Mech. Analysis	1 per heat/lot			MTC	√	2	2	1	
1.12	Wear rings, 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/ Approved Test procedures		WPS, PQR and WQR	--	2	2	1	
2.2	Casing	NDE	Major	DPT/MPI	100%			NDE reports	√	2	1	--	
2.3		Leakage	Critical	Hydrostatic test	100%			Test reports	√	2	1	--	
2.4	Butt welds on casing (if any)	NDE	Major	RT	100%			IR	√	2	2	1	
2.5	Fillet welds on casing (if any)	NDE	Major	MPI	100%			IR	√	2	2	1	
2.6	Impeller and Diffuser	NDE	Major	DPT / MPI	100%			NDE reports	√	2	2	1	
2.7	Shaft	NDE	Major	DPT / MPI and UT (if shaft diameter > 50 mm)	100%			NDE reports	√	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.

बी एच ई एल BHEL		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: CENTRIFUGAL PUMPS BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 3 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	
2.8	Wear rings	NDE and hardness test	Major	DPT and hardness test	100%	Tech Spec/ Approved Datasheet/ Approved Drawing/ Approved Test procedures		DP and hardness test reports	√	2	2	1	
2.9	Interconnecting Piping (as applicable)	NDE and leakage	Major	DPT and hydro test	100%			DPT and hydro test report	√	2	2	1	
2.10	Coupling	Dynamic balancing	Critical	Balancing	100%			IR	√	2	1	--	
2.11	Impeller	Dynamic balancing	Critical	Balancing	100%			IR	√	2	1	--	
2.12	Rotor assembly with coupling half	Dynamic balancing	Critical	Balancing	100%			IR	√	2	1	--	
3.0	FINAL INSPECTION & TESTING												
3.1	Motor driven pump with job motor, job coupling, job base plate and engine driven pump with job diesel engine, job coupling, job base plate	Overall Dimensions	Major	Measurement	100%	Tech Spec/ Approved Datasheet/ Approved Drawing/ Approved Test procedures		TC	√	2	1	--	100% pumps will be witnessed by inspection agency.
3.2		Performance and complete unit test	Critical	Testing	100%			IR	√	2	1	--	
3.3		NPSH test (if NPSHa - NPSHr is < than 1 meter)	Major	Testing	100%			TC	√	2	1	--	
3.4		Submergence test (for vertical pumps)	Major	Testing	100%			TC	√	2	1	--	
3.5		Mechanical run test	Critical	Testing	100%			TC	√	2	1	--	
3.6		Strip Examination in case of abnormal noise & vibrations	Major	Dismantling	100%			TC	√	2	1	--	
3.7		Accessories and Spares (if any)	Major	Part verification and BOQ	100%			IR	√	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.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: CENTRIFUGAL PUMPS BHEL TECH SPEC:				REV NO:		DATE:		
									PAGE 4 OF 4				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
									D	P	W	V	
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	2	--	
4.2		Inspection reports/ certificate traceability index	Major	Visual	100%			Index	√	2	2	--	
4.3		Packing #	Major	Visual	100%			Packing List	√	2	2	--	# Seaworthy packing for export orders

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.
4. PMI to be witness by inspection agency for all accessible SS or AS parts.
5. Noise and vibrations values shall be recorded in report at all points.

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
MOC	-	Material of construction			

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032		PROJECT: PACKAGE: LT 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 P W V	REMARKS		
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	
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.:					
		PROJECT ENGINEERING & SYSTEMS			PROJECT:			REV NO:			DATE:		
		DIVISION BHEL, RC PURAM, HYD-502032			PACKAGE: LT MOTOR BHEL TECH SPEC:			PAGE 2 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	
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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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: LT MOTOR BHEL TECH SPEC:			REV NO:		DATE:			
								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
3.12	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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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:						
								REV NO:		DATE:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032						PROJECT: PACKAGE: LT 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 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:-

1. This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
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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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:							
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR (EXCLUDED FROM BIDDER'S SCOPE) 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 P W V			REMARKS		
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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बी एच ई एल 		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR (EXCLUDED FROM BIDDER'S SCOPE) BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 2 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	
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, BTD, Space heater)	Major	Electrical	100%			TR	√	2	1	--	
3.8		Reduced voltage running up test	Major	Electrical	100%			TR	√	2	1	--	

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR (EXCLUDED FROM BIDDER'S SCOPE) BHEL TECH SPEC:			REV NO:		DATE:			
								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
3.9		Open CKT. Voltage test (For SRIM only)	Major	Electrical	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		TR	√	2	1	--	APPLICABLE FOR HORIZONTAL MOTORS
3.10		Vibration Test During no load run	Major	Electrical	100%			TR	√	2	1	--	
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	

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: HT MOTOR (EXCLUDED FROM BIDDER'S SCOPE) BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 4 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
3.20		Starting torque, starting current, and pullout torque calculation	Major	Electrical	1 Motor			TR	√	2	2	1	Based on no load reading
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 Organization

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		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%	Tech Spec/ Approved Datasheet/ Approved Drawing		IR	√	2	2	1	
2.2	Fuel pump, Lube oil pump and control panel	Functional test	Major	Testing	100%			TC	√	2	2	1	Bidder may submit separate QAP for Panel.

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 P W V			REMARKS
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	--	# Seaworthy packing for export orders	
4.2		Packing #	Major	Visual	100%			Packing List	√	2	2	1		

Notes:-

4. This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
5. Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
6. 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

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.



ANNEXURE – 08

(PQC Format)



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : **PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)**

विषय / SUB : **PQC format for Hydrant/Spray Pump**

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 Four (4) 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 (10) years and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on as on the bid due date. 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



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : **PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)**

विषय / SUB : **PQC format for Hydrant Booster Pump**

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 Four (4) 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 (10) years and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on as on the bid due date. 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



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : **PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)**

विषय / SUB : **PQC format for Spray Booster Pump**

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 Four (4) 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 (10) years and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on as on the bid due date. 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



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : **PATRATU SUPER THERMAL POWER PROJECT EXPANSION, PHASE-I(3X800 MW)**

विषय / SUB : **PQC format for Jockey Pump**

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 Four (4) 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 (10) years and at least Two (2) of these pumps shall have supplied and commissioned and kept in trouble free operations for the past 5 years as on as on the bid due date. 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 – 09

(Sub Vendor List)

9A) Customer Approved Vendor List

9B) BHEL PMD List

BATTERY CHARGER (110V/220V)	M/S AMARARAJA	TIRUPATI
	M/S HBL- POWER SYSTEM	HYDERABAD
	M/S CHHABI ELECTRICAL	JALGAON
	M/S. CHLORIDE POWER	KOLKATTA
	M/S STATCON	HAPUR
	SAFT NIFE POWER SYSTEMS	SINGAPORE
	MASSTECH	JALGAON
	EMERSON NETWORK	THANE
	JEMA ENERGY	SPAIN
	M/S DUBAS	BANGALORE

BATTERY (110V/ 220V)	HBL-POWER SYSTEM	HYDERABAD
	M/S HOPPEKE	GERMANY
	M/S EXIDE	KOLKATA
	AMCO SAFT	BANGALORE

1)	L T (415 V) Motors	Refer Note 1	ABB	FARIDABAD	A	UPTO 55KW
			ABB	BANGALORE	A	55KW - 200KW
			BHARAT BULEE	MUMBAI	A	RQP, FOR FLAME PROOF ALSO
			CGL	AHMEDNAGAR	A	FOR FLAME PROOF ALSO
			JYOTI	BARODA	A	
			KEC	BANGALORE	A	FOR FLAMEVPROOF ALSO
			KEC	HUBLI	A	UPTO 90KW; FOR FLAME PROOF ALSO
			LHP	SOLAPUR	A	UPTO 200KW
			MARATHON	KOLKATA	A	FOR FLAME PROOF ALSO
			NGEF	BANGALORE	A	UPTO 15KW
			SIEMENS	MUMBAI	A	A

NOTE 1 : FOR LT MOTORS

a) Less than 30 KW

Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets.

b) 30 KW -50KW

Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets.

c) Above 50 KW as per NTPC approved quality plan

Approval Conditions attached to above vendors-as applicable shall prevail.

General Notes:

- 1) Vendor list & category of the mandatory spares shall be as mentioned above.
- 2) For item not appearing in the above list, main contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
- 3) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be informed on specific request of Main Contractor.



Itin
(JATIN GAHLAWAT)
BHEL
Deptt.

D.K.INSTRUMENTS (P) LTD.,	LEVEL GUAGES (MAGNETIC TYPE)
Sigma Instruments Company	LEVEL GUAGES (MAGNETIC TYPE)
GAUGES BOURDON INDIA PVT. LTD.	LEVEL GUAGES (MAGNETIC TYPE)
NISAN SCIENTIFIC PROCESS	LEVEL GUAGES (MAGNETIC TYPE)
PUNE TECHTROL PVT LTD	LEVEL GUAGES (MAGNETIC TYPE)
SCIENTIFIC DEVICES (BOMBAY) PVT. LT	LEVEL GUAGES (MAGNETIC TYPE)
Shridhan Automation Pvt.Ltd	LEVEL GUAGES (MAGNETIC TYPE)
IGEMA GmbH	LEVEL GUAGES (MAGNETIC TYPE)
V AUTOMAT AND INSTRUMENTS PVT LTD	LEVEL GUAGES (MAGNETIC TYPE)



ANNEXURE – 10

(Master DOC List Format)

- 4A) MDL for Hydrant/Spray Pump with Drives
- 4B) MDL for Hydrant/Spray Booster Pump with Drives
- 4C) MDL for Jockey pump with Drives

Annexure-10A: MASTER DOCUMENT LIST - Hydrant 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	28/Aug/18			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	
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-Motor Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
7	Pump Cross Sectional Drawing-Engine Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
8	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
9	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																		
10	Motor TB drawing	Later		I	Y	N	Within 2 weeks after PO placement																		
11	Motor Curves	Later		I	Y	Y	Within 2 weeks after PO placement																		
12	T-S Curve	Later		I	N	N	Within 2 weeks after PO placement																		
13	Diesel engine GA Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
14	Diesel engine Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
15	Control Panel GA Drawing & Wiring Diagram	Later		A	Y	Y	Within 2 weeks after PO placement																		
16	Diesel Engine Wiring Diagram	Later		I	Y	N	Within 2 weeks after PO placement																		
17	Battery Charger Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
18	Battery Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
19	Battery capacity calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
20	Fuel tank Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
21	Fuel tank calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
22	P&ID/Schematic of Diesel Engine	Later		I	N	N	Within 2 weeks after PO placement																		
23	Coupling GA Drawing for Motor Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
24	Coupling GA Drawing for Engine Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
25	Mechanical Seal GA Drawing and details: Motor driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
26	Mechanical Seal GA Drawing and details: Engine driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
B	INSTRUMENTTAION																								
1	Data Sheet of Level Switch cum Gauge	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																		
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																		

Annexure-10A: MASTER DOCUMENT LIST - Hydrant 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	28/Aug/18			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	
C	MISCELLANEOUS																								
1	Performance Test Procedure: Motor driven & Engine Driven	Later		A	Y	N	Within 8 weeks after PO placement																		
2	NPSH test procedure	Later		I	N	N	Within 8 weeks after PO placement																		
3	Vibration test procedure & 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																		
6	NDE 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 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																		
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-10B: MASTER DOCUMENT LIST - Hydrant and Spray 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	28/Aug/18			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	
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-Motor Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
7	Pump Cross Sectional Drawing-Engine Driven	Later		I	Y	N	Within 2 weeks after PO placement																		
8	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
9	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement																		
10	Motor TB drawing	Later		I	Y	N	Within 2 weeks after PO placement																		
11	Motor Curves	Later		I	Y	Y	Within 2 weeks after PO placement																		
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13	Diesel engine GA Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
14	Diesel engine Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
15	Control Panel GA Drawing & Wiring Diagram	Later		A	Y	Y	Within 2 weeks after PO placement																		
16	Diesel Engine Wiring Diagram	Later		I	Y	N	Within 2 weeks after PO placement																		
17	Battery Charger Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
18	Battery Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement																		
19	Battery capacity calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
20	Fuel tank Drawing	Later		A	Y	N	Within 2 weeks after PO placement																		
21	Fuel tank calculation sheet	Later		I	Y	N	Within 2 weeks after PO placement																		
22	P&ID/Schematic of Diesel Engine	Later		I	N	N	Within 2 weeks after PO placement																		
23	Coupling GA Drawing for Motor Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
24	Coupling GA Drawing for Engine Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
25	Mechanical Seal GA Drawing and details: Motor driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
26	Mechanical Seal GA Drawing and details: Engine driven Pump	Later		I	Y	N	Within 2 weeks after PO placement																		
B	INSTRUMENTTAION																								
1	Data Sheet of Level Switch cum Gauge	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																		
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																		

Annexure-10B: MASTER DOCUMENT LIST - Hydrant and Spray 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	28/Aug/18			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	
C	MISCELLANEOUS																								
1	Performance Test Procedure: Motor driven & Engine Driven	Later		A	Y	N	Within 8 weeks after PO placement																		
2	NPSH test procedure	Later		I	N	N	Within 8 weeks after PO placement																		
3	Vibration test procedure & 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																		
6	NDE 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 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																		
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-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	28 /Aug/18			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	
1.0 Mechanical																				
A	MECHANICAL																			
1	Pump Data Sheet	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 & Motor assembly GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement													
4	Pump Cross Sectional Drawing	Later		I	Y	N	Within 2 weeks after PO placement													
5	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO placement													
6	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO placement													
7	Motor Curves	Later		I	Y	Y	Within 2 weeks after PO placement													
8	T-S Curve	Later		I	N	N	Within 2 weeks after PO placement													
9	Coupling GA Drawing for Motor Driven Pump	Later		I	Y	N	Within 2 weeks after PO placement													
10	Mechanical Seal GA Drawing and details	Later		I	Y	N	Within 2 weeks after PO placement													
B	INSTRUMENTTAION																			
C	MISCELLANEOUS																			
1	Performance Test Procedure	Later		A	Y	N	Within 8 weeks after PO placement													
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													
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 Despatch													

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	28/Aug/18			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 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 :			
		" " - Not yet Due.																		
		OD-Overdue					TOTAL "OD"		0											
		" " - Not yet Due.																		

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/CUSTOM ER 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)

ANNEXURE-11: DEVIATION FORMAT

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

(Prebid Clarification Format)

ANNEXURE-12: PRE-BID QUERIES FORMAT

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 (along with all Annexures) shall also be referred.



ANNEXURE – 13

(C&I Specification)

CLAUSE NO.	TECHNICAL REQUIREMENTS 	
	PLANT AUXILIARY SYSTEM 1.00.00 CONTROL AND INSTRUMENTATION FOR MAIN PLANT AUXILIARY SYSTEMS 1.01.00 Contractor shall provide complete Control and Instrumentation system with all accessories, auxiliaries and associated equipments and cables for the safe, efficient and reliable operation of the plant auxiliary systems as indicated under scope part at IIC, Part-A, Section VI. 1.02.00 All electrical devices like switches/ transmitters/ controller/ analyzer/ solenoid valves which are located in the hydrogen generation plant shall be made intrinsically safe by providing suitable type of transformer isolated barrier/ Zener barrier of standard make in case it is a standard and proven practice of the bidder. Otherwise such instruments shall be provided with explosion proof enclosure suitable for hazardous areas described in National Electric Code (USA), Article 500, Class-I, Division-I or EN60079-14 or shall comply with the essential requirements of ATEX directives. All fittings, cable glands etc. shall be strictly as per NEC recommendation article, 500 to 503. 1.03.00 Contractor shall provide control system for safe, efficient and reliable operation of each of the plant auxiliary systems. The type of control system shall be as indicated under scope part at IIC, Part-A, Section VI. 1.04.00 It shall be possible to remove/replace online various modules (like any I/O module, interface module, etc.) from its slot for maintenance purpose without switching off power supply to the corresponding rack. System design shall ensure that while doing so, undefined signaling and releases do not occur and controller operation in any way is not affected (including controller trip to manual, etc) except that information related to removed module is not available to controller. Further, it shall also be possible to remove/replace of controller module without switching off the power to the corresponding rack and this will not result in system disturbance or loss of any controller functions for the other controller. The on-line removal/insertion of controller, I/O modules shall in no way jeopardize safety of plant and personnel. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration. 1.05.00 The control system shall provide safe operation under all plant disturbances and on component failure so that under no condition the safety of plant, personnel or equipment is jeopardized. Control system shall be designed to prevent abnormal swings due to loss of Control System power supply, failure of any Control System component, open circuit/short circuit etc. 1.06.00 The Control system shall include on-line self-surveillance, monitoring and diagnostic facility giving the details of the fault on the Human Machine Interface System (HMIS) as per standard and proven practice of the contractor. 1.07.00 The Control system shall generally operate in air conditioned area and shall be suitable for sustained operation for limited air conditioning failure.	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM PAGE 1 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	MICROPROCESSOR/ PROGRAMMABLE LOGIC BASED CONTROL SYSTEM		
2.01.00	Microprocessor/PLC PROCESSOR		
	The processor unit shall be capable of executing the following functions:-		
	a	Receiving binary and analog signals from the field and providing command output to MCC/SWGR/Drive etc. through Input / Output modules and operator initiated commands from HMIS / control panel.	
	b	Implementing all logic functions for control, protection and annunciation of the equipment and systems.	
	c	Implementing modulating control function for certain application as specified elsewhere in the specification.	
	d	Providing supervisory information for alarm, various types of displays, status information, trending, historical storage of data etc.	
	e	Performing self-monitoring and diagnostic functions.	
2.02.00	For each unit, PLC based control system shall be provided. PLC system shall consist of two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete process operation automatically. The transfer from main processor to standby processor shall be totally bump less and shall not cause any plant disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processors as master and other as standby. The standby processor shall be updated in line with the changes made in working processor. Wherever multiple functional groups have been specified/ required, the above requirements are applicable for each functional group. For Hydrogen Generation plant, the control system shall be as per Contractor's standard and proven practice. Programmed operating sequences and criteria shall be stored in non volatile semi conductor memories like EPROM. All dynamic memories shall be provided with buffer battery back up which shall be for at least 360 hours. The batteries shall be lithium or Ni-Cd type. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.		
2.03.00	Priority of different commands shall be as follows: Manual intervention shall be possible at any stage of operation. Protection commands shall have priority over manual commands and manual commands shall prevail over auto commands. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM
			PAGE 2 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS				
2.04.00	HUMAN MACHINE INTERFACE SYSTEM (HMIS)				
2.04.01	Graphical Interface Unit (GIU) / Operator work station (OWS) shall perform control, monitoring and operation of all auxiliaries/ drives interacting with PLC based/Microprocessor control system. It shall be possible to use the same as programming station of the PLC/ Control system and the Human Machine Interface System. In case the PC based OWS can not be used as programming station of the PLC/ Control system and the Human Machine Interface System, then separate PC based programming station shall be provided.				
2.04.02	Operator shall be able to access all control/information related data under all operating conditions including a single processor/computer failure in the HMIS.				
2.04.03	The operator functions for each OWS shall as a minimum include Control System operation (A/M selection, raise/lower, set point/bias change, on/off, open/close operation, mode/device selection, bypassing criteria, sequence auto, start/stop selection, drive auto selection, local-remote/other multi-position selection etc.); alarm acknowledge; call all kind of displays, logs, summaries, calculation results, etc.; printing of logs & reports; retrieval of historical data; and any other functions required for smooth operation, control & management of information as finalized during detailed engineering.				
2.04.04	The display selection process shall be optimized so that the desired display can be selected with the minimum no. of operations. Navigation from one display to any other should be possible efficiently through paging soft keys as well as through targets defined on the displays.				
2.04.05	The system shall have built-in safety features that will allow/disallow certain functions and entry fields within a function to be under password control to protect against inadvertent and unauthorised use of these functions. Assignment of allowable functions and entry fields shall be on the basis of user profile. The system security shall contain various user levels with specific rights as finalised by the Employer during detailed engineering. However, no. of user levels, no. of users in a level and rights for each level shall be changeable by the programmer (Administrator).				
	For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.				
2.04.06	When any drive or sequence is being controlled from one OWS, the system shall inhibit control access of the same drive or sequence from other OWS or Local Control Panel. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.				
2.02.07	Graphical Interface Unit shall meet the minimum functional requirements of monitoring, operating & controlling the process and displaying information related to process. GIU shall be provided with TFT active matrix display and keypad for operation. GIU shall be ruggedly designed to withstand hard environments like high temperature, shock and vibration.				
2.05.00	PROGRAMMING FUNCTIONALITIES				
	Programming of the PLC/ Control system Processor / controller as well as programming of HMIS shall be user friendly with graphical user interface and shall not require knowledge of any specialized language. For example, the programming of PLC/ Control system shall use either of the following:- <table><tr><td>-</td><td>Flow-chart or block logic representing the instructions graphically.</td></tr></table>			-	Flow-chart or block logic representing the instructions graphically.
-	Flow-chart or block logic representing the instructions graphically.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM PAGE 3 OF 12		

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	- Ladder diagrams. The programming of HMIS (like development and modification of data base, mimics, logs / reports, HSR functionalities etc.) shall also be possible through user-friendly menus etc All programming functionalities shall be password protected to avoid unauthorized modification.		
2.06.00	SOFTWARE REQUIREMENT		
2.06.01	All necessary software required for implementation of control logic, operator station displays / logs, storage & retrieval and other functional requirement shall be provided. The programs shall include high level languages as far as possible. The contractor shall provide sufficient documentation and program listing so that it is possible for the Employer to carry out modification at a later date.		
2.06.02	The Contractor shall provide all software required by the system for meeting the intent and functional/parametric requirements of the specification.		
2.06.03	Industry standard operating system like UNIX/WINDOWS (latest version) etc. to ensure openness and connectivity with other system in industry standard protocols (TCP-IP/ OPC etc.) shall be provided. The system shall have user friendly programming language & graphic user interface.		
2.06.04	All system related software including Real Time Operating System, File management software, screen editor, database management software. On line diagnostics/debug software, peripheral drivers software and latest versions of standard PC-based software and latest WINDOWS based packages etc. and any other standard language offered shall be furnished as a minimum.		
2.06.05	All application software for PLC/ Control system functioning like input scanning, acquisition, conditioning processing, control and communication and software for operator interface of monitors, displays, trends, curves, bar charts etc. Historical storage and retrieval utility, and alarm functions shall be provided.		
2.06.06	The Contractor shall provide software locks and passwords to Employer's engineers at site for all operating & application software so that Employer's engineers can take backup of these software and are able to do modifications at site.		
3.00.00	INPUT/OUTPUT MODULES		
3.01.00	The PLC/ Control system should be designed according to the location of the input/output cabinets as specified.		
3.02.00	Input Output modules, as required in the Control System for all type of field input signals (4-20 mA, RTD, Thermocouple, non change over/change over type of contact inputs etc.) and outputs from the control system (non change-over/ change-over type of contact, 24 VDC output signals for energizing interface relays, 4-20 mA output etc.) are to be provided by the Contractor.		
3.03.00	Electrical isolation of 1.5KV with optical couplers between the plant input/output and controller shall be provided on the I/O cards. The isolation shall ensure that any inadvertent voltage or voltage spikes (as may be encountered in a plant of this nature) shall not damage or mal-operate the internal processing equipment.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM PAGE 4 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.04.00	The Input/output system shall facilitate modular expansion in fixed stages. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
3.05.00	Individually fused output circuits with the blower fuse indicator shall be provided. All input/output points shall be provided with status indicator. Input circuits shall be provided with fuses preferably for each input; alternatively suitable combination of inputs shall be done and provided with fuses such that for any fault, fuse failure shall affect the particular drive system only without affecting other systems. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
3.06.00	All input/output cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching of power supply. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
3.07.00	The Contractor shall provide the following monitoring features: a. Power Supply monitoring b. Contact bounce filtering c. In case of power supply failure or hardware fault, the critical outputs shall be automatically switched to the fail-safe mode. The fail-safe mode shall be intimated to the successful Contractor during detailed engineering. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
3.08.00	Binary Output modules shall be rated to switch ON/OFF coupling relays of approx. 3 VA at 24 VDC. Analog output modules shall be able to drive an load impedance of 500 Ohms minimum.			
3.09.00	Output module shall be capable of switching ON/OFF inductive loads like solenoid valves, auxiliary relays etc. without any extra hardware.			
3.10.00	Only one changeover contact shall be provided in MCC for control and interlock requirement. Further multiplication, if required, shall be done by the contractor in PLC/ Control system.			
3.11.00	All input field interrogation voltage shall be 24V DC.			
3.12.00	Wiring Scheme for inputs to control system shall be as per contractor's standard and proven practice.			
3.13.00	In case of loss of I/O communication link with the main processing unit, the I/O shall be able to go to predetermined fail safe mode (to be decided during detailed engineering) with proper annunciation. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
3.14.00	Any single sensor/transducer/transmitter failure alarm shall be provided on programmer station screens for all sensors/transducers/transmitters. Contractor shall provide remote Input/Output modules Housed in free-standing cabinets/racks (with suitable redundant datalink to the central PLC system) as specified. These Input/Output modules shall meet the technical requirements as mentioned in the above clauses. Further these Input/Output modules shall be designed to continuously work under the environment expected to be encountered in assigned areas without any air-conditioning support. Wherever the cable route distance of these I/O cabinets/racks exceeds a distance of 400 meters from the Central PLC, fiber optic datalink has to be provided. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM	PAGE 5 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
4.00.00	SYSTEM SPARE CAPACITY			
4.01.00	Over and above the equipment and accessories required to meet the fully implemented system as per specification requirements, Control System shall have spare capacity and necessary hardware/ equipment/ accessories to meet following requirement for future expansion at site:			
4.02.00	10% spare channels in input/output modules fully wired up to cabinets TB.			
4.03.00	Wired-in "usable" space for 10% modules in each of the system cabinets for mounting electronic modules wired up to corresponding spare terminals in system cabinets.			
4.04.00	Each processor / controller shall have 30% spare functional capacity to implement additional function blocks, over and above implemented logic/ loops.			
4.05.00	The Data communication system shall have the capacity to handle the additions mentioned above.			
4.06.00	Twenty (20) percent spare relays of each type and rating mounted and wired in cabinets TB. All contacts of relays shall be terminated in terminal blocks of cabinets.			
5.00.00	DATA COMMUNICATION SYSTEM (DCS)			
5.01.00	The Data Communication System shall include a redundant Main System Bus with hot back-up. Other applicable bus systems like cubicle bus, local bus, I/O bus etc shall be redundant except for backplane buses which can be non-redundant. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.			
	The DCS shall have the following minimum features :			
	a	Redundant Communication controllers shall be provided to handle the communication between I/O Modules (including remote I/O) and PLC/ Control systems and between PLC/ Control systems and operator work station/HMI device. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.		
	b	The design shall be such as to minimize interruption of signals. It shall ensure that a single failure anywhere in the media shall cause no more than a single message to be disrupted and that message shall automatically be retransmitted. Any failure or physical removal of any station/module connected to the system bus shall not result in loss of any communication function to and from any other station/module.		
	c	Built-in diagnostics shall be provided for easy fault detection. Communication error detection and correction facility (ECC) shall be provided at all levels of communication. Failure of one bus and changeover to the standby system bus shall be automatic and completely bump less and the same shall be suitably alarmed/logged.		
	e	The design and installation of the system bus shall take care of the environmental conditions as applicable.		
	f	Data transmitting speed shall be sufficient to meet the responses of the system in terms of displays, control etc.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM
				PAGE 6 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	g	Passive coaxial cables or fibre optic cables shall be employed.	
	The Contractor shall furnish details regarding the communication system like communication protocol, bus utilization calculations etc.		
5.02.00	The PLC/ Control system shall be provided with necessary hardware and software for dual fiber optic connectivity & interconnection with station wide LAN (for scope of Station LAN refer Part-A) for transfer of signals for the purpose of information sharing. The plant information shall be made available through an Ethernet link following TCP/IP standard. The system shall be OPC compliant. The exact data structure shall be as decided during detailed engg. All required plant data shall be transferred to/from through this ensuring complete security. The exact number of points to be transferred through the above communication link and the format of the data shall be finalised during detailed engineering. The Contractor shall provide all assistance to the BOP C&I System (for scope of BOP C&I System refer Part-A) Supplier including co-ordination and flow of required information etc. for display of all input points under alarm, connected to PLC/ Control system or generated by PLC/ Control system, on various operating stations on BOP C&I System (for scope of BOP C&I System refer Part-A) and various client PCs on station LAN.		
6.00.00	SYSTEM REACTION TIME		
6.01.00	The reaction time of the programmable control system from input signals at the input cards to output of the associated signals or commands of the output card inclusive of programmed logic processing, comprising a mixture of logic gates, arithmetic operations and other internal operations shall be less than 100 milli seconds under the most arduous control system operating conditions. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration.		
7.00.00	OPERATOR INTERFACE DISPLAYS/LOGS/REPORTS		
7.01.00	Suitable Operator Interface Displays/Logs/Reports for control operation & monitoring shall be provided. The details shall be finalized during detailed Engg. stage taking into account the contractors standard and proven practice.		
8.00.00	HISTORICAL STORAGE AND RETRIEVAL SYSTEM (HSRS)		
8.01.00	The data to be stored in the above system shall include alarm and event list, periodic plant data, selected logs/reports. The data/information to be stored & frequency of storage and retrieval shall be as finalised during detailed engineering. The system shall provide user-friendly operator functions to retrieve the data from historical storage. It shall be possible to retrieve the selected data on OWS or printer in form of trend/report by specifying date, time & period. Further, suitable index files/directories shall also be provided to facilitate the same. The logs/reports for at least last seven (7) days shall be available on the disk.		
8.02.00	In addition to above, the system shall also have facility to store & retrieve important plant data for a very long duration (plant life) on portable long term storage media). These data will include any data from the database as well as processed/computed data based an various calculations/transformation. The retrieved data from long term storage media should be possible to be presented in form of X-T display, X-Y display, logs, reports, etc.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM PAGE 7 OF 12

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
9.00.00	CONTROL & POWER SUPPLY SCHEME			
9.01.00	General Requirements The requirements of Electrical Power Supply system are specified herein on system basis. The Contractor shall be responsible for engineering and furnishing a complete and operational system fully meeting the intent and requirements of this specification including tender drawings. All equipment and accessories required for completeness of this system shall be furnished by the Contractor whether these are specifically mentioned herein or not. All the equipments and sub systems offered shall be from reputed experienced manufacturers. All system cabinets, enclosures, & distribution boards shall be manufactured, assembled, wired and fully tested as a complete assembly as per the requirements of this specification at the manufacturer's works. 24 V DC power supply system shall be provided as below:- (A) 24V DC power supply system for PLC based control system shall comprise of two sets, each set shall consist of 1 x 100% Chargers, 1 x 100% Nickel - Cadmium batteries for one (1) hour duty, 1 X 100% DC distribution board. For specification of power supply system refer Sub Section-IIIC-05, Part-B of Specification. (B) All interconnection hardware including cables to be provided. (C) For Hydrogen Plant, 24V DC supply shall be provided as per Cl. 1.03.00(D), Sub Section-IIIC-05, Part-B of Specification. Uninterrupted Power Supply of required capacity shall be provided by contractor for HMI and other relevant equipment of Hydrogen Generation Plant.			
10.00.00	CONTROL CABINETS / PANELS			
10.01.00	The cabinets shall be IP-22 protection class. The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. This shall be demonstrated to the Employer during the factory testing of the system. The Contractor shall ensure that the temperature rise is limited to 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition as specified in Sub-section-basic Design criteria (Part-B, Section-VI) and specification requirements for remote I/O cabinets. Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper enclosure and details shall be furnished with proposal. Suitable louvers with wire mesh shall be provided on the cabinet.			
10.01.01	The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables.			
10.01.02	The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications, preferred height of the cabinet is 2200 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Contractor during detailed engineering.			
10.01.03	Cabinet doors shall be hinged and shall have turned back edges and additional braking where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at			
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.		
10.01.04	Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm. The finish colors for exterior and interior surfaces shall conform to following shades: (a.) Exterior:- As per RAL 9002 (End panel sides RAL 5012), to be finalized during detailed engineering. (b.) Interior:- Same as above.		
10.01.05	Paint films which show sags, checks or other imperfections shall not be acceptable.		
10.01.06	As an alternative, single coat of anodic dipcoat primer along with single textured powder coating with epoxy polyester meeting the thickness requirement is also acceptable.		
10.01.07	Refer Subsection Basic Design Criteria, Part B, and Section VI for grounding requirements.		
10.01.08	The mimic shall be configured on the OWS and it shall be possible to control, monitor and operate the plant from the same.		
10.01.09	The technical specification covering panel fabrication details, wiring and termination details etc. shall be as described under Sub-Section INST CABLE of this specification.		
11.00.00	ANNUNCIATION SYSTEM		
11.01.00	Only OWS based alarm system shall be provided with audio alarm facility (beep/tone generator). No facia annunciation is envisaged in the control room. Hooters are to be provided.		
11.02.00	The system shall display history of alarms in chronological order on any of the OWS. The system shall have all alarm functions and related function keys like alarm acknowledge, reset, paging, summaries etc. The alarm display/report format shall be as approved by the Employer.		
11.03.00	Facility of audio annunciation shall be provided in OWS upon the occurrence OWS alarms irrespective of whether alarms are displayed or not. Facility to disable the audio annunciation shall be provided.		
11.04.00	At least three levels of alarm priority shall be available which will be displayed in different colour. It shall be possible to display & print alarms of any of the three levels. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration		
11.05.00	Alarm boxes shall be provided in each display to alert the operator about an alarm when he is viewing some other picture. No of alarm boxes shall be finalised during detailed engineering for each process area & each priority therein. For Hydrogen Generation plant, Contractor's standard and proven practice in this regard shall also be taken into consideration		
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CLAUSE NO.	TECHNICAL REQUIREMENTS 	
12.00.00	CONTROL DESK	
12.00.01	Industry standard Control desk shall be provided to keep the TFT monitors at top and computers inside. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, mouse pads, monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal and vertical directions. PA system handsets, telephone sets, any PB stations and lamps required shall be mounted on the control desk on mosaic grid structure and same shall be decided during detailed engineering. ASCII Keyboard shall be capable of being pulled out through a tray.	
12.00.02	The cabling / wiring between OWS & CPU'S, power supply cables etc. shall be aesthetically routed and concealed from view.	
12.01.00	FURNITURE Chairs – Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back. Chair pedestal shall be made of 5mm thick MS plate covered with poly-propylene cladding. Arm-rests in one piece shall be of poly-urethane and twin wheel castor of glass filled nylon. The exact details shall be finalized & approved by Employer during detailed engineering. Tables -- Industry standard tables shall be provided for printers.	
13.00.00	SOFTWARE DOCUMENTATION AND SOFTWARE LISTINGS	
13.01.00	All technical manuals, reference manuals, user's guide etc., in English required for modification/editing/addition/deletion of features in the software of the PLC/ Control system shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system finalization for Employer's review and approval.	
13.02.00	All The software listings including source code for application software, All special - to-project data files etc. shall be submitted by the Contractor.	
14.00.00	SOFTWARE LICENCES The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project (e.g. organisation or site license) and shall not be hardware/machine-specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Employer to seek a new license/renew license due to upgradation/change of hardware/machine in Contractor's System at site. All licenses shall be valid for the continuous service life of the plant. As a customer support, the Contractor shall periodically inform the designated officer of the Employer about the software upgrades/new releases that would be taking place after the system is commissioned so that if required, same can be procured & implemented at site.	
15.00.00	(A) SPECIFICATIONS OF OWS The minimum requirement for PC based OWS shall be as below:	
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CLAUSE NO.	TECHNICAL REQUIREMENTS																										
	CPU	Latest generation CPU																									
	Removable bulk storage drive (MOD / DVD / DAT)	6 GB (minimum)																									
	Removable Bulk Storage Media for above	10 nos																									
	Monitor	Minimun 19" Full Flat TFT Resolution 1600 x 1280, refresh rate min 85 Hz.																									
	UPS	1 no. on-line Interactive UPS with 30 mins. battery backup on machine load (for PC & its printer)																									
	Software	a General MS Windows latest version, MS-Office, Microsoft Visual Studio, Adobe Acrobat, anti-virus McAfee or equivalent, etc. b Application software - to suit project specific requirement																									
	Accessories	Required furniture for mounting of HMI peripherals shall be provided.																									
(B) GRAPHICAL INTERFACE UNIT																											
The minimum requirement of Graphical Interface Unit are as follows:																											
<table><tr><th>SI No.</th><th>Description</th><th></th></tr><tr><td>1.</td><td>Power supply</td><td>24 V DC/</td></tr><tr><td>2.</td><td>Display Type</td><td>10.4" Colour, TFT screens with keypad</td></tr><tr><td>3.</td><td>Humidity & Operating Temperature</td><td>5-95%, 0-50 deg C</td></tr><tr><td>4.</td><td>Protection class</td><td>IP-65 for extremely dust prone area, otherwise IP-55. Enclosure shall be provided to prevent ingress of dust.</td></tr><tr><td>5.</td><td>Keys</td><td>Function keys and numeric keys</td></tr><tr><td>6.</td><td>Interfacing requirements</td><td>Interface with PLC system</td></tr><tr><td>7.</td><td>Functional requirements</td><td>Ability to operate drives locally using function keys Graphics display including alarms and operator guidance messages</td></tr></table>				SI No.	Description		1.	Power supply	24 V DC/	2.	Display Type	10.4" Colour, TFT screens with keypad	3.	Humidity & Operating Temperature	5-95%, 0-50 deg C	4.	Protection class	IP-65 for extremely dust prone area, otherwise IP-55. Enclosure shall be provided to prevent ingress of dust.	5.	Keys	Function keys and numeric keys	6.	Interfacing requirements	Interface with PLC system	7.	Functional requirements	Ability to operate drives locally using function keys Graphics display including alarms and operator guidance messages
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			PAGE 11 OF 12																								

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
16.00.00 16.01.00	Note: Refer Appendix to Part-A FOR QTY of GIU. PRINTER One number A4 size color laser printer at hydrogen generation plant control room shall be provided as a part of the HMIS system. It shall print out all alarm/trip conditions and event changes in plant status along with date and time of occurrence.		
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SUB-SECTION – B-16

BATTERY CHARGER

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)**

**TECHNICAL SPECIFICATION
SECTION – VI, PART-B
BID DOC NO. : CS-9585-001-2**

CLAUSE NO.	TECHNICAL REQUIREMENTS 			
1.00.00 1.01.00	BATTERY CHARGER CODES AND STANDARDS			
	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of techno-commercial bid. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards and codes.			
	ANSI-C 37.90a	Guide for surge withstand capability tests		
	IS:5	Colours for ready mix paints.		
	IS : 694	PVC Insulated Cable for working voltages upto and including 1100 V.		
	IS : 1248	Specification for Direct acting indicating analogue electrical measuring instruments.		
	IS:13947 Part-1	Degree of protection provided by enclosures for low voltage switch gear and control gear.		
	IS : 13947	Specification for low voltage switch gear and control gear		
	IS : 3231	Electrical relays for power system protection.		
	IS : 3842	Application guide for Electrical relays for AC System		
	IS : 3895	Mono-crystalline semi-conductor Rectifier Cells and Stacks		
	IS : 4540	Mono crystalline semi-conductor Rectifier assemblies and equipment.		
	IS:6005	Code of practice for phosphating of Iron and Steel.		
	IS:6619	Safety Code for Semi-conductor Rectifier Equipment.		
	IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto 1000 V AC or 1200 V DC.		
	IS : 9000	Basic environmental testing procedures for electronic and electrical items.		
	IS:13703	Low voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.02.00	EEUA-45D	Performance requirements for electrical Alarm Annunciation System	
		Indian Electricity Rules	
		Indian Electricity Act.	
	Equipment complying with other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.		
2.00.00	EQUIPMENT DESCRIPTION		
2.01.00	PART-I BATTERY CHARGER FOR LEAD ACID PLANTE TYPE BATTERY		
	(a.) The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 2.25 Volts per cell. All chargers shall also be capable of Boost Charging the associated D.C. Battery at 2.3 to 2.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C. (b.) All Battery Chargers shall have provision to receive two input supplies along with suitable automatic changeover between the sources. (c.) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging. (d.) All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition. (e.) Soft start feature shall be provided to build up the voltage to the set value slowly within fifteen seconds. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode. (f.) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3/-5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step-less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations(w.r.t. temperature) as suggested by the respective battery manufacturer. Step-less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode. (g.) During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type. (h.) Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds. (i.) Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change. (j.) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION-VI, PART-B BID DOC.NO.:CS:9585-001-2	SUB-SECTION B-16 BATTERY CHARGER	PAGE 3 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device. (k.) Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery. (l.) The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided by the Employer in the DC distribution board for remote annunciation. (m.) Digital Outputs shall be configured for connection to the DC health monitoring system for real-time charger status updation. Outputs like charger output current, output voltage, float/boost mode, etc may be configured.			
2.02.00	PART-II BATTERY CHARGER FOR NICKEL-CADMIUM TYPE BATTERY (a.) The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Nickel-Cadmium Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost Charging the associated D.C. Battery at 1.53 to 1.7 Volts per cell at the desired rate. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C. (b.) All Battery Chargers shall have provision to receive two input supplies along with suitable automatic changeover between the sources. (c.) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging. (d.) All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition. (e.) Soft start features shall be provided to build up the voltage to the set value slowly within fifteen seconds. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter			
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	characteristic shall be such that any sustained overload or short circuit in DC system shall not damage the Charger, nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode. (f.) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of +/-10%, frequency variation of +3 to -5%, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and stepless adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations(w.r.t. temperature) as suggested by the respective battery manufacturer. Stepless adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode. (g.) During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type. (h.) Energising the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilise, to within the specified limits as mentioned elsewhere shall be less than fifteen seconds. (i.) Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change. (j.) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
	(k.) Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery. (l.) The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided by the Employer in the DC distribution board for remote annunciation. (m.) Digital Outputs shall be configured for connection to the DC health monitoring system for real-time charger status updation. Outputs like charger output current, output voltage, float/boost mode, etc may be configured. 2.03.00 Printed Circuits Boards (PCB) PCB shall be made of glass epoxy of 1.6 mm thick, fire resistant, bonded with 99.8% pure copper foil, free of wrinkles, blisters, scratches and pinholes. The contact surface of the edge connectors of the PCBs shall be plated with hard gold to a minimum thickness of 5 microns. Component identification shall be printed on PCB by silk screen method. All PCBs shall be tropicalised and masked. 2.04.00 CONTACTORS All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. The operating coil shall be rated for 415 Volts AC. 2.05.00 Thermal Overload Relay A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor. 2.06.00 Rectifier-Transformers and Chokes The rectifier transformer and chokes shall be dry and air cooled (AN) type. The rating of the rectifier-transformers and chokes shall correspond to the rating of the associated rectifier assembly. The rectifier-transformers and chokes shall have class-B insulation with temperature rise limited to class-A insulation value. 2.07.00 Rectifier Assembly The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger. The rectifier cells shall be provided with their own heat dissipation arrangement with natural air cooling for up to 400A rating chargers. However, the rectifier cells shall be provided with their own heat dissipation arrangement along with forced air cooling for above 400A rating chargers and fan shall be temperature controlled with 100%		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	standby redundancy. The rectifier shall utilise diodes/thyristors and heat sinks rated to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 85°C absolute duly considering the maximum charger panel inside temperature. The Contractor shall submit calculations to show what maximum junction temperature will be and what the heat sink temperature will be when operating at 200% and 100% load current continuously duly considering the maximum surrounding air temperature for these devices inside the charger panel assuming air ambient temperature of 50°C outside the panel. Necessary surge protection devices and rectifier type fast acting fuses shall be provided in each arm of the rectifier connections.			
2.08.00	DIGITAL INDICATING INSTRUMENTS Digital indicating instruments with built in communication port for remote data transfer shall be provided for all chargers. The instruments shall indicate DC current, DC voltage & AC voltage and instrument shall be 96 x 96 mm², with display accuracy 0.5%, 4 digit-7 segment LED/LCD display and RS 485 Serial Bus port.			
2.09.00	AIR BREAK SWITCHES All Chargers shall have AC input and DC output switches of air break, single throw, load break and fault make type. The contacts of the switches shall open and close with a snap action. Switches shall be rated for 120% of the maximum continuous load. 'ON' & 'OFF' position of the switch shall be clearly indicated.			
2.10.00	CONTROL AND SELECTOR SWITCHES Control and selector switches shall be of rotary stayput type with escutcheon plates showing the functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred. The contact ratings shall be atleast the following: (a.) Make and carry continuously – 10 Amps. (b.) Breaking current at 220 V DC – 0.5 Amp. (inductive) (c.) Breaking current at 240 V AC – 5 Amp. At 0.3 p.f.			
2.11.00	FUSES Fuses shall be of HRC cartridge fuse link type. Fuses shall be mounted on fuse carriers which are mounted on fuse bases. Wherever it is not possible to mount fuses on fuse carriers, fuses shall be directly mounted on plug in type bases. In such cases one insulated fuse pulling handle shall be supplied for each charger. Kick-off fuses (trip fuses) with alarm contacts shall be provided for all D.C. fuses.			
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2.12.00	Indicating Lamps Three (3) indicating lamps shall be provided to indicate A.C. supply availability. The indicating lamp shall be of panel mounting, filament type low wattage or LEDs and capable of clear status indication under the normal room illumination. The lamps shall be provided with series resistors (non-hygroscopic) preferably built in the lamp assembly and replaceable from front. The lamp covers shall be preferably screwed type, unbreakable and moulded from heat resistant material			
2.13.00	Blocking Diode Blocking diode shall be provided in the output circuit of each Charger to prevent current flow from the D.C. Battery into the Charger.			
2.14.00	Annunciation System Visual indications through indicating lamps/LEDs or annunciation fascia as per EEUA-45D shall be provided in all Chargers for the following: (a.) A.C. supply failure (b.) Rectifier fuse failure (c.) Surge circuit fuse failure (d.) Filter fuse failure (e.) Load limiter operated (f.) Charger trip (g.) Battery on Boost Potential free NO contacts of all above conditions shall be provided for following remote alarms in the Employer’s Unit Control Board: (a) Battery on Boost (b) Charger trouble (this being a group alarm initiated by any of the faults other than ‘Battery on Boost’)			
2.15.00	Name Plates and Marking The name plates shall be made of non-rusting metal/3 ply Lamicoid and shall have black back-ground with white engraved letters and secured by screws. These shall be provided near top edge on the front as well as on rear side of Charger. Name plates with full and clear			
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	inscriptions shall also be provided on and inside the panels for identification of the various equipments.			
3.00.00	CONSTRUCTION			
3.01.00	The Chargers shall be indoor, floor mounted, self supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The lugs for cables shall be made of electrolytic copper with tin coat. Cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and gland plates. The Charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed. The degree of protection of Charger enclosure shall be atleast IP-42.			
3.02.00	All indicating instruments, control & selector switches and indicating lamps shall be mounted on the front side of the Charger. Design of panels shall be based on the following dimensions.			
	1)	Overall height	-	Maximum 2350 mm
	2)	Operating handles	-	Maximum 1800 mm
		(highest and lowest positions reached by operator's hands),		Minimum 350 mm
		protective mechanical indicators		
	3)	Doors and panel	-	Maximum 1800 mm
		handles and locks		Minimum 300 mm
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3.03.00	The layout of Charger components shall be such that their heat losses do not give rise to excessive temperature within the Charger panel surface. Location of the electronic modules will be such that temperature rise of the location, in no case, will exceed 10°C over ambient air temperature outside the Charger.			
3.04.00	Each Charger panel shall be provided with an illuminating lamp and one 5 Amp. Socket. Switches and fuses shall be provided separately for each of the above.			
3.05.00	Locking facilities shall be provided as following: 1. For locking Trickle/Boost selector switch in the trickle position only. This would be used for having key mechanical interlock between Trickle/Boost selector switch and isolator in D.C. distribution board which is being procured separately by the employer. The co-ordination & execution of this interlock shall be carried out by the contractor. 2. The Charger enclosure door locking requirements shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.			
3.06.00	Wiring			
3.06.01	Each Charger shall be furnished completely wired upto power cable lugs and terminal blocks ready for external connection. The power wiring shall be carried out with 1.1 KV grade PVC insulated cables conforming to IS:1554 (Part-I). The control wiring shall be of 1.1KV grade PVC insulated stranded copper conductors of 2.5 sq.mm. conforming to IS:694. Control wiring terminating at electronic cards shall not be less than 1.0 sq. mm. Control terminal shall be suitable for connecting two wires with 2.5 sq.mm. stranded copper conductors. All terminals shall be numbered for ease of connections and identification. At least 20% spare terminals shall be provided for circuits.			
3.06.02	Power and control wiring within panels shall be kept separate. Any terminal or metal work which remains alive at greater than 415 V, when panel door is opened, shall be fully protected by shrouding.			
3.06.03	An air clearance of at least ten (10) mm shall be maintained throughout all circuits, except low voltage electronic circuits, right upto the terminal lugs. Whenever this clearance is not available, the live parts should be insulated or shrouded.			
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3.07.00	PAINTING Treatment as per IS:6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.			
4.00.00	TESTS			
4.01.00	All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of techno-commercial bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
4.02.00	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.			
4.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.			
4.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design change". Minor changes if any shall be highlighted on the endorsement sheet.			
4.05.00	GENERAL 1. The contractor shall furnish the following type tests reports for each rating of the equipment to be supplied under this contract. a) Complete physical examination b) Temperature rise test at full load. (For chargers of up to 400A rating, Temperature rise test report for rectifier assembly at 200% of full load shall also be submitted.) c) Insulation resistance test. d) High voltage (power frequency) test on power and control circuits except low voltage electronic circuits.			
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	e) Ripple content test at i) No load ii) Half load iii) Full load f) Automatic voltage regulator operation test at specified A.C. supply variations at i) No load ii) Half load iii) Full load g) Load limiter operation test h) Efficiency and power factor measurement. i) Input and output surge withstand capability test. Surge Voltage as per ANSI-C37.90a shall be applied for period not less than 2 sec. At the following points of the Charger operating at full load : i) Across each A.C. input phase ii) Across AC input line to ground. iii) Across D.C. output terminals. iv) Across each D.C. output terminal to ground The Charger shall not exhibit any component damage and there shall be no change in performance as per (g) and (h).			
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	j) Environmental Tests Steady state performance tests (f) and (g) shall be carried out before and after each of the following tests. i) Soak Test The electronic modules shall be subjected to continuous operation for a minimum period of 72 hours. During last 48 hours, the ambient temperature shall be maintained at 50 deg. C. The 48 hour test period shall be divided into four equal 12 hour segments. The input voltage during each 12 hours shall be nominal voltage for 11 hours followed by 110% of nominal voltage for 30 minutes, followed by 90% of nominal voltage for 30 minutes. ii) Degree of protection test. 2. Dynamic response test and Temperature rise test at full load shall be carried out on each charger before dispatch at manufacturer's works.			
5.00.00	COMMISSIONING			
5.01.00	The contractor shall carryout the following commissioning tests and checks after installation of the equipment at site: a) Complete physical examination. b) Checking of proper operation of annunciation system. c) Insulation resistance test. d) Automatic voltage regulator operation. e) Load limiter operation. f) Updation of charger status in DC Battery Health monitoring system.			
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ANNEXURE – 14

(FPS Specification)

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1.00.00 1.01.00 1.02.00 1.03.00 1.04.00 2.00.00 2.01.00 3.00.00 3.01.00	FIRE PROTECTION AND DETECTION SYSTEM GENERAL DESCRIPTION A comprehensive Fire Detection and Protection System covering all the areas of the power plant including Employer's facilities/ system /buildings, service building , Administrative building, Auditorium building, Canteen, IT building, permanent stores, Township, is included in the scope of the Contract. The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/ standards / rules of TAC/ NFPA / IS: 3034 / OISD etc. and all the systems, equipments and installation shall be got approved from TAC accredited professional(s)-India. Fire Water Source Water for the Fire Protection system shall be drawn from fire water storage tanks to be provided by the Bidder. Water for filling up the fire water storage tanks shall be drawn from the following two sources: - From Circulating System blow down - From raw water header as second source. Fill in line from above two sources shall be in the scope of fire fighting vendor. Bidder shall interconnect the same to each of the fire water tank through individual motorised isolation valve. Raw water make-up line to tanks shall be provided with Basket strainer & an isolation valve of suitable size. Pressurisation System This system consists of two (2) nos. electric motor driven jockey pumps (1 no. working + 1 no. stand-by). HYDRANT SYSTEM Hydrant system shall consist of Hydrant pumps, pressurization arrangement, water mains network, hydrant valves, landing valve, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose houses etc. Areas to be Covered Complete main plant, & off site areas including CHP, PT & DM plant, Ash handling plant including its conveying system, FGD, Ash silo area and Air compressor house, CPU regeneration area, ACW, ESP building & chimney area,, FGD area, CHP area, Fuel oil unloading & pumping area, switchyard (GIS Building), water treatment area, and other auxiliary & miscellaneous buildings / areas including township under the scope of the Bidder. HVW AND MVW SPRAY SYSTEM General It shall consist of: Spray pumps, pressurization arrangements, water mains network, deluge valves, alarm valves, flow switches, isolation valves, Y-type strainers, spray nozzles/projectors, spray nozzles piping network, detection system, instrumentation, local control panels, cables etc.
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3.02.00	Spray system shall mainly comprise of the following:- • Automatic deluge valve (DV) assembly suitable size and trims • Isolation (butterfly) valve at the upstream & downstream of each DV • Y-strainer of suitable size at upstream of each dv • S.S Spray nozzles • QB Detectors • Solenoids valve for each DV • One (01) no. pressure switch each in detection line & spray discharge • One (01) no. limit switch for each isolation valve • Local control Panel with relays and interface units for each DV • GI piping for spray network at downstream of DV • 25NB M.S. Black wet detection piping network.			
3.03.00	Areas to be covered by HVW Spray System - All transformers located in transformer yard of main plant. - All other transformers having oil capacity above 2000Ltrs & located with-in plant boundary. - Steam Turbine Lube oil storage tanks, oil coolers and purifier units. - Central Lube oil tanks (Both Clean oil & dirty oil units) and purifier units. - Boiler Feed Pumps lube oil tanks, coolers, purifier, consoles, etc. - Generator seal oil system tanks, cooler assembly, etc. - Turbine Oil canal pipelines in main plant. - Boiler burner fronts including fuel oil racks at boiler. - Apart from above any other equipments/systems having requirements of HVW spray protection.			
3.04.00	Areas to be covered under MVW Spray System - All cable galleries/ cable vault/ cable spreader room in main plant including ESP control room building, FGD control building and switchyard control room, etc. - Employer's facilities viz.- Feeder transfer point, Coal conveyors, ash conveying system, transfer points, crusher house, etc. - All the un-insulated liquid fuel oil tanks (including HFO & LDO tanks) storing fuels of flash point less than 65 deg. C.			
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	iv) All the Fuel oil pumping (unloading & pressurizing) stations and DG set oil tanks. v) For Stacker-Reclaimer machines, MVW spray system shall cover both boom conveyor & intermediate &/or tripper conveyors and associated structure. Water for spray system shall be tapped from hydrant header running along the stock-yard. For this, combination of butterfly valves & quick cam couplings (SS-304 construction) with one end flanged shall be provided at every 20M interval in the hydrant header running along the stock yard. Whenever, Stacker-reclaimer is in stationary condition, a flexible hose (SS-304 construction) with suitable end coupling shall be connected to quick cam coupling installed on hydrant header. The other end of flexible hose shall be permanently connected to Deluge valve. vi) Apart from above any other equipments/systems having requirements of MVW spray protection. Note: Criteria for taking two (2) spray pumps in service:- While designing the HVW/MVW spray system for crusher house, HFO & LDO tanks, etc. where flow of one spray pump of 410m³/hr may not be adequate, operation of two (2) spray pumps shall be considered. In such a situation, suitable arrangement shall be done to start the second spray pump automatically from PLC/Fire alarm panel on receipt of fire signal from respective areas.			
3.05.00	BLADDER TYPE FOAM PROTECTION SYSTEM			
3.05.01	GENERAL The fixed foam system of bladder tank foam proportioning type consist of skid mounted foam bladder tank assembly, foam makers, discharge outlets, interconnection piping, valves, fittings and instrumentation. Semi-fixed system consisting of a separate foam solution ring main around the tank with foam hydrant valves at regular intervals shall also be provided in addition to the water hydrants. The operation of the fixed foam system shall be automatic with the aid of dedicated fire detection system provided in the tank. The semi-fixed system shall be operated through the foam hydrants/ monitors, portable type foam water monitors (wheeled type with in-built foam maker), hoses and nozzles for extinguishing spill fire in and around the tank area.			
4.00.00	FIRE EXTINGUISHERS, FIRE TENDER AND FIRE STATION EQUIPMENTS			
4.01.00	Fire Extinguishers As indicated in Bidder's Scope (Refer Relevant Sub-section, Part A, Section VI).			
4.02.00	Fire Tender & Fire Station Equipments As indicated in Bidder's Scope (Refer relevant sub-section, Part A of scope, Section VI).			
5.00.00	FIRE DETECTION, ALARM AND CONTROL SYSTEM			
5.01.00	Codes and Standards			
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5.02.00	a. The design, manufacture, testing, performance, etc. of the various components of the analog addressable Fire Detection and Alarm System shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the contractor of this responsibility. b. Unless otherwise specified, the Fire Detection and Alarm System and the components shall conform to the latest applicable Indian or IEC Standards. Equipment complying with any other authoritative National Standards such as British, USA, VDE, etc. will also be considered, provided the parameters specified are equivalent or better than the corresponding IS. c. The Contractor shall be solely responsible for obtaining the required approval and clearance for the different components and systems of the Fire Detection and Alarm System from the following authorities, as applicable: d. Department of Atomic Energy (Certification of safety from Radioactivity). e. Central Building Research Institute, Roorkee. f. Central Mining Research Station, Dhanbad. g. Local Fire Authorities. h. The equipment and the system shall be of types approved by any of the following bodies, as applicable: i. Loss Prevention Council, (LPC), U.K. j. National Fire Protection Association, (NFPA), USA k. Under-writers laboratories, (UL), USA i. Factory mutual(FM) Areas to be covered under Fire detection and alarm System a) Multisensor type detection system (Above and below the false ceiling or below the false flooring as the case may be) i) All switchgear / MCC/battery rooms of main plant, ESP, FGD, Switchyard (GIS control room building), various auxiliary buildings like ash handling system, condensate polishing plant, water treatment plant, pump houses, service building, administrative & auditorium building, Canteen, Township, etc. ii) Cable galleries of main plant, ESP, FGD & switchyard (GIS control room building) protected by MVW spray system. Further, multisensory detectors shall also be provided inside all cubicles/panels of control room, control equipment room and UPS / Battery charger areas. iii) Above and Below false ceiling areas of all air-conditioned rooms of main plant building, ESP building, FGD control building, service building, administrative & auditorium building, canteen, Township, various control rooms of auxiliaries as defined in Sl. No. (i) above and return air ducts of inert gas protected areas.			
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	b) Linear heat sensing cable detection system Coal conveyors, Boom & Tripper/ Intermediate conveyor of stacker-reclaimer machines and various Cable Galleries covered under MVW Spray System. Further, Gypsum and ash conveying system shall also be provided with LHS cable. c) Quartzoid bulb heat detection system Equipments protected by HVW spray system, coal conveyors, HFO/LDO/DAY tanks and fuel oil unloading & pressurizing pump houses protected by MVW spray system. d) Probe type heat detectors for HFO & LDO tanks. e) For buildings / enclosures with High height like Auditorium, etc. Beam Detectors shall be provided for fire detection system. f) Minimum twelve (14) nos. Infrared Detectors (IRDs) shall be provided at strategic location of various coal conveyors and other conveyor. Location of IRDs shall be finalized during detailed engineering. 5.03.00 General requirements for all types of Detectors 5.03.01 Detectors shall be housed or mounted in suitable enclosure in such a way that their performance is in no way affected. Special maintenance procedures if any required for the satisfactory operation of the detectors shall be clearly stated in the bid. 5.03.02 Necessary mounting accessories shall be provided for all the detectors. 5.03.03 In case the detectors are offered with their output (on sensing a fire) in the form of an electrical contact, it shall be noted that the contact shall be 'NC' type such that under fire conditions, this contact will open to initiate the fire alarm system. 5.03.04 Detectors shall preferably be designed as plug-in units, which fit into various bases according to place and type of mounting. This would also enable interchangeability. 5.03.05 Detectors shall be provided with the necessary compression type cable terminating glands for the incoming cables of flameproof type or PVC/metallic flexible/rigid conduits. 5.03.06 Depending upon the environmental conditions in which detectors are installed, chlorinated rubber based or epoxy or equivalent paint shall be used for finishing the surface of the enclosure. 5.03.07 The coverage or the zone of protection afforded by the detector and recommended height of mounting shall be furnished by the Bidder. The bidder shall furnish the test certificate in support of this. 5.03.08 Any metal parts used for detector construction shall be inherently resistant to corrosion or shall be plated or otherwise suitably treated to afford protection against corrosion. The plating or treatment shall in no way affect the detector performance.			
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5.03.09	Any plastic material or any sealing compound used in the detector shall be such as it will not deform or fail under the maximum temperature to be expected.			
5.03.10	No detector shall contain any moving parts subject to wear and tear and must be able to operate afresh after each alarm release, without its exchange or adjustment.			
5.03.11	The detector shall be located where the largest combustion gas concentration can be expected.			
5.03.12	Adequate compensation and considerations shall be made for effects for wind velocities such as air-conditioning system and exhaust fans where dilution of particles of combustion is greater.			
5.03.13	The exact location of detectors shall be coordinated with other services like air-conditioning grills, light fittings, cable trays etc. to provide aesthetically pleasing appearance. The return air paths of air-conditioning shall be avoided for detector location.			
5.03.14	The detectors shall not be affected by temperature, humidity; air flow or by drift failures and shall not give any false alarm due to above.			
5.03.15	The detectors shall not be sensitive to vibrations. Any special mounting arrangements required to counteract vibration shall be included in the contractor scope.			
5.03.16	The quantity of multi- sensor detectors in each zone shall be based on the coverage factor of 25-sq. meter per detector. However the actual quantity of detectors required, taking into consideration obstructions due to floor beams, ventilation, doors, windows etc., shall be worked out and supplied (based on the actual layout) and installed by the contractor.			
5.03.17	The detectors shall not give false alarm due to high humidity, temperature, and velocity of air in the surroundings and static electricity conditions.			
5.03.18	Process actuated switch devices such as pressure switches, flow switches, level switches, etc. shall be provided with suitable individual addressable interface (local or remote) units or modules so that these devices are addressable from the panel.			
5.04.00	Infra-red Detectors			
	Application	Detection of Moving Fire on Coal Conveyor as well as hot spot beneath the surface		
	Sensor type	Infrared		
	Working voltage(detection)	24 V DC		
	Working voltage(purging)	230 V AC		
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5.05.00	Purging type	Air purging		
	Location	Head of the conveyor		
	Features	1. Ability to detect both black body and diffusion flame radiation. 2. Reject electric arc, heaters, artificial light sources and sunlight etc 3. Ability to function in heavily coal-dust prone atmosphere without regular maintenance 4. Insensitive to vibrations		
	Annunciations	Trouble in purging, Fault Alarm, Trip LED, Power supply ON		
	Output Controls	Two nos. Change over contacts for Alarm & Trip		
	Accessories	Air purge unit including blowers, starter for blowers, hose pipe etc		
	Linear Heat Sensor Cables			
	Application	Detection of Stationary fire		
	Type	Digital		
	Operating voltage	24 V DC		
	Approval	FM/UL		
	Conductor material	Steel		
	Insulation	Heat sensitive polymer		
	Outer Sheath	Black or colored PVC or flouropolymer suitable for the application environment		
	Installation features for LHSC/IR detectors			
	1. Mounting arrangement have been indicated in tender drawing. 2. The detection zone/loop divisions of LHSC system shall match with MVW spray zones. Conveyors where LHSC shall be installed shall be divided into no. of various zones whereas conveyor for which IR detector is installed shall be considered as one zone.			
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5.06.00	3. Linear heat sensing cable detector shall run in a zigzag fashion (with an included angle of 90 deg) on each top cable tray, bottom tray and every alternate intermediate trays of each section of cable tray without undue sagging and interfering the normal operations. All supporting materials for mounting of LHSC shall be provided by the bidder. Addressable Analog Intelligent Detectors In addition to the features specified under the item General requirements for all types of Detectors, the Addressable Analog Intelligent Detectors shall be provided with the following features: a) Detectors not specifically listed for sensitivity testing from the control panel are not acceptable due to the expense involved with manual testing as required by NFPA 72E. b) The detector shall be suitable for two-wire operation and two-way communication on the intelligent analog signaling circuit. c) The detector shall display a steady LED when in the Alarm State. The LED shall flash when in stand by or normal mode. d) Each detector in a loop shall have short circuit isolator suitable for style-7 wiring as per NFPA-72. e) Address and sensitivity assignments shall be set preferably electronically. However, dip switches / rotary switches for the same are acceptable. The detectors shall be assigned a sensitivity level based on environment, time of day or any programmable function as required by the system user, and shall respond at that level whether in the "on line" or "default" mode. f) The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. g) The detectors furnished shall be listed for use in environments as covered by Factory Mutual and UL and shall be installed according to the requirements of NFPA 72E for open area coverage.			
5.07.00	Multi sensor Detectors			
5.07.01	Multi sensor detectors shall incorporate a heat detection element and a photoelectric detection element. Both the elements shall be incorporated in a single unit. Both the elements shall be operative at all times and the fire signal shall be available from any or both elements combined together.			
5.07.02	The detectors shall be sensitive to very low smoke densities of the order of say 0.05 g/m ³ . Also it shall be possible to adjust this sensitivity on a step less basis over a range so that the optimum sensitivity could be selected at site to suit the conditions of installations. The coverage area of the smoke detection under standard NFPA test conditions shall not be less than 80-90m ² .			
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5.07.03	The detectors shall be complete with a mounting base that includes a terminal box into which the detector can be plugged in. Terminals for looping of the cables shall be provided.			
5.07.04	All detectors shall be provided with built-in response and indicating lamps which shall give local visual indication, when it has operated in dense smoke conditions. The failure of lamp shall not prevent the function of detector.			
5.07.05	In areas such as false ceiling where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.			
5.07.06	It shall be possible to replace any type of detector head by a different type detector without requiring change in cabling/panel wiring and condition of the zone, originally covered by the detector.			
5.08.00	System Configuration			
5.08.01	Each of the Addressable Fire Alarm panel shall be able to communicate with one another as well as with repeater annunciation panel and PLC based control panels located at different places. The detectors or other devices of any other unit/area shall be addressable only from the respective Addressable Fire Alarm Panel, so that each of the Addressable Fire Alarm Panel is under the control of designated operating personnel at that location. Facility to operate pumps of booster pump house and fire water pump house shall be provided from PC based monitoring station.			
5.08.02	At least one spare loop shall be provided in each of the addressable type fire alarm panel located in control equipment room and in CHP control room with complete loop card and all other accessories so that Employer can expand the system in future. Further, at least 10% of loop capacity be left free in each of the connected loop in all the panels, so that, additional devices may be connected to the system in any of the loop by Employer in future.			
5.08.03	Fire system (as a whole including PLC control systems) shall be provided with necessary interface hardware and software for dual fibre optic connectivity & interconnection with station wide LAN for two –way transfer of signals for information sharing. The information shall be made available through Ethernet link following TCP/IP standard. The system shall be OPC compliant. All required plant data shall be transferred ensuring complete security. The exact number of points shall be finalized during detailed engineering.			
5.09.00	Analog Addressable Fire Detection and Alarm System			
5.09.01	General Requirements			
5.09.02	This specification in general covers the functional requirements, and general design aspects of Microprocessor based, Analog Addressable Fire Detection Alarm / Annunciation and Control System.			
5.09.03	The following description intends to describe only the brief hardware and functional requirements, scope of hardware requirements etc. but the actual configuration of			
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	the system shall be in line with the prevalent normal practices in the industry and shall conform to latest product range of selected manufacturer. The fire detection and control system offered shall be complete in all respects for the safe and reliable operation of the entire system. Any additional hardware/software than those mentioned herein required to make the system complete shall be included in the scope of the Bidder.			
5.09.04	All the system and its equipment specifically detectors, interface modules, panels, power supply, battery chargers etc. shall be furnished from a single source and the same shall be new and latest state of the art products of manufacturer engaged in the manufacture of Integrated Microprocessor based Analog Addressable Fire Detection and Alarm System.			
5.09.05	All equipments such as detectors, panels etc shall be approved and listed by UL/FM/LPCB/VDS.			
5.09.06	All types of smoke detectors shall be of analogue addressable type. Conventional detectors with interface modules are not acceptable. Each zone of LHSC detector and each IR detector shall be provided with interface module.			
5.09.07	All the fire detection systems, process actuated switch devices such as pressure/flow/temperature switches and relays of control functions shall be hooked up with the analogue addressable fire detection and alarm system. Required addressable interface units shall be provided for various switch devices by the bidder to make them addressable.			
5.09.08	The wiring shall be of class-A as per NFPA-72.			
5.09.09	Bidder shall provide isolators at the start & end of the loop.			
5.09.10	The complete system shall include, but not be limited to the following: a) Master system CPU. b) Analog Addressable Fire Detection and Alarm System panels including alarm modules, system supervisory control modules, auxiliary output control modules etc. c) PC based monitoring station with colour graphic display terminal with programming and historical archiving facility along with laser printer. d) Power supplies, batteries and battery chargers. e) Analog addressable type smoke detectors. f) Non addressable type conventional detectors (Linear heat sensing cable detector/ infra red type heat detector) and switching devices each with its own addressable interface modules. g) Software and hardware as required for complete operation of the system.			
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	h) Complete Wiring/cabling including its conduits/trays/fixtures etc. i) The fire alarm control panel shall function as a communication interface between central processing unit and sensors. This panel shall have facility to process the input signal and to control all the input data received from initiating and indicating devices. j) Fire alarm control panel shall have filters to ignore false alarm and increase sensitivity to real fire from sensors. The sensitivity of each detector should be automatically raised if detectors are gradually polluted due to dust and dirt entering inside the detector. If detectors are more polluted the control panel shall give a warning. The trouble report shall indicate the location of device requiring service. k) Fire alarm control panel shall have printer to print out the alarm/ trouble occurrences. l) The CPU shall serve as the systems central processor. Software shall be designed especially for fire alarm annunciation system applications and shall monitor status of processing alarms according to priorities, controlling/processing communications and synchronizing all system activities. n) The system shall be able to recognize and indicate an alarm condition in a degrade mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels. o) All devices shall be individually identifiable for its type, its zone location, alarm set value, alarm and trouble indication by an unique alpha numerical label. p) The software logic modules and system database shall be programmable using a MS - Windows compatible program (latest version) on PC at site and required hardware shall be included in scope of supply. The system software programme shall be password protected and shall include full upload and download capability and during program upload or download through the PC, the capability of alarm reporting shall be retained. The software shall be downloaded to a PC for editing. The software shall enable Employer to add the spare loop provided in the fire alarm panels or addition of additional devices/detectors in any of the fire alarm panel. q) The system shall support the use of Color Graphic display terminal for the display of information in an appropriate format. r) The system shall include software for system data base, historical event log, logic, and operating system. The system shall require no manual input to initialise in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. s) Activation of any fire alarm initiating device shall display (LCD alpha numeric display) message in describing the device originating the alarm condition at			
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	the Central monitoring station, at alarm panel, simultaneously at the repeater annunciation panel and shall initiate the associated protection systems & other related control functions. Similarly activation of any supervisory circuit, (supervised valve closure, air pressure abnormal, fire pump trouble, water pressure low, etc.) or receipt of trouble report (primary power loss, open or grounded initiating or signaling circuit wiring, battery disconnect etc) shall display at the fire alarm control panel the origin of supervisory condition or origin of trouble condition as the case may be. It shall also record the occurrence of the event, the time of occurrence and the device initiating the same.			
	t) System configuration shall be menu driven and capable of being operated by, a person with no previous computer programming experience.			
5.10.00	System Functional Requirements			
5.10.01	The fire alarm panel shall evaluate the signals received from the detectors and shall handle the following functions: 1. System self monitoring and fault signaling. 2. Transmission of alarm and fault signals to the respective fire alarm panels and as well as in the repeater panel in fire station. Further, the panel shall activate a hooter/sounds in each of the area locally provided with fire/smoke detection system. Further, the system shall enable operation of spray system from the panel through monitoring station when the system operation is selected under remote, manual mode. 3. Initiate control functions like stoppage of conveyor, closure of fire doors, shutdown of draft fans, air-conditioning and ventilation plant/ equipment, opening smoke extraction vents, switching on smoke extraction equipment, emergency lighting etc. 4. Triggering stationary extinguishing systems such as clean agent system. 5. Supervising of unauthorised removal of a detector head from its base and giving a fault alarm on the control panel. 6. Supervising and monitoring the detection cabling, to indicate fault conditions in case of open/short circuit in the wiring. 7. Supervising by a separate annunciation window, changeover from mains supply to battery supply. "Mains On" indication shall be continuously on, as long as the main supply is available. 8. Facilitating simulation of fire conditions to enable the testing of circuits (without creating actual fire) under the test mode from the fire Alarm panel. 9. The control unit shall contain all the systems main switches lamps and fuses. Switches and lamps shall be easily identified even in closed casings. 10. All the circuits from the detectors to the panels and the circuits from panels to the actuating/operating devices of the respective extinguishing system shall be of closed loop type and shall be supervised for open-circuiting and			
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5.10.02	short-circuiting of cables. The cable fault shall be audio-visually annunciated on the panels. Separate hooters with different tones shall be provided for 'fault' alarms and 'fire' alarms. 11. Actuate solenoid valve in spray system in case of fire from respective fire alarm panel. For achieving this if any additional hardware is required like relays, power supply and cables, the same may be provided.			
	Analog Addressable Fire Detection and Alarm System shall also meet the following functional requirements: i. Each of the system shall support analog addressable detectors of all types, non-addressable type detectors/devices along with its addressable interface units/modules, Video display units etc. ii. Each of the devices and/or detectors shall be individually, uniquely and continuously addressable by the panel to which it is connected. iii. Detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the requirement for cleaning and tested by a single technician using the field test routine. Sensitivity of each of the detectors made available in the panel shall be adjustable from the panel. iv. The system shall be capable of self-adjustment to compensate for the accumulation of contaminants that would change the detector sensitivity in either a more or less sensitive direction to prevent false indications or failure to alarm in the actual fire conditions. The system shall annunciate a trouble condition when any analog addressable smoke detector reaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarm. v. Continuous supervision/monitoring of all the circuits and its components shall be made available from the panel for open, short circuits and grounding. vi. The system shall be able to recognize and indicate and alarm condition in a degraded mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels. vii. The system shall be programmable at site and required hardware shall be included in the scope of supply. The system software Programs shall be password protected and shall include full upload and download capability. During program upload or download the system shall retain the capability for alarm reporting. The system shall download to a PC for program editing. The software shall eligible employer to add the spare loop provided in the fire alarm panel or addition of additional devices/detectors in and of loop in any of the fire alarm panel. viii. The system shall support the use of color interactive History Reporting			
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5.11.00	video display terminal for the display of information in an appropriate format. ix. The system shall include software for system database, historical event log, logic and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state performing all programmed functions upon power restoration. x. Software logic modules and system database shall be programmable using a windows compatible program on PC. It shall be possible to program or edit the system database off site after down loading from the panel. xi. All detectors shall incorporate internal automatic temperature compensation to overcome the effects of either high or low ambient temperatures in the installed environment on the detector sensitivity. The detectors shall be tested at a specified frequency by raising the detector sensitivity level to the alarm threshold, to check the operation of the detector without system alarming automatically by the control panel. xii. In an alarm or trouble condition the following shall occur on the monitoring station: 1. Sound an audible. 2. Write details of the actuation to a system log file on the PC. 3. Print the details of the actuation to the system printer. 4. Activate the color graphic display system controls, providing functions such as zooming, scrolling of Alarms, troubles, etc. xiii. System configuration shall be menu driven and capable of being operated by a person with no previous computer programming experience.			
	Panel Display Requirements. System display shall consist of minimum 80 character back lighted alphanumeric LCD display readable at any angle. Thirty-two character customer defined custom messages shall describe the location of the active device. In addition to the above, the following features shall be available. a. The system shall be capable of programming to allow troubles occurred and restored in the system to be automatically removed from the display queue, eliminating the necessity for individual acknowledging of these events. This feature shall not affect the historical logging of events as programmed. b. As a minimum an LED display for “Alarm”, “Audible Silenced”, “Supervisory”, “Trouble”, “Security”, “Power On”, And “Partial System Disabled”. c. Touch activated membrane switches for “Alarm Acknowledge”, “Audible Silence”, “Supervisory Acknowledge”, “Security Acknowledge”, “Reset”,			
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5.12.00	“Display Hold”, And “Display Next”. d. All membrane switches shall be tactile with audible feedback when pressed. System Software Requirements i) The software shall control the operation, function and display of the graphic system and provide for automatic boot up and run from the hard disk drive of the computer. ii) All project specifics actuating device programming shall be capable of being carried out on site via password access. iii) The system shall monitor all alarm, supervisory; trouble and security conditions detected by the fire alarm control panel and provide separate disk based files, for each condition. These logs may be enabled, disabled, or cleared with password access. This log information is not to be lost upon power failure or fire alarm control panel reset. A utility file shall be provided to sort the log data by date or by device and display this information either on the screen or the system printer. iv) Selective memory storage up to 800 events, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports. a. Software shall allow selection of events to be logged, including; inputs as alarms, troubles, supervisors, securities, status changes and device verification; out puts, as audible control and output activation; action, as reset, set sensitivity, arm/disarm, override, password, set time and acknowledge. b. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory. v) Software has driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or desensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning. a. Values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 sec of system initiation from a "cold boot". During the boot sequence, alarms from detectors programmed with the feature shall be suppressed. When the full data history is active all devices shall be checked and any active alarms displayed.			
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	b. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty-four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state. c. The system shall be capable of monitoring the stage of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminate. d. The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference. vi) When an alarm or trouble is registered at the fire alarm control panel the graphics system shall display the first screen image for the first actuated device. The system shall be capable of zooming in for further information if required. At all times when in the alarm or trouble mode the fire control panel status i.e. number of current alarms and or troubles is to be displayed on the graphics screen.			
5.13.00	Power Supply for Fire Alarm Panels & Repeater Alarm Panel			
5.13.01	One set of 24V DC redundant power supply system comprising of 2 x 100% chargers and 1 x 100% batteries shall be provided for each fire alarm panel and repeater alarm panel. The batteries for fire alarm system shall be sealed maintenance free lead acid type. The battery backup for each fire alarm panel and repeater alarm panel shall be 24 hours and 30 minutes (in alarm conditions). At least 25% of the devices shall be considered to be active in alarm conditions. Each of the redundant chargers shall be sized to meet connected load requirements and keep the connected batteries full charged (Float Mode). Furthermore, the charger shall be sized to enable the boost charge of a fully discharged battery in 10 hours while feeding the load.			
5.13.02	The batteries shall be sized as per relevant IEEE standard. For battery sizing calculation, an aging factor of 0.8, a temperature correction factor (based on temperature of 4 deg. C), voltage drop of 2V in cables. Capacity factor, Float Correction Factor, as per Battery Supplier Standard, shall be taken into consideration, if applicable and ambient temperature shall be considered as the electrolytic temperature. The sizing of the battery shall be as approved by Employer during detailed engineering.			
5.13.03	The battery chargers and batteries shall be placed at a suitable location inside the fire alarm panel with partitions.			
5.13.04	The detailed specification related to power supply system of fire detection & protection system shall be as specified in other sections of the technical specification.			
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5.14.00	Control & Instrumentation requirements																			
5.14.01	The specification for PLC control system for fire protection system shall be as specified in other sections of the technical specification.																			
5.14.02	The specification for PC, printer and other HMI items shall be as specified in other sections of the technical specification.																			
5.14.03	The specification related to Basic design criteria, Measuring Instruments, Process connection & piping, Control panels, Type test requirements etc shall be as specified in other sections of the technical specification.																			
5.15.00	Cabling for fire alarm system All instrumentation cables twisted & shielded, FRLS PVC insulated and sheathed data highway / fibre optical cables, short term fire proof cables including prefabricated cables (with plug-in connectors) etc shall be provided by Contractor. The contractor shall follow the cable philosophy as below:																			
		<table><tr><th colspan="2">Application</th><th rowspan="2">Type of cable</th></tr><tr><th>From</th><th>To</th></tr><tr><td>PLC cabinets</td><td>PC, Printers etc.</td><td>As Mfr.'s Standard. However, connection between PLC and the remote I/Os shall be through fibre optic cable by Bidder if length is>300 M & coaxial cable if length<300 M</td></tr><tr><td>Detectors (including detectors mounted inside panels) /Any loop device</td><td>Detector (including detectors mounted inside panels) / Isolator/ Interface unit</td><td>Shielded, Twisted, PVC Cu. FRLS cables type "S" Refer Note 2 below.</td></tr><tr><td>Detectors (including detectors mounted inside panels) / Isolator / Interface Unit</td><td>JB</td><td>Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.</td></tr><tr><td>JB</td><td>Fire alarm Panel</td><td>Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.</td></tr></table>		Application		Type of cable	From	To	PLC cabinets	PC, Printers etc.	As Mfr.'s Standard. However, connection between PLC and the remote I/Os shall be through fibre optic cable by Bidder if length is>300 M & coaxial cable if length<300 M	Detectors (including detectors mounted inside panels) /Any loop device	Detector (including detectors mounted inside panels) / Isolator/ Interface unit	Shielded, Twisted, PVC Cu. FRLS cables type "S" Refer Note 2 below.	Detectors (including detectors mounted inside panels) / Isolator / Interface Unit	JB	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.	JB	Fire alarm Panel	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.
Application		Type of cable																		
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JB	Fire alarm Panel	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2 below.																		
		Notes: 1. 10% spare pair shall be provided for all cables having more than four pairs. 2 Type "S" cable shall satisfy requirements of Article 760 NFPA 70.																		
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5.16.00	3. Over and above, contractor may note that short term fire proof cables shall be provided for coal handling plant and inert gas protected areas. Short term fire proof cables shall be Mineral insulated copper conductor and copper sheathed type satisfying requirements of Fire resistance, safety in the industrial application areas mentioned in the specification and also, shall be approved by UL standards and certified by LPCB. The contractor shall provide all the cables so as to complete the system 4. The detailed specification of cables shall be as specified in other sections of the technical specification. Detection System for Coal Conveyors i) Linear Heat Sensor Cables: a) The LHS cable detector for each conveyor to be provided for both forward and return conveyors and shall be mounted as per the standard practice of the manufacturer/ supplier. Suspension of LHSC through flexible chains is a preferred arrangement. Further, LHS cable shall also be provided for return side of conveyors inside the bunker house. b) The detection zone/loop divisions of LHSC system shall match with the MVW spray system. c) Upon detection of fire either by QB detector or LHSC detector, the spray system shall be initiated. It shall also initiate spray system for the two adjacent zones after a time delay settable at site. d) The LHSC detector shall be provided with suitable interface unit, which shall generate/ make the signal compatible with fire alarm panel. (e.) Type: Digital, Operating Voltage: 24V DC, Conductor Material: Steel, Approval: FM/UL ii) Infra Red Detector: (a.) The infra red type (IR) detectors shall be suitable for detecting moving fires in coal conveyors. The IR detector shall stop the conveyor upon detection of fire and give audio-visual annunciation locally and in fire alarm panel. (b.) Each of the IR detector shall be provided with its own purging arrangement using blowers, hoses, etc and required power supply shall be derived from the fire alarm panel. Alternatively, bidder may offer separate blowers (2x100%) for purge air supply for all the detectors and the complete air piping from the blowers to each of the IR detector shall be provided by the bidder.			
	5.17.00	Detection System of Cable Galleries i) In cable galleries, MVW spray system shall be actuated either by detection of fire by Linear Heat sensing cable detectors or by fire signal from Multisensor detection system. Apart from the automatic operation of spray system in the detected zone, the adjacent two zones shall also be sprayed with water automatically after a set time delay simultaneously.		
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5.18.00	ii) LHSC detector shall run in a zig-zag fashion (with an included angle of minimum 90 ⁰ atleast) in each of the top tray, bottom tray and in every alternate trays. The mounting arrangement of LHSC detector shall be as per manufacturer's standard practice.			
	iii) The detection zone/ loop divisions shall match with MVW spray zones.			
	Multisensor Detection System			
	i) Upon detection of fire, multisensor detector shall be annunciated in the respective panels and shall activate a local hooter/sounder in the areas where fire is activated and this fire signal shall be employed to initiate the fire extinguishing system of that area such as automatic MVW spray system of cable galleries, fire extinguishing system of Control rooms/Control Equipment Rooms.			
6.00.00	ii) Cross zoning of the signal from two adjacent multisensor detectors shall be employed to initiate the fire extinguishing system of inert gas protected areas and MVW spray system of cable galleries.			
	iii) Multisensor detector shall be provided for return air ducts of main plant, which shall consist of intake probe, detector housing, and exhaust pipe etc. The detector shall be mounted outside the duct.			
	iv) The design coverage area for detectors (to be considered) shall not exceed 25 Sq.M. for each detector.			
	AUTOMATIC TOTAL FLOODING INERT GAS EXTINGUISHING SYSTEM			
6.01.00	General			
6.02.00	a) Fire protection system for the Central control room and other areas as defined below shall be by means of INERT gas extinguishing system. The INERT gas system shall employ any of the proven inert gas system specified under NFPA-2001. System shall be automatic and shall be activated by a dedicated detection system to be provided for each hazard area.			
	b) System shall consist of inert gas (as per NFPA-2001) gas cylinders filled with the agent gas, cylinder mounting accessories, cylinder manifold, automatic discharge valves, discharge piping, nozzles, automatic operating devices, manual actuation devices/abort switches, associated fire detection/alarm system audio-visual safety warning devices, instrumentation associated control systems, panels etc.			
	Areas to be covered under Automatic total flooding Inert Gas Extinguishing System			
	a) Central control rooms, control equipment rooms, UPS/Battery charger rooms, PC room, programmer room, PADO room, panel room, etc. of main plant building.			
	b) IT building as per NFPA-2001including associated programmer/server rooms, PC rooms, panel room, UPS/Battery charger rooms for IT building			
	c) Training Simulator as per NFPA-2001 including simulator training room, programmer/server rooms, UPS rooms etc. for training simulator.			
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7.00.01	CLEAN AGENT DIRECT / INDIRECT LOW PRESSURE AUTOMATIC FIRE DETECTION & SUPPRESSION SYSTEM WITH LINEAR PNEUMATIC HEAT DETECTION TUBE			
7.01.00	Regulatory Requirement			
	(a) The clean agent automatic direct / indirect low pressure fire suppression system shall be approved by UL/FM/VDS/LPCB.			
	(b) Clean agent used should be NOVEC-1230			
7.02.00	System Description			
	(a) The clean agent automatic direct / indirect system consists of the following major components:			
	- Clean agent (NOVEC-1230) cylinder & valve assembly along with cylinder mounting arrangement.			
	- Linear heat detection/discharge tube along with necessary fittings.			
	- Discharge Network (applicable for indirect system) composed of copper tubing / stainless steel tubing / braided hose, necessary fittings and appropriate nozzles.			
	- Pressure switch, End of line adapters, Audio-visual indication unit.			
	(b) Each clean agent extinguishing unit shall be equipped with its own automatic (non electric) detection/discharge tubing system, which when actuated, automatically releases the suppression agent into the electrical panel.			
	(c) Clean agent cylinder / container shall be a part of UL/FM/VDS/LPCB listed/approved system. Further, cylinders shall have approval by Chief Controller of Explosives (CCOE) – India (if applicable).Each container shall be equipped with a valve, a pressure gauge to monitor container pressure, etc.			
	(d) Detection/discharge tubing shall be installed within the limitations stated in the manufacturer’s manual.			
	(e) A pressure switch shall be connected at the other end of detector/discharge tubing or on main valve to monitor system pressure and/or signal of system actuation, etc.			
7.03.00	Design Requirement:			
	(a) Design concentration of clean agent used shall be as per NFPA-2001 / manufacturer’s recommendation.			
	(b) All documents/drawings related to design of the system shall be vetted by the system manufacturer before submission to NTPC for approval.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 20 of 27

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
8.00.00	FIRE WATER STORAGE, PUMPS & PUMP HOUSE			
	i)	Horizontal type centrifugal pumps shall be provided for hydrant, spray and jockey pumps. Maximum speed of the pumps shall be 1500 rpm. However, for jockey pumps the speed upto 3000 rpm is acceptable. The motor driven pump and the corresponding diesel engine driven pump shall completely interchangeable in respect of speed, impeller diameter, etc.		
	ii)	Capacity, discharge pressure & quantity of pumps for the hydrant water system and spray water system shall be individually designed as per Tariff Advisory committee (TAC) guidelines. However for minimum design requirement please refer Annexure- II		
	iii)	Atleast one hydrant pump of identical capacity be provided as standby pump so that in case any of the working hydrant pump is not available, the total requirement can be met by the standby pump.		
	iv)	Atleast one spray pump of identical capacity be provided as standby pump apart from the working spray pumps.		
	v)	The standby hydrant and spray system pumps shall be of diesel engine driven.		
	vi)	The headers of spray and hydrant system shall be interconnected with an isolation and a non-return valve so that hydrant pumps can feed to spray system not vice-versa.		
	vii)	The diesel engine drive of the pump shall conform to the requirements of TAC. Each of the diesel engine shall be provided with batteries (2x100%) and battery chargers (2x100%).		
	viii)	Battery of the diesel engine shall be lead acid type as per IS and shall be large enough to crank the engine twelve times successively, each for a duration of 10 sec. without any charging in between.		
	ix)	Each engine shall be provided with fuel oil tank having adequate capacity to hold sufficient fuel oil for a minimum of twelve (12) hours of full load run. The fuel oil tank shall preferably be mounted on the engine. No fuel oil tank will be provided by the Employer.		
	x)	Continuous drive motor rating (at 50 ⁰ C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.		
	xi)	The feeding line of the spray system from the header shall be provided with 2x100% capacity basket type filters to avoid any particles in the spray system.		
	xii)	The system shall be complete with required instrumentation, control recirculation pipe line with valves for each of the pumps, NRV in discharge outlet etc.		
xiii)	Pumps shall be designed for continuous operation at its best efficiency point to meet the specific requirements of the system for which it is to be employed. Pumps of each category shall be suitable for parallel operation.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 21 of 27

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	xiv) Fire Water Storage Tanks: Two numbers each of 50% capacity vertical cylindrical column supported fixed cone roof type fire water storage tanks shall be provided by the bidder. To avoid vacuum creation inside the tank, two (2) nos. vents each of size 300 NB shall be provided on the roof of the tanks. Bidder shall ensure that the total capacity of fire water storage shall be as per the recommendation of TAC. xv) Fire water booster pump house: Two sets of Hydrant & Spray booster pumps (one motor driven & one diesel driven pump) alongwith associated equipment shall be installed in fire water booster pump house. Tapping shall be taken from nearest hydrant and spray header. xvi) Fire water storage tank: Two numbers each of 50% capacity vertical cylindrical column supported fixed cone roof type fire water storage tanks shall be provided by the bidder. To avoid vacuum creation inside the tank, two (2) nos. vents each of size 300 NB shall be provided on the roof of the tanks. Bidder shall ensure that the total capacity of fire water storage tank shall be as per the recommendation of TAC with a minimum capacity of each tank equal to 2300 m³.			
9.00.00	PIPING AND VALVES			
9.01.00	General Data for Pipes etc.			
	i) Mild steel as per IS:1239 (Part-I) medium grade (upto 150 NB) & as per IS:3589 Gr 410 (above 200 NB) or Equivalent for pipes normally filled with water. ii) Mild steel as per IS:1239 (Part-I) medium grade (upto 150 NB) & as per IS:3589 Gr.410 (above 200 NB) or Equivalent and galvanised as per IS:4736 for pipes normally empty and periodically charged with water and foam system application. iii) Pipe protection shall be as follows : To prevent soil corrosion buried pipes / pipes in trench shall be properly lagged with corrosion protective tapes of coal tar type as per IS:15337 or AWWA C 203. The total thickness of protective tapes to be applied on buried pipes / pipes in trench shall be 4.0mm. This can be achieved by using 4.0mm thick tape in single layer or 2.0mm thick tape in double layer. iv) Pipe thickness: a) For Pipe sizes upto 150 NB and above: As per IS:1239 Part-I medium grade. b) For Pipe sizes 200 NB and above refer Annexure-I. v) All valves shall be as per applicable IS/BS codes & approved by TAC for specific fire protection system and shall be provided with locking arrangement (with locks) in open or close condition. Further, all gate/butterfly valves of size 200 mm & above shall be provided with spur gear reduction unit. vi) All the flanges and counter flanges shall conform to ANSI B 16.5 Cl 150. vii) Strainer Body as per IS: 2062 (tested).			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 22 of 27

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	viii) Pipe Fittings 1) The material shall conform to ASTM A 234 Gr WPB or ASTM A 105 or equivalent and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be. Further, galvanised malleable cast iron fittings as per IS:1879 in Cast iron fitting as per BS-1641 are also acceptable. 2) Grooved couplings: Vendor may also use mechanical grooved couplings type fittings in GI pipe lines for HVW / MVW spray system. All materials and products shall be either Underwriters Laboratories (UL) Listed or Factory Mutual (FM) Approved and installed in accordance with NFPA Standard 13 / equivalent Standard. 3) The fittings shall be galvanised as per IS: 4736 for galvanised pipe application. In case of branching connections from GI mains for spray piping network, socket may be welded for more than two pipe reduction instead of standard tees. 4) Fabricated fittings shall not acceptable up to pipe size to 300 NB. For sizes 350 NB and above, fittings may be fabricated as per BS: 2633/BS: 534. ix) Welding of galvanised iron pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by Employer. After, welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further, the Contractor shall provide proper zinc paint at the point of welding.			
10.00.00	PAINTING			
10.01.00	All the Equipments shall be protected against external corrosion by providing suitable painting.			
10.02.00	The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting.			
10.03.00	Fire Water Storage Tanks: i) The Contractor shall clean the tank plates and structure steel before erection by wire brushing and air blowing. After erection of tank and hydro testing, tanks are subjected to surface preparation and painting as per procedure detailed below: ii) Surface Preparation: Outside/inside surface preparation shall be carried out by shot blasting as per SA2 ½. iii) Inside surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.: CS-9585-001-2	SUB SECTION-A-18 Fire Detection & Protection System	Page 23 of 27

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC									
10.04.00	iv)	Outside surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of epoxy resin based finish paint with 25 micron as thickness of each coat.											
	v)	Outside bottom surface painting: One coat of epoxy zinc phosphate primer of min. DFT of 30-35 micron followed by three (3) coats of coal tar epoxy paint with 25 micron as thickness of each coat.											
10.05.00	All Steel Surfaces (external) exposed to atmosphere (outdoor installation)												
	(i)	Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.											
10.06.00	(ii)	Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.											
	All Steel Surfaces (external) inside the building (indoor installation)												
10.06.00	(i)	Surface Preparation: The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.											
	(ii)	Painting: One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with two (2) coats synthetic enamel paint, with 25 microns as thickness of each coat. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.											
10.06.00	Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc.												
	Painting of all equipments /.components of FDPS package shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality.												
		<table><tr><th>Environment</th><th>Paint scheme</th><th>Total DFT</th></tr><tr><td>Normal / Mild Corrosive Environment</td><td>Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)</td><td>Min 125 microns</td></tr><tr><td>Corrosive Environment (as in coastal areas)</td><td>Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)</td><td>Min 200 microns</td></tr></table>	Environment	Paint scheme	Total DFT	Normal / Mild Corrosive Environment	Primer- zinc filled epoxy Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 125 microns	Corrosive Environment (as in coastal areas)	Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 200 microns		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																											
	ANNEXURE-I PIPING THICKNESS: Pipes for sizes 200 NB & above shall confirm to IS: 3589 Grade 410. The final thickness shall not be less than that specified as per IS: 3589 as indicated below. <table><tr><th>Nominal pipe Size (mm)</th><th>Outside Diameter (mm)</th><th>Wall Thickness (mm)</th></tr><tr><td>200 NB</td><td>219.1</td><td>6.3</td></tr><tr><td>250 NB</td><td>273</td><td>6.3</td></tr><tr><td>300 NB</td><td>323.9</td><td>7.1</td></tr><tr><td>350 NB</td><td>355.6</td><td>8.0</td></tr><tr><td>400 NB</td><td>406.4</td><td>8.0</td></tr><tr><td>450 NB</td><td>457</td><td>8.0</td></tr><tr><td>500 NB</td><td>508</td><td>8.0</td></tr><tr><td>600 NB</td><td>610</td><td>8.0</td></tr></table>				Nominal pipe Size (mm)	Outside Diameter (mm)	Wall Thickness (mm)	200 NB	219.1	6.3	250 NB	273	6.3	300 NB	323.9	7.1	350 NB	355.6	8.0	400 NB	406.4	8.0	450 NB	457	8.0	500 NB	508	8.0	600 NB	610	8.0
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	Annexure-II Technical Data: <table><tr><td>1. Fire water pumps</td><td>Hydrant</td><td>Spray</td><td>Booster Hydrant</td><td>Booster Spray</td><td>Jockey</td></tr><tr><td>Number of pumps</td><td>4(3 motor driven & 1 diesel engine driven)</td><td>3 (2 motor driven & 1 diesel engine driven)</td><td>2 (1 motor driven & 1 diesel engine driven)</td><td>2 (1 motor driven & 1 diesel engine driven)</td><td>2 (both motor driven)</td></tr><tr><td>Design Capacity</td><td>410 m³/hr</td><td>410 m³/hr</td><td>171 m³/hr</td><td>410 m³/hr</td><td>75 m³/hr</td></tr><tr><td>TDH of pump (MWC)</td><td>120 (min) or as per system reqt.</td><td>120 (min) or as per system reqt.</td><td>45 (min) or as per system reqt.</td><td>45 (min) or as per system reqt.</td><td>120 (min) or as per system reqt.</td></tr><tr><td>MOC</td><td colspan="5">Casing:IS:210 Gr. FG 260 (2.5% Ni), Impeller: Bronze IS:318 Gr.II, Impeller shaft, coupling :SS316</td></tr><tr><td rowspan="2">2. Hydrant Valve</td><td colspan="5">Oblique female type as per IS:5290</td></tr><tr><td colspan="5">MOC: Body/bonnet/stop valve/valve seat/trim : SS304/SS316</td></tr><tr><td rowspan="2">3. Water monitor</td><td colspan="5">As per IS:8442 Type-I, Size: 75mm, Nozzle dia: 38mm</td></tr><tr><td colspan="5">MOC: Water barrel/reducer/elbow: CS (seamless)/SS Nozzle: Copper alloy / SS confirm in to IS:3444</td></tr><tr><td rowspan="2">4. Water branch pipe & nozzle</td><td colspan="5">As per IS:903 / IS:2871</td></tr><tr><td colspan="5">MOC: Branch pipe: SS316 (Gr 4 of IS:3444) (both ends) Nozzle : SS316 (Gr 4 of IS:3444), Size: min 16mm & max 25mm</td></tr><tr><td rowspan="3">5. Water line Gate / Sluice Valve</td><td colspan="5">- Design Code: a) IS:14846 or BS:5150 (for valves coming inside fire water pump house) b) BS:5150 (for valves at other locations) - Pressure rating: PN1.6 (as per IS:14846) / PN16 (as per BS:5150) -Working Pr. :12Kg/cm2</td></tr><tr><td colspan="5">MOC: Body/bonnet/Yoke/Wedge : CI to IS:210 FG-200 Spindle: SS to ASTM-A-276 type 410</td></tr><tr><td colspan="5"></td></tr><tr><td rowspan="3">6. Check Valve</td><td colspan="3">Below 50NB size</td><td colspan="2">50NB & above</td></tr><tr><td colspan="3">Design Code; IS:778 (below 50NB)</td><td colspan="2">IS:5312 / BS:5153</td></tr><tr><td colspan="3">MOC: Body/cover/flap: Lead tin bronze to IS:318 Gr. LTB-2</td><td colspan="2">CI to IS:210 FG-200</td></tr><tr><td rowspan="2">7. Butterfly Valve</td><td colspan="5">Design Code: Double flanged or lugged wafer type of low leakage rate confirming to BS:EN:593/API-609/AWWA C-504 Pressure class: PN 16</td></tr><tr><td colspan="5">MOC: Body & Disc : Cast Iron, Shaft : SS 410 / SS 420 Seat Rings : EPDM</td></tr></table>					1. Fire water pumps	Hydrant	Spray	Booster Hydrant	Booster Spray	Jockey	Number of pumps	4(3 motor driven & 1 diesel engine driven)	3 (2 motor driven & 1 diesel engine driven)	2 (1 motor driven & 1 diesel engine driven)	2 (1 motor driven & 1 diesel engine driven)	2 (both motor driven)	Design Capacity	410 m³/hr	410 m³/hr	171 m³/hr	410 m³/hr	75 m³/hr	TDH of pump (MWC)	120 (min) or as per system reqt.	120 (min) or as per system reqt.	45 (min) or as per system reqt.	45 (min) or as per system reqt.	120 (min) or as per system reqt.	MOC	Casing:IS:210 Gr. FG 260 (2.5% Ni), Impeller: Bronze IS:318 Gr.II, Impeller shaft, coupling :SS316					2. Hydrant Valve	Oblique female type as per IS:5290					MOC: Body/bonnet/stop valve/valve seat/trim : SS304/SS316					3. Water monitor	As per IS:8442 Type-I, Size: 75mm, Nozzle dia: 38mm					MOC: Water barrel/reducer/elbow: CS (seamless)/SS Nozzle: Copper alloy / SS confirm in to IS:3444					4. Water branch pipe & nozzle	As per IS:903 / IS:2871					MOC: Branch pipe: SS316 (Gr 4 of IS:3444) (both ends) Nozzle : SS316 (Gr 4 of IS:3444), Size: min 16mm & max 25mm					5. Water line Gate / Sluice Valve	- Design Code: a) IS:14846 or BS:5150 (for valves coming inside fire water pump house) b) BS:5150 (for valves at other locations) - Pressure rating: PN1.6 (as per IS:14846) / PN16 (as per BS:5150) -Working Pr. :12Kg/cm2					MOC: Body/bonnet/Yoke/Wedge : CI to IS:210 FG-200 Spindle: SS to ASTM-A-276 type 410										6. Check Valve	Below 50NB size			50NB & above		Design Code; IS:778 (below 50NB)			IS:5312 / BS:5153		MOC: Body/cover/flap: Lead tin bronze to IS:318 Gr. LTB-2			CI to IS:210 FG-200		7. Butterfly Valve	Design Code: Double flanged or lugged wafer type of low leakage rate confirming to BS:EN:593/API-609/AWWA C-504 Pressure class: PN 16					MOC: Body & Disc : Cast Iron, Shaft : SS 410 / SS 420 Seat Rings : EPDM				
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ANNEXURE – 15
(Packing and forwarding)

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/Assemblies/Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 TYPES OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' – Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing - Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing - Electrical Components/Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film to Specification No.AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of

silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

4 PREPARATION OF PACKING CASES

4.1 DOMESTIC:

Based on the availability, the wood shall be Rubber wood (Havea Brasiliensis)/Pine wood for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

4.2 DIMENSIONS:

- a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.
- b) Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- c) Minimum number of planks shall be used for a shook.
- d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- e) External sides of front and rear planks to be planed to facilitate writing of address and other markings.
- f) Width of binding planks shall be minimum 100mm.
- g) Distance between any 2 binding planks shall be less than 750mm.
- h) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- i) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- j) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.3 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.4 TONGUE AND GROOVE JOINTS

Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.5 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shooks. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.6 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD

- 1) This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.
- 2) The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.
- 3) The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 4.6.5) can also be used.
- 4) The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.
- 5) Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]: Copper – Chromium – Arsenic preservative formulation shall be as per IS:10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

– Arsenic Pent oxide	AS ₂ O ₅ 2H ₂ O	12.5
– Copper Sulphate	CuSO ₄ 5H ₂ O	37.5
– Sodium Dichromate	Na ₂ Cr ₂ O ₇ 5H ₂ O	50.0
– Or Potassium Dichromate	K ₂ Cr ₂ O ₇	

4.7 OTHER MATERIALS

4.7.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.7.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.7.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6 +0.01mm. The material shall be free from rust.

4.7.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.7.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

4.7.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.7.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

70GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.7.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.7.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.7.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Details and specifications are given in Fig-4

4.7.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.7.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.

4.7.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.7.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.7.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.7.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

4.7.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.7.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.7.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1. Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 6) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 7) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 8) Direction sticker " Front " & " Back " - 4 nos. Size 2.0Cm x 0.75Cm
- 9) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 10) "Fragile " sticker: 2 Nos Size. 2.1Cm x 1.5Cm
- 11) "DO NOT STACK " sticker - 2 Nos. Size 3.0Cm x 2.2Cm

5 PACKING OF CUBICLES WITH RUBBER WOOD:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shoo's shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7) using blue nails (as per 4.7.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.7.7).

5.5 SILICA GEL:

Silica gel (as per 4.3.15) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.7.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 4.7.8) with distance between consecutive layers less than 500mm.

5.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 4.7.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 4.7.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 4.7.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 4.7.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

5.14 PACKING OF CUBICLES WITH PINE WOOD

Packing of cubicles for export shall be done exactly in same manner as described at Cl.No 5 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.

- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

6 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall be rubber wood with Tongue and Groove joint as per clause 4.4.
- 3) Chemical treatment as per Clause 4.6 to be done.
- 4) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 5) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 6) Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 4.7.7) using blue nails.
- 7) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 8) Internal packing: Items that go into the box shall be packed using 70GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect .
- 9) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.

- 10) Silica gel as per clause 4.7.12 held in cotton bags as per clause 4.7.13 shall be kept at proper places in the box.
- 11) Packing slip kept in polyethylene bag (clause 4.7.16) shall be placed in the box.
- 12) Marking plate as per clause 4.7.10 shall be nailed to side of the box.
- 13) Two numbers of hoop iron strips as per clause 4.7.3 shall be strapped tightly on the case using clips.
- 14) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 15) Loose items to be kept inside the cubicle
 - The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
 - Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

7.2 BOX SIZES

Table 2 – VALVES WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1A	320X250X260	10	
1	320X250X430	15	
2	430X370X430	25	
3	670X670X470	65	
4	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
10	1300X770X1050	155	
11	2500X850X800	225	
12	2000X1500X1200	305	
14	1850X1050X1250	260	
15	2000X800X800	180	
17	2600X1500X1600	470	
21	250X250X600	20	
22	250X250X880	30	
23	300X300X700	25	
24	380X380X880	45	
25		25	
26	510X510X1400	60	
27	570X570X1400	80	
28	575X575X1875	105	
29	3600X1100X1100	390	
30	900X500X800	110	
52	2000X950X740	225	
53	1600X1120X700	220	
54	2500X2000X1200	490	
55	2900X1900X1400	525	
56	3000X1000X900	370	
57	3200X2200X950	450	
58	2150X1100X750	325	
61	2000X2000X700	130	
62	700X1200X1325	130	

TYPICAL PATTERN OF WOODEN BOX

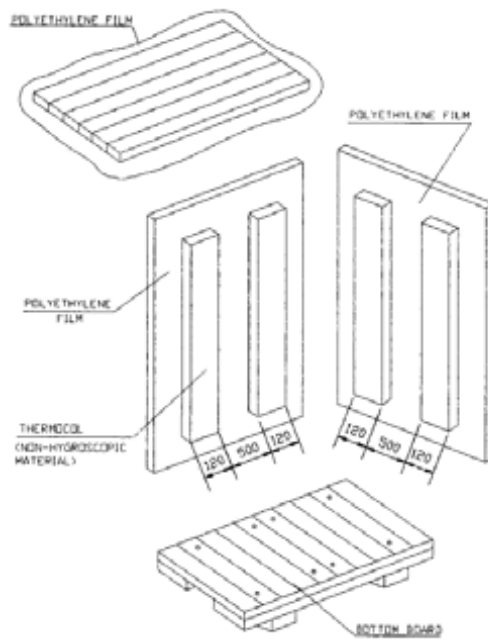


Figure 1

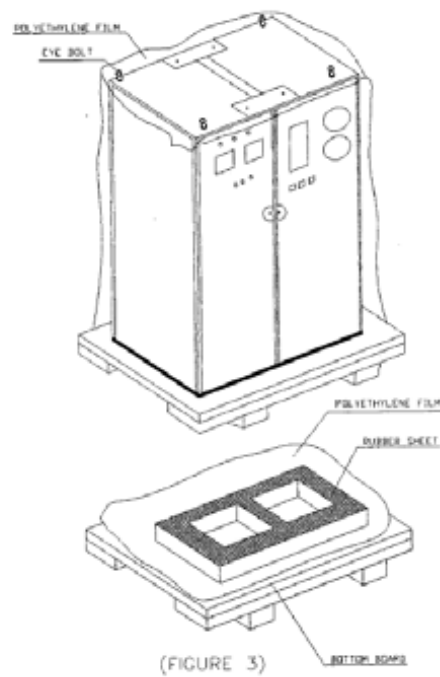


Figure 2

7.3 STANDARD BOX SIZES

WOODEN BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
01	I	2370	1570	1650	675	4000
02	IIA	1570	720	885	200	2500
03	II	1200	900	600	150	2000
04	III	900	600	600	100	1000
05	IV	600	450	450	40	750
06	V	600	300	300	35	500

STEEL BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
07	I	2480	1680	1500	339	4500
08	II	1200	900	600	061	2000
09	IIB	1800	850	950	115	2500
10	III	900	600	600	029	1000
11	IV	600	450	500	019	750
12	V	400	350	300	011	500

Table 3

7.4 STEEL CONTAINERS

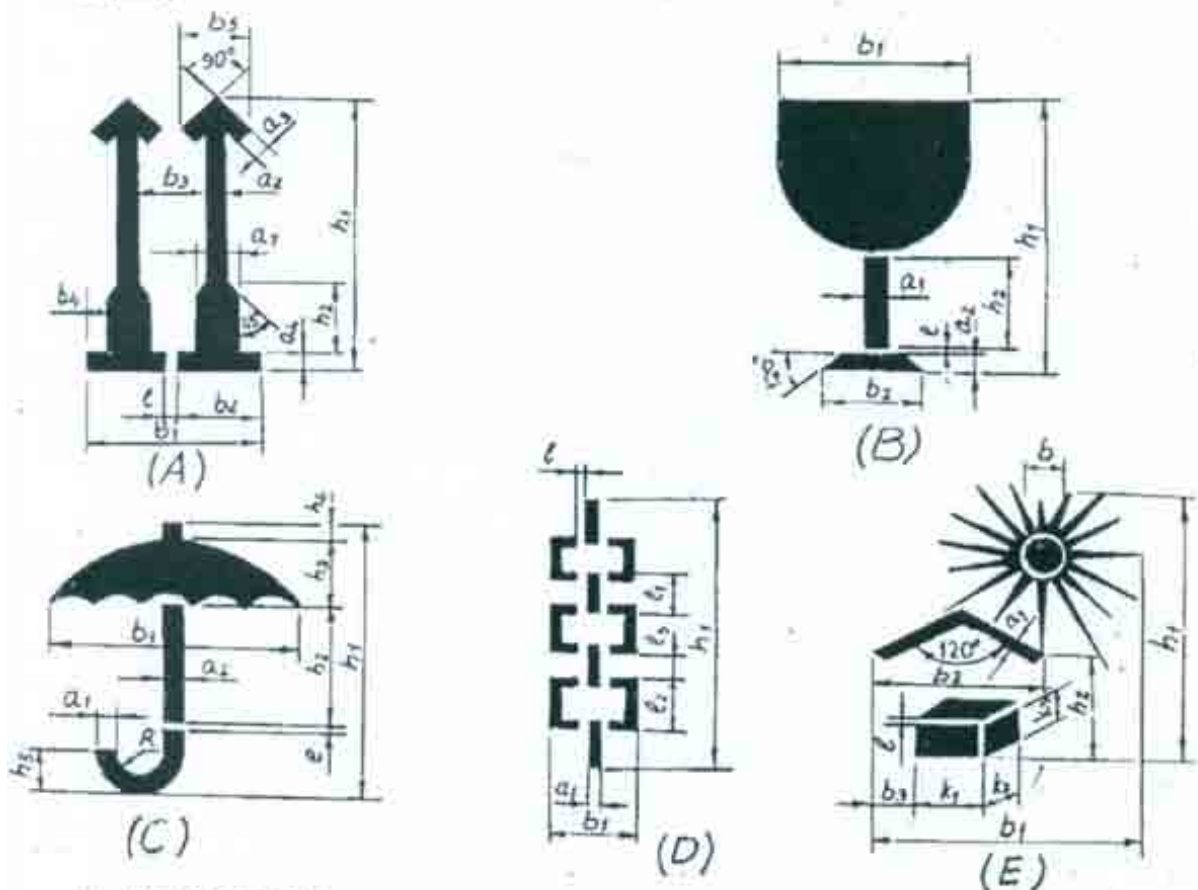
Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

- Following precautions are to be taken during packing: -
- Put the machine in the steel container properly,
- Cover the machine with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- Put cover on steel, container and Bolt Properly

8 MARKINGS/STENCILINGS

MARKINGS ON PACKING CASE 5

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.

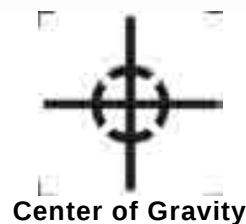


Figure 3

DESIGN- ATION		DIMENSION IN MM																						
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R
A	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
B	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
C	1	4	3			66						2	80	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
E	1	3				69	47	10			16	2	91	26				17	8	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	6				138	94	20			32	4	182	62				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

225						170	
	BHEL-EDN-BANGALORE-26						
CONSIGNEE							
MATERIAL							
CUSTOMER REF.					MO. NO.		
DESPATCH ADVICE NOTE NO.					CASE NO.		
DIMENSIONS(MM) LXBXH					NET WT -KGS	GROSS WT -KGS	
SPECIAL INSTRUCTIONS	HANDLE WITH CARE – KEEP DRY DO NOT DROP – DO NOT TILT						

Figure 4 – TYPICAL MARKING PLATE



Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.

- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to weighment bridge for weighment, thereafter, he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of de-nailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will be handed over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS –STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings" duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

10 STANDARD METHOD OF PACKING

Table 5 –

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSURE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
BOILERS								

BOILER DRUMS					O						
BOILER ITEMS											
COILS			O								
PANELS					O						
HEADERS			O		O						
FEEDERS											
MACHINED ITEMS											
SHELL SEGMENTS					O						
SHELL SEGMENTS IN STACKS					O						
SPHERE PETALS											
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O						
ROLLERS	O										
VALVE TRAYS											
VALVE TRAY COMPONENTS	O										
LATTICE GIRDERS		O									
FASTENERS	O										
GASKETS	O										
DESCRIPTION				CA SE	CRA TE	SK ID	BUN DLE	BA RE	DR UM	METAL DRUM	FIBRE DRUM
SUB CONTRACTS											
FAB STRUCTURALS								O			
SUPPORTING STRUCTURALS								O			
STRUCTURE SUB ASSEMBLY								O			
FAB PIPES								O			
GRATINGS								O			
STAIR CASES								O			
HANDRAILS/ PLATFORMS								O			
BOUGHT OUT COMPONENTS											
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)								O			
PIPE FITTINGS											
CS PIPES, TUBES								O			
SS PIPES, TUBES								O			
FIN TUBES				O							
ELBOWS					O			O			
FLANGES				O	O						
VALVES				O							
GAUGES				O							
DEMISTERS					O						
DESCRIPTION				CA SE	CRA TE	SKI D	BUND LE	BA RE	DR UM	METAL DRUM	FIBRE DRUM

ABSORBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

11 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 11.1** Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 11.2** Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 11.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 11.4** For critical items, where specified, special handling fixtures shall be used for lifting.
- 11.5** Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 11.6** Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 11.7** Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

11.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per CI.no:08

- 11.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- 11.8.2** Handling and lifting should be done without jerks or impacts.
- 11.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 11.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 11.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
- 11.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

12 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

12.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length:	10000mm
Over Gooseneck:	13000mm
Width:	3000mm
Carrying Capacity:	40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length:	12000mm
Over Gooseneck:	16000mm
Width:	3000mm
Carrying Capacity:	75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length (for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

12.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

For Diameter up to 4000mm

Wooden Saddles Length: 1836/2743mm (6'0"/9'0")
 Width: 300mm (1'0")
 Height: Saddle + one/two wedges a top.
 For Diameter up to 4000mm
 Wooden Saddles Length: 3353mm (11'0")
 Width: 300mm (1'0")
 Height: Saddle + three/four wedges a top.

NUMBER OF SADDLES:
 Minimum: 3 in case of Loading inside Well
 + 1 when loaded on Gooseneck.
 Maximum: 4 in case of Loading inside Well
 +2 when loaded on Gooseneck.

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12.3 NUMBER OF LASHINGS ARE:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3 Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

13 GUIDELINES FOR HANDLING/LOADING/LASHING

13.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.
 Pipes with split type end cover will be checked



Figure 7

All Coil Tubes to be provided with End Caps.



Figure 8

Neatly stacked Coil Assemblies.



Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.



Figure 10

13.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating



Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.



Figure 12

No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.



Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.



Figure 16

13.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.



Figure 17

Nylon Belts used for lashing the beams.



Figure 18

14 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard

15 REFERRED STANDARDS (Latest publications including amendments):

- | | | | |
|------------|------------|------------|------------|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 |
| 5) AA10108 | 6) AA56126 | | |