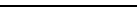


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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED , It must not be used directly or indirectly in any way detrimental to the interest of the company.	TECHNICAL SPECIFICATION FOR BOILER FEED PUMPS																					
	<table border="1"> <tr> <td>PROJECT</td><td colspan="5">1 X 120 MW COAL BASED REHEAT TPPJHAGADIA, BHARUCH, GUJARAT</td></tr> <tr> <td>CUSTOMER</td><td colspan="5">DCM SRIRAM LTD. BHARUCH, GUJARAT</td></tr> <tr> <td>CONSULTANT</td><td colspan="5">DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA</td></tr> </table>					PROJECT	1 X 120 MW COAL BASED REHEAT TPPJHAGADIA, BHARUCH, GUJARAT					CUSTOMER	DCM SRIRAM LTD. BHARUCH, GUJARAT					CONSULTANT	DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA			
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	Prepared by :	Checked by :	Approved by :	Date :
Revisions: Refer to record of revisions	 RATISH KUMAR	 GIRISH PRASAD PALO	S S Nagesh M	10.04.2020

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DOCUMENTS TO BE SUBMITTED WITH THE BID:

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

- a) Duly filled in Pump datasheet [Annexure: 2]
- b) Preliminary GAD and P&ID for Pump
- c) Pump Performance curves (Flow Vs Head, Flow Vs Efficiency, Flow Vs NPSHr, Flow Vs BkW)
- d) T-S Curve for Pump at open discharge valve condition
- e) Un-priced copy of attached BHEL price bid formats [Annexure: 3] indicating quoted/not quoted against each row & column.
- f) Equipment qualification criteria / PTR / Reference Lists [Annexure: 6]
- g) Checklist [Annexure: 4]
- h) Deviation list [if any] [Annexure: 10]**

** Bidder shall submit Annexure: 10 indicating as **NO DEVIATION** along with their offer. Any specific deviations, with respect to specification requirement due to design constraints and OEM limitation, which are impractical to meet, shall be raised in form of pre-bid queries as per Annexure: 11 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 **Boiler Feed Water Pump** with all equipment/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 all its annexures. In case of any discrepancy arising between this specification & its annexures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its annexures, 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 In case 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

PROJECT	1 X 120 MW COAL BASED REHEAT TPP JHAGADIA, BHARUCH, GUJARAT
CUSTOMER	DCM SRIRAM LTD. BHARUCH, GUJARAT
CONSULTANT	DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA

Location of Project Site:

The plant site is located at GIDC, Jhagadia taluk in Bharuch district, in the state of Gujarat.

Exact location co-ordinate of this project site is as follows:

Latitude : 21°43'10.12" N

Longitude : 73°9'3.63" E

METEOROLOGICAL DATA:

- a) Temperature :
 - (i) Maximum 50 °C
 - (ii) Minimum 12 °C
 - (iii) For Performance 35 °C
 - (iv) For Electrical design 50 °C
- b) Thermal Insulation temperature : Max. Ambient + 20 °C
- c) Relative humidity :
 - (i) For Performance 60%
 - (ii) Maximum 75%
 - (iii) Minimum 42%
- d) Wind load : In accordance with IS-875 for a basic wind speed of 44 m/sec (max.), up to a height of 10 metres above mean ground level.
- e) Seismic Zone : Zone III as per IS:1893 latest edition.
- f) Site Altitude : 35 M above MSL.
- g) Area classification : Safe & Non-Hazardous.
- h) Environment : Non-Corrosive.
- i) Importance factor : 1.5

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

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4. APPLICATION OF SYSTEM

BFPs are envisaged to transfer feed water from deaerator to Boiler. For this Total 3 Nos. [3 x 50%] of Boiler Feed Pumps [2 Working + 1 Stand-by] are envisaged.

5. TECHNICAL DETAILS/REQUIREMENTS

SL No	Description	Unit	Rated Condition	Guaranteed Condition	Capability Condition-1	Capability Condition-2	Capability Condition-3	Capability Condition-4
1	Suction Temp	Deg. C	175.9	171	175.90	171	171	152.50
2	Design Temp	Deg. C	200					
3	Capacity of each pump	m ³ /hr	268	239	295	264	264	209
4	Pump Differential Head	mlc	2010	1767	1799	1940	1989	1676
5	Available Pressure at Pump suction flange	Kg/cm ² (a)	10.93	10.03	10.93	9.94	9.94	7.07
6	NPSHA at pump suction flange	mlc	18.34	19.53	18.34	18.56	18.56	20.63
7	Margin between NPSH A & NPSHR	Bidder to ensure that NPSH (R) at 3%head drop for feed pump shall be 0.4 times of NPSH (A) at design point.						

Note: Please note that the Pump Curve selected shall satisfy all Capability & Guaranteed Conditions as mentioned above table.

Accordingly, the actual rated head can be higher than the rated head mentioned above.

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6. SCOPE OF SUPPLY

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

Bidder's scope of supply shall be as per enclosed P&ID (Annexure-1).

Bidder's scope of supply to include all requirements specified in this specification and annexures including testing, painting, documentation, sub vendor list, equipment specifications etc.,

Quantity of Pump [Excluding Drive Motor along with Variable Frequency Drive (VFD)] along with accessories:

No. of BFP and its associated accessories: 3 Nos. (2W+1S)

Note: Pump along with all required accessories shall be suitable for outdoor installation. No equipment shelter is being envisaged by BHEL.

6.1. Pump

Horizontal, Centrifugal, Multistage, outer casing Barrel Type design pump complete with all accessories as per specification are in bidder's scope of supply.

The design standard, manufacturing, testing of pump shall be as per tender specification & its annexure along with enclosed customer/consultant Specification (Annexure-5) & datasheet(Annexure-2).

Bidder to note that the pump shall be operated at variable speed as per plant operation requirement. For this purpose VFD driven HT motor is provided by BHEL

The HT motor and VFD shall be in BHEL scope of supply.

Warm Up Arrangement: Warm arrangement shall be as per manufacturer recommendation for the selected operating condition. For the offered model and parameters as mentioned above, bidder to confirm the applicability of the same with offer. In case the same is required, all the materials (IBR certified Pipes, Valves, instrument on lines, Orifice Plate etc.) shall be in Bidder's Scope of supply.

In case bidder does not recommend provision of same, the same shall be substantiated by proven experience. However, rapid start-up of pump set shall be possible from any operational condition i.e. cold or partially warmed up.

Auxiliary Power limitation:

Auxiliary power for Pump shall be limited to **1465 kW while running at guarantee condition** including gear box losses in case gear box is applicable. Auxiliary power for Pump above 1465 kW while running at guarantee condition is not acceptable and bidder's offer shall be liable for rejection.

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Note: Above Auxiliary power shall be pump shaft power + Gear Box losses (if applicable) at guaranteed condition.

6.2. Motor along with VFD (in BHEL Scope of Supply)

Drive motor along with VFD shall be in BHEL scope of supply.

The canopy with legs, cable glands and lugs, earthing lugs and all other accessories required as per specification shall be in bidders scope of supply.

Bidder to consider a margin of 10% over the total power required by BFP and shaft driven main lube oil pump at the rated condition of the pump. Accordingly, bidder to recommended suitable motor kW rating.

Bidder to furnish pump T-S curve at discharge valve open condition with offer.

6.3. Coupling

All interconnecting coupling between Pump, Gear Box (If Applicable) shall be in bidder's scope of supply.

The supplied coupling shall comply with the following:

- i. Design standard of coupling shall be as per Manufacturing Standard.
- ii. Couplings shall be of metallic, non-lubricated, flexible element type (i.e. either diaphragm or discs) with spacer, for all equipment. All coupling models shall be selected for a minimum service factor of 1.5 over driver rating. DBSE shall be more than the seal cartridge length, as specified in respective pump data sheet such that cartridge of seal shall be removed without disturbing of pump and motor mounting.
- iii. 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. The guard shall be sufficiently rigid to withstand deflections as a result of bodily contact of nominally 100 kgs.

6.4. ARC Valve

Automatic Recirculation control valves and pressure break down orifices, as necessary to pass the minimum flow required for the pump shall be provided by Bidder.

Note:

- i. Modulating type Automatic Recirculation Control valve with flanged ends for pump minimum flow control.
- ii. The ARC valve size shall be as per pump supplier's recommendation, however not less than Pump discharge nozzle size.
- iii. ARC valve shall be selected based on required minimum re-circulation flow of the pump.
- iv. ARC Valves to be selected in such a way that the pressure drop across the ARC Valve for 130% of the rated flow shall be limited to 1.0 kg/cm² only. This is to ensure flexibility of operating system at marginally higher flows as per site conditions if any.
- v. Material of construction: Body: CS, Internals: SS
- vi. Additional requirements: IBR certification is required for ARC valve

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6.5. Mechanical Seal

Cartridge type Mechanical seal along with cooling system [as per Manufacturing Standard] shall be provided for each pump. Mechanical seals to be suitable for maximum shut off pressure/ casing design pressure under static conditions.

Mechanical Seal shall be selected on the basis of proven long term operating experience in a BFP environment.

For Seal flushing plans & auxiliary Pump Process piping (Casing Vent, Casing Drain and Balance line), the piping material shall be of SS 316 as a minimum.

6.6. LO skid:

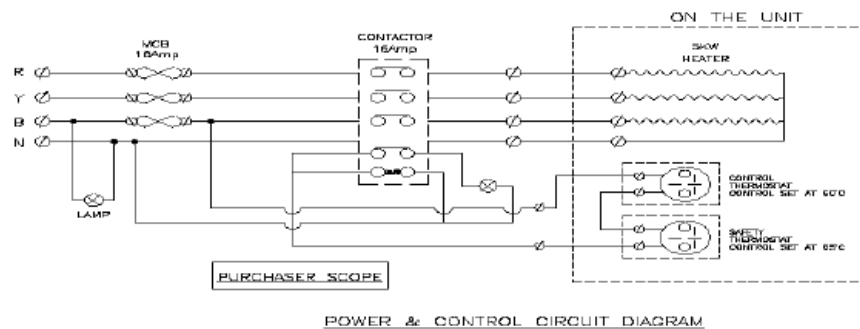
LO skid shall be as per manufacturing standard , a complete self-contained lubricating oil system including tanks, pumps (shaft driven MOP, AOP), twin coolers, 3-way valve, twin filters, PSVs, strainers, piping, etc. along with all necessary instrumentation and control hardwares for the lubrication of the main pump, drive motor and other accessories of the skid shall be in bidder scope of supply.

However, following minimum requirements shall be considered by the bidder:

- i. The lube oil system shall be console type, mounted separately at adequate level difference from the main pump skid to ensuring positive draining of lube oil to tank and maintain bearing oil temperature rise within the limits.
- ii. Each pump train shall be provided with independent lube Oil Console.
- iii. The lube oil console shall be located adjacent to the main pump package skid.
- iv. Twin lube oil coolers with 3-way valve shall be provided for on-line interchangeability.
- v. Heating arrangement for lube oil reservoir may be provided (if required). The minimum retention time for the reservoir sizing shall be 3 minutes based upon normal oil flow and total reservoir volume below the minimum operating level. Also the reservoir shall be sized to provide rundown capacity of at least 10% more than the amount of oil contained in all components, bearing housing and return oil piping of the L.O. system.
- vi. Main lube oil pump shall be shaft driven. The standby lube oil pump shall be motor driven and shall be of identical performance characteristic as that of main LO pump. The LO pump capacity shall be based on maximum system usage plus a minimum of 10% and motor shall also be rated to operate at lowest ambient viscosity of oil of rated capacity.
- vii. The standby lube oil pump shall be rotary positive displacement type as per OEM recommendation.
- viii. All lube oil piping (supply & return) along with flanges, fittings & valves shall be SS 316 construction. Any tubing required shall be of SS-316.
- ix. The interconnection piping between the equipments (Pump, Gear box (if applicable), Motor) and Lube oil system in bidder scope of supply.
- x. LO skid shall cater for the LO requirement of Pump, Motor (lube oil requirement), Gear Box (if applicable) and other accessories of the skid.

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- xi. MOP shall be designed to supply the lube oil to bearings from boiler feed pump minimum speed (as per OEM recommendation) to the rated speed. Accordingly, bidder to select suitable MOP.
- xii. For other details, pls refer annexure-1.
- xiii. A typical power and control circuit diagram for the lube oil heater is mentioned below:



Bidder to note that BHEL shall provide only 3 ph, 415 V feeder. All other necessary items for auto cut off of heater shall be supplied by the bidder only.

6.7. Inter connecting Piping & Instrumentation:

Inter connecting piping:

Suitable IBR certified suction, discharge, recirculation and BLO line spool pieces, reducers/expanders, Flanges & Companion flanges with necessary gaskets & bolts at all terminal points matching with BHEL pipe sizes as indicated in the P& I D [Annexure-1B] shall be in bidder's scope of supply.

Flanges & Counter flanges & pipe fittings shall be as per enclosed PMS [Annexure: 1C].

Instrumentation:

Instrumentation Required for Pump, Gear Box (If Applicable) shall be as per as per enclosed Annexure-1 & C&I specification, Annexure-5.

Following instruments are also in bidder scope of supply:

- i. 1 No of Pressure Safety relief valve at each Balance leak off line.
- ii. Pressure Gauges at each individual consumer [Pump, Gear Box (if applicable), lube oil skid] cooling water inlet & outlet lines of complete skid.
- iii. Temperature Gauges at each individual consumer [Pump, Gear Box (if applicable), lube oil skid] cooling water inlet & outlet lines of complete skid. All temperature instruments shall be provided with thermo-well.
- iv. Sight flow indicator shall be provided on each individual consumer [Pump, Gear Box (if applicable), lube oil skid] cooling water return lines of complete skid and at return header of the skid. Sight flow indicator shall have ball or flag for easy verification of water flowing through pipes.

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- v. Thermal relief valve (in each isolatable cooling water circuit) shall be provided upstream of globe valve on each individual cooling water outlet lines of complete skid and at return header of the skid.
- vi. Gate valve at each individual consumer [Pump, Gear Box (if applicable), lube oil skid] cooling water inlet lines of complete skid.
- vii. Globe valve at each individual consumer [Pump, Gear Box (if applicable), lube oil skid] cooling water Outline lines of complete skid.

Note:

- 1) All Instruments hook up shall be provided by bidder for bidder and BHEL supplied instruments.
- 2) Bidder's supplied instruments (RTD, PSV, PG, TG & TRV etc.) technical detail shall be as per Annexure: 5.

Provision for BHEL Supplied Instruments:

Applicable for Instruments mounted on BFP Suction, Discharge, Recirculation & Balance leak off line.

A) For all pressure measuring instruments [Pressure gauge, Pressure Transmitters, Differential Pressure Gauge, Differential Pressure Transmitters], Pump supplier to provide stub with root valves and hook up arrangement including manifold up to local gauge board as per manufacturing Standard. Refer Annexure-5. Only instruments shall be supplied by BHEL and rest of the items up to gauge board shall be in bidder scope of supply. Based on the pressure rating & as per annexure-1, pump supplier to provide single / double root valves. Following are the instruments for which bidder to provide provisions along with hook up arrangements including manifold:

i) Pressure Gauges at:

- pump suction
- pump discharge
- Re-circulation line
- Balance leak off line

ii) Differential Pressure Gauge across Suction strainer [Hook up arrangement by BHEL]

iii) Differential Pressure Transmitter across Suction strainer [Hook up arrangement by BHEL]

iv) Pressure Transmitter at:

- pump suction
- pump discharge
- Balance leak off

B) For all temperature instruments temperature stub of 1 ½" Flanged connection up to #600 & 2" flanged connections beyond #600 be provided by the bidder. Refer annexure-6 for stub length.

Following are the instruments for which pump suppliers to provide provisions with Flanged connections as mentioned above:

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- i) Temperature Gauges at:
 - pump suction
 - pump discharge

- ii) Thermocouple with Temperature Transmitter at:
 - pump suction
 - pump discharge

Notes:

- i. Bidder to provide provision for mounting the above mentioned BHEL supplied instruments.
- ii. Referring to the above, The Pressure & temperature instruments along with JB & cabling shall be in BHEL scope of supply. However, bidder to supply structural support for mounting JBs on Base plate. However, all other instruments for Pump, Gear Box (If Applicable) along with all accessories such as hook up arrangements, cabling, Cable trays, JBs etc. shall be in bidder scope of supply.
- iii. Process switches are not applicable.
- iv. Cable trays & installation of the cable trays for all the instruments [Instruments supplied by both BHEL & bidder] shall be in bidder scope of supply.

Provision for Vibration Monitoring System items:

Only provision for mounting probes shall be made available on All Pumps, Gear Box(If Applicable) etc. Provision for mounting Key Phasor to be provided for each speed change of the shaft system. Pump supplier to furnish type of probes [velometer or accelerometers or proximity probes] based on the type of bearings so that suitable probes can be supplied by BHEL. Based on the probe details, Notch dimensions and vibration pad details (Dimension, tapping details) shall be provided during detail engineering stage.

Bearing RTD & JB for Pumps and Gear Box (if applicable):

All instrumentation shall be as per enclosed C&I specification, Annexure-5.

Pump:

- i. 2 Nos. Duplex RTD for radial bearing of pump DE
- ii. 2 Nos. Duplex RTD for radial bearing of pump NDE
- iii. 4 Nos. [2 Nos. for active & 2 Nos. for inactive side] Duplex RTD for thrust bearing of pump
- iv. 1 no of TGs for each bearing

Gear Box (If Applicable):

- i. 2 Nos. Duplex RTD for radial bearing of HSS DE
- ii. 2 Nos. Duplex RTD for radial bearing of HSS NDE
- iii. 2 Nos. Duplex RTD for radial bearing of LSS DE
- iv. 2 Nos. Duplex RTD for radial bearing of LSS NDE
- v. TGs for each bearing

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Note: Required Temp Transmitters for the RTDs shall be supplied by BHEL.

Casing skin temperature monitoring system

BFPs shall be provided with pump casing skin temperature monitoring system consisting of Four thermocouples along-with yoke mounted temperature transmitters with integral indicator for each thermocouple including interconnecting cables, JB's etc.

No. of Junction Boxes in bidder scope of supply : Refer Annexure-1

Each Pump & Drive assembly skid shall be provided with following No. of Junction Boxes.:

- i. For Pump – Bidder to recommend as per no of instruments & spare philosophy

6.8. Local Gauge Board:

Local gauge board [as required] for mounting instruments shall be included in pump supplier scope. Provision shall be available on the gauge board for mounting all instruments supplied by both BHEL & Bidder.

All the gauge boards shall be box type, weatherproof construction suitable for outdoor mounting with front side glass for readability for local gauges.

Gauge board shall be constructed from steel sheet with other necessary SS supporting structure.

6.9. Supply of Accessories and Services

Following accessories shall be included in bidder scope:

- i. Drain& Vent connection with valve
- ii. Eye-bolts, lifting tackle etc.

6.10. Common base frame

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

6.11. Complete Unit Test

Complete unit test is included in bidder scope of supply.

All ordered pumps shall be tested with Job motor, Job coupling, and Job base plate, Job Gear Box (if applicable) etc.

It may be noted that, since HT motors are exclude from bidder scope of supply, motor shall be free issued to vendor from BHEL for testing at bidder works.

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6.12. First Fill of Lubricant

Not in Bidder's Scope of Supply.

6.13. Necessary foundation bolts, nuts, shims/grouting pads etc. for Pump and Motor.

6.14. All other items necessary for safe and smooth running of Pump & accessories required to make the supplied equipment complete in all respect.

6.15. Commissioning Spares

Three sets (One set for each pump for Pump and Drive assembly).

Commissioning spare shall be as per OEM recommendation. However, following commissioning spares shall be considered as a minimum for each pump:

- a) Set of O rings, gaskets,
- b) Set required Lube oil filters for initial flushing
- c) Set of required Strainer elements for LO skid

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

Any leftover (unused) spares after commissioning, out of those included by vendor, shall be handed over to the owner.

1 set stands for requirement for one no. of skid. Bidder to furnish the list along with the offer. Bidder shall include all the required commissioning spares in their scope of supply and ensure that the erection and commissioning of the plant is not delayed for want of Commissioning spares.

Prices for the commissioning spares shall be part of main scope of supply. No separate price shall be offered for the same.

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

6.16. Mandatory Spares:

Not Applicable

6.17. Special Tools and Tackles

3 Sets (One set for each pump for Pump and Drive assembly).

One set (1 Set) of Special tools and tackles [special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance (disassemble, assemble, or maintaining the unit) of the Pump and Motor assembly shall be quoted as per manufacturer's recommendation.

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1 Sets stands for requirement for one no. of skid. Bidder to furnish the list along with the offer.

Prices for Special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

6.18. LOGIC DIAGRAM & WRITE UP

Interlocks & Protections realized in PLC, DCS (BHEL scope). However, vendor shall provide the necessary write-up & logic diagram.

6.19. CONFLICTS IN SPECIFICATION REQUIREMENTS

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

6.20. COOLING WATER PARAMETERS

BHEL shall provide cooling water at one location for each Pump skid. Further distribution [Pump, Motor, Gear Box (if applicable)] shall be in Pump supplier scope of supply & all return line shall be terminated at BHEL provided return header at each skid.

BHEL inlet & outlet pipe size:2". Accordingly, suitable reducer/expander to meeting BHEL pipe size shall be in bidder scope of supply.

The parameters are as follows:

Working pressure (Min/Normal/Max): 3.5/4.5/5.5 kg/cm² (a)

Mech. design Pressure: 8.5 kg/cm² (a)

Max. Allowable pressure drop in the system: **0.6 kg/cm²**

Inlet Temp.: 35.5 Deg. C

Mechanical design Temp.: (Max.)

Max. Temp. Rise in the system: **6 Deg. C***

***Note: Considering the above mentioned maximum temperature rise, bidder to design the lube oil cooler.**

Necessary arrangement in order to meet the internal pressure demand of Pump-Hydraulic Assembly to be considered by bidder.

7. OPTIONAL PRICES

Please Refer to Attached Price Bid Format (Annexure: 4).

Bidder to quote optional price for following items:

- i. Supervision charger for Erection & Commissioning of BFP

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- ii. 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.]

8. EQUIPMENT QUALIFICATION CRITERIA (EQC)

Vendor to furnish duly fill in Experience Record Proforma as per Annexure-6.

9. QUALITY PLAN & INSPECTION & 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.

Pl refer Annexure: 7 for guidelines & QAP format. For details, refer enclosed specifications.

9.2. INSPECTION

BHEL/Third Party appointed by BHEL/DCM/DCPL.

The various review/witness/observation stages by individual agencies (or) Group of Agencies as above will be in line with approved quality plan. Pl refer Annexure: 7 for guidelines & QAP format. For details, refer enclosed specifications.

9.3. TESTING

Testing shall be as per PTC 8.2 : ASME Performance Test Codes for Centrifugal Pumps. However, Performance tolerance for Pump shall be as mentioned below:

- i. Rated head: Zero negative tolerance @ rated flow rate & rated speed
- ii. Shut-off head: Following criteria shall apply:
 - a) Positive tolerance permitted as long as maximum shutoff pressure corresponding to shut-off head (as observed during the shop performance test) and the maximum suction pressure (as specified on pump datasheet), does not exceed 2589 mlc (including 5 percent positive tolerance).
 - b) Negative tolerance is not permitted.
- iii. NPSHR: Zero positive tolerance
- iv. Guaranteed case & Rated point BkW: Zero positive tolerance.

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[Auxiliary power for Pump shall be limited to **1465 kW while running at guarantee condition** including gear box losses in case gear box is applicable. Auxiliary power for Pump above 1465 kW while running at guarantee condition is not acceptable and bidder's offer shall be liable for rejection.

Note: Above Auxiliary power shall be pump shaft power + Gear Box losses (if applicable) at guaranteed condition.]

10. PAINTING

The VENDOR's scope of work shall include surface preparation, and application of shop painting and final painting to all equipment and accessories, uninsulated piping and structural steel work forming part of this package. The color code shall be based on Indian Standard, IS.

Prior approval of painting shall be taken from BHEL after award of contract.

11. PACKING AND FORWARDING

The equipment shall be protected for a storage of 12 months at site. If any extra precaution is to be taken by the purchaser for storage beyond 12 months, the same shall be explicitly indicated in the Operation & Maintenance manual. For details pl refer Annexure-5C.

12. SUB VENDORS

Bidder shall follow approved sub vendors list as per Annexure: 8.

In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list [Annexure: 8] and to furnish Proven Track record , credentials for the proposed vendors for BHEL approval.

For other items for which sub vendors are not specified, bidder can follow their standard vendors with due intimation to BHEL during detailed enggstage. Also they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

13. INSTRUCTIONS ON PRICE BID FORMAT

Bidder to indicate his offer as per Price Bid format enclosed as Annexure: 3.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per Annexure: 11, 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.

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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.

14. PRE-BID CLARIFICATIONS & DEVIATIONS:

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.

Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.

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.

All pre-bid clarifications & deviations shall be clear bring as per Annexure: 11 only.

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. In such cases, proof of the same shall be furnished along with the offer.
- 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 considered by bidder will not be permitted.
- d) Deviations [if any] shall be clear bring as per Annexure: 10 only.

15. 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: 9.

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

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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: Approval

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.

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.

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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 category.	Soft copy only	Within 14 days of placement of order
2)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 10 days of document submission
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 7 day of receipt of commented Drawings from BHEL
4)	BHEL shall furnish their observation on revised submitted documents	Soft copy only	Within 7 days 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

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

16. VARIANT TABLE:

Variant	Item	Material Code
01	Boiler Feed Pump Assembly with commissioning spare and Special tool and Tackles.	



RECORD OF REVISIONS

[illegible]

ESP- 001-2A		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-1	
				Rev. No.	00

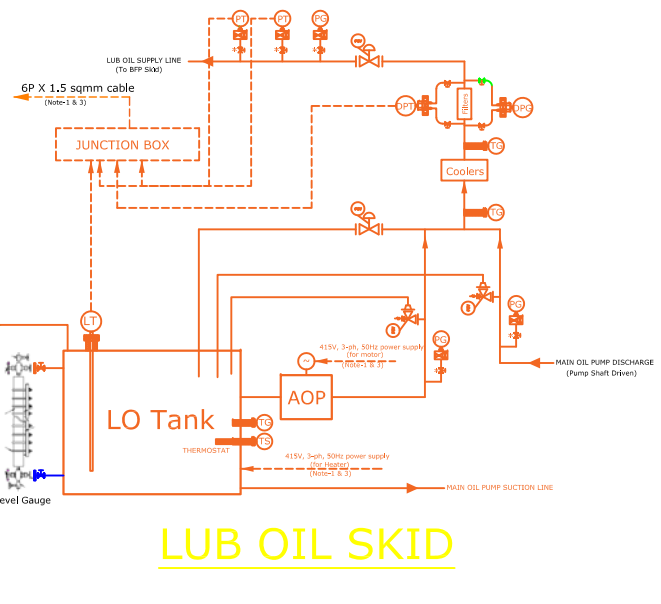
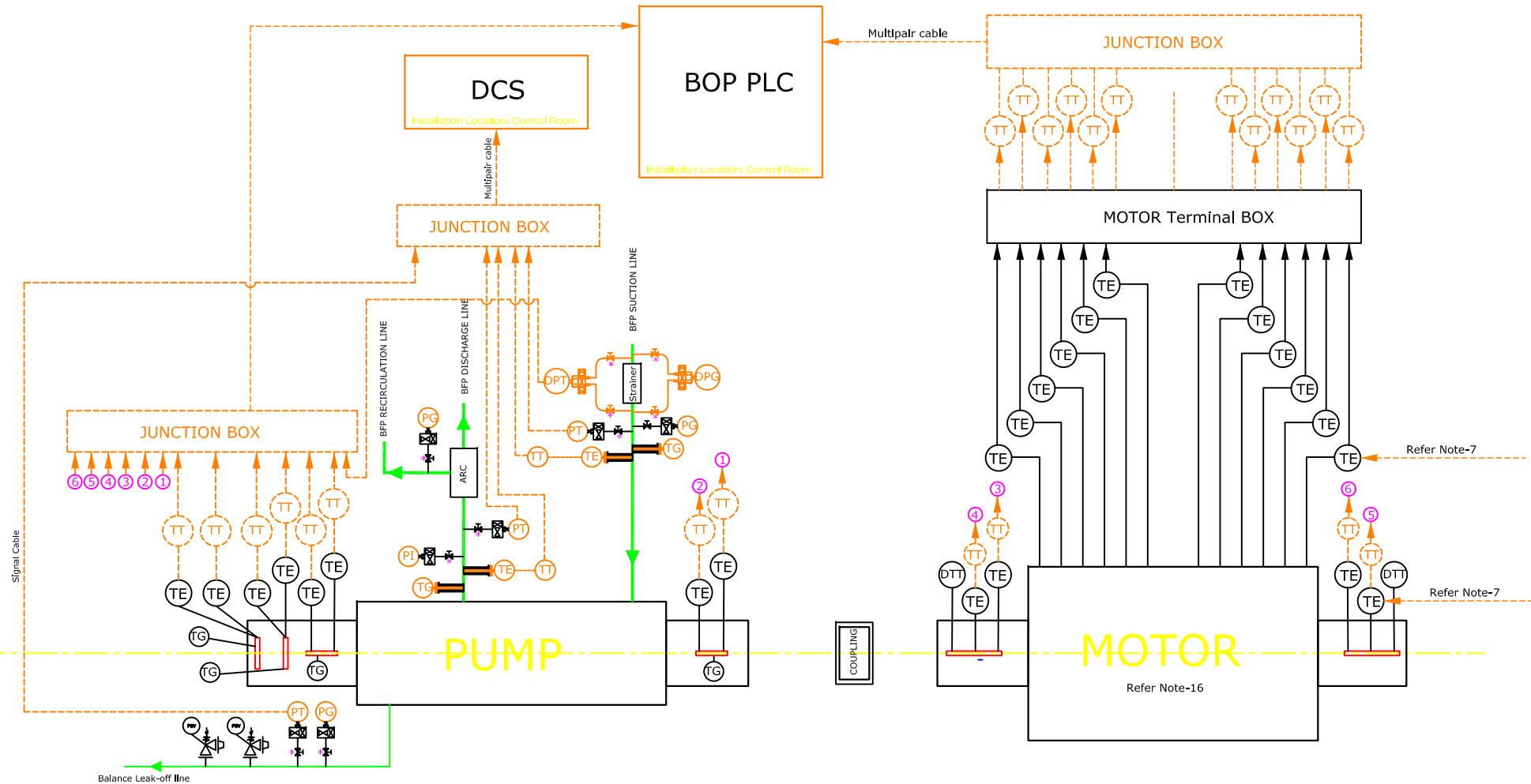
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-1 Annexure 1 -A: BFP interface & scope matrix Annexure 1 -B: Schematic Diagram for Boiler Feed Pump Annexure 1 -C: Piping specifications [PMS]				

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
	Refer to record of revisions	Ratish Kumar Thakur	Girish Prasad Palo Surya Satya Nagesh M	08.04.20

BFP SKID Interface & Scope Matrix between BHEL & BFP Supplier(Annexure-1 A)

NOTES:

- 1) Termination accessories (like cable glands, lugs, dummy plugs, etc) and termination of all types of cables at bidder supplied items/panels shall be in Bidder scope
- 2) Vendor shall furnish the Earthing requirements of BFP SKID along with technical bid.
- 3) Purchaser shall provide the power supplies as per scope markings indicated above.
- 4) All the instruments / JB's (including BHEL supplies) of above skids shall be installed in Local Gauge Boards supplied by bidder. Necessary structural supports (as required for instruments installation) shall be considered by bidder.
- 5) Configuration of Pump-Motor & LO Skid shall be as per bidder recommendation.
- 6) Bidder to include minimum instrumentation as per this scheme. However, for complete scope of supply specification & applicable codes to be referred.
- 7) Winding & Bearing RTDs of Motor and BTTs are excluded from bidder scope(For HRSG & VHP BFP Drive).For MP BFP Drive instruments are not applicable.
- 8) This document refers only for signal exchange and instrument scope.
- 9) Bidder shall provide the provision on installation of Vibration probes/Key Phasor on Pump/Motor etc.
- 10) Instruments tag numbers / junction box schedules shall be provided during detail engg by BHEL.
- 11) Bidder shall provide sufficient space required for maintenance and easy access of instruments / junction boxes / cables.
- 12) Instrument hookup materials for all BHEL /bidder supplied instruments shall be in bidder scope. These materials shall be hydro tested by connecting dummy plugs in place of instruments before dispatch of the skid.
- 13) All the drains and vents shall be connected internally and brought to bottom location with common and single drain and vent pipes with flanged connection within skid.
- 14) Piping, instrument installation and cables shall be properly dressed with suitable erection hardware to have better aesthetic look.
- 15) Impulse line / hookup line / cable routing shall be done considering aesthetic look of skid and criss-crossing shall be avoided. Routing shall NOT be cause hindrance for maintenance. Routing arrangement shall be submitted to BHEL for approval.
- 16) Drive Motor is in BHEL scope of supply.



LEGENDS:

- DTT -> Dial type Thermometer
- ST -> Speed Indicator cum Transmitter
- XG -> Local Gauges (Pressure / Temperature)
- XT -> Field transmitters (Pressure / Temperature / Level)
- TG -> Dial Type Temperature Gauge
- * X stands P/L as applicable.

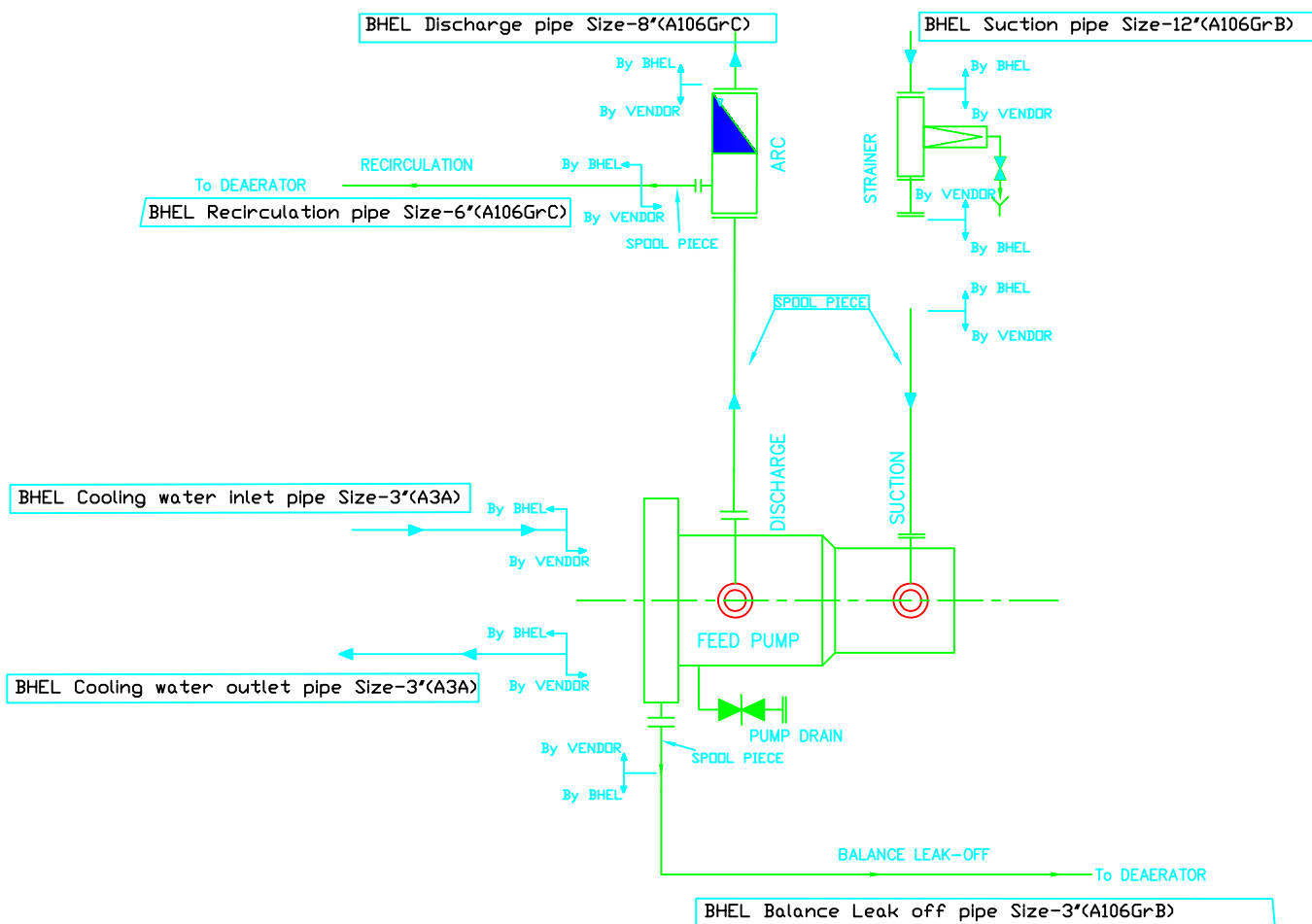
----- Instruments / cables/Tubing etc. indicated with Orange color are NOT in bidder scope.

Instruments indicated for LO Skid is indicative only. Bidder to consider additional instruments if recommended by manufacturer for proper functioning.

CUSTOMER:		DCM SHRIRAM LTD. BHARUCH, GUJARAT			
CONSULTANT:		DEVELOPMENT CONSULTANTS PRIVATE LIMITED, KOLKATA			
PROJECT:		1 X 120 MW COAL BASED REHEAT TPP JHAGADLA, BHARUCH, GUJARAT			
DEPT.		UNTOL. DIMS. GR. Ø/M/ft		SCALE NTS	
CODE		WEIGHT (KG) -NA-		REF. TO ASSY. DRG. -NA-	
TITLE		CARD CODE NA		REV. 00	
BFP INTERFACE & SCOPE Matrix between BHEL & BFPs Supplier		DRG. NO. SHT. No 01		NO. OF SHT. 01	

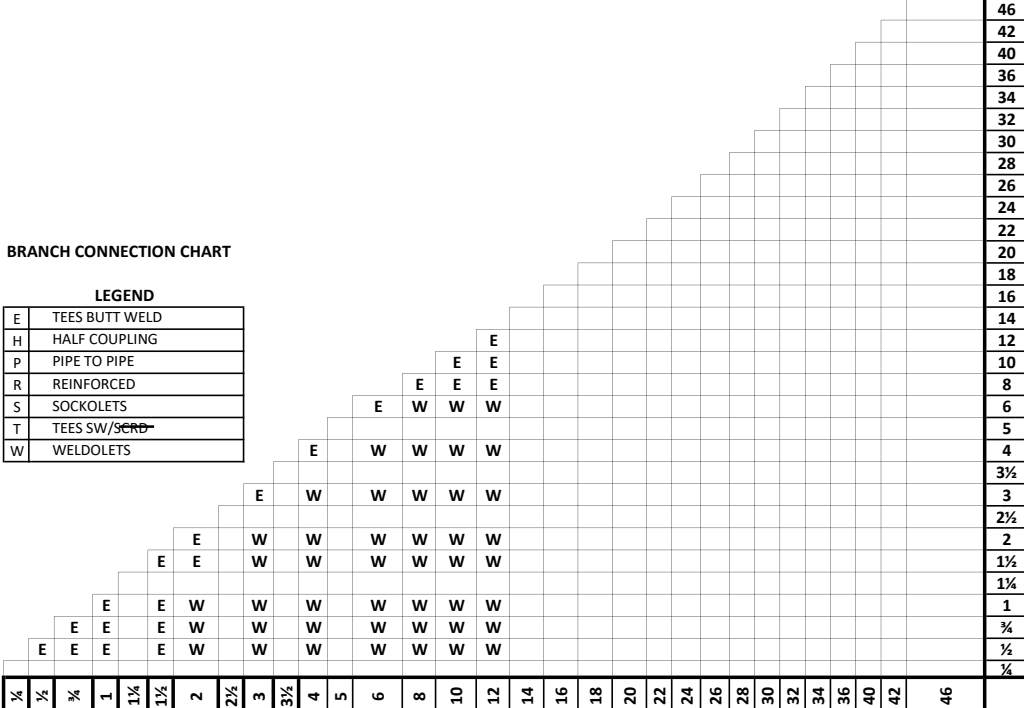
ANNEXURE 1-B

1.TYPICAL SCHEMATIC DIAGRAM FOR HRSG BFP



NOTES

1. BHEL pipe sizes are mentioned in the above schematics. Suitable spool pieces, Flanges, Companion flanges with required gaskets & studs, nuts etc , Reducer/Expanders to meet BHEL pipe sizes shall be in bidder scope of supply.
2. BHEL shall provide cooling water at one location for each BFP skid. Further distribution to Pump, Motor, LO Skid shall in bidder scope of supply. For instrumentation in individual CW inlet/outlet line specification shall be referred.
3. This schematic is only for indicating terminal point details. For scope of supply Specification shall be referred. However, for clarity on Instrumentation please refer Annexure 1-A.
4. Required stubs, isolation valves, hook up arrangements etc for DPG & DPT shall be provided by BHEL on BHEL supplied piping.
5. Bidder to provide spool pieces in BLO & Recirculation line as indicated above. Further bidder to provide required stubs, isolation valves, hook up arrangements etc for PG & PT in BLO line & PG in Recirculation line.
6. 1 nos of PSV on BLO line shall be supplied by the bidder on BLO line spool piece.
7. Please refer clause no 6.7 reg provision for BHEL supplied instruments.
8. Tag Nos. shall be provided after order placement.

 PE&SD-Mech.	PIPING MATERIAL SPECIFICATION	51C														
Customer: DCM SHRIRAM ANSI CLASS: #1500 MATERIAL: CARBON STEEL CORR.ALL. 1 mm Special requirement IBR																
TEMPERATURE (Deg.C) & PRESSURE (kg/cm² g) RATINGS																
TEMP	-29	38	50	100	150	200	205									
PRESS.	241.0	241.0	241.0	241.0	241.0	241.0	241.0									
SERVICE	BOILER FEED WATER (DO NOT USE THIS PMS BEYOND 241 KG/CM ² G AND 205°C)															
ITEM	SIZE		DESCRIPTION													
MAINT. JOINTS	ALL		FLANGED (TO BE KEPT MINIMUM)													
PIPE JOINTS	1½" AND BELOW		SW COUPLING (REF NOTE-3)													
	2" AND ABOVE		BUTT WELDED AS PER ANSI B16.25													
DRAINS	ALL		1" & AS PER PROJECT REQUIREMENTS													
VENTS	ALL		1" & AS PER PROJECT REQUIREMENTS													
TEMP. CONN.	M33X2		PLEASE ALSO REFER 'PIPE-INSTRUMENT INTERFACE' DOCUMENT ISSUED BY C&I GROUP													
PRESS. CONN.	1/2" SW		PLEASE ALSO REFER 'PIPE-INSTRUMENT INTERFACE' DOCUMENT ISSUED BY C&I GROUP													
NOTES	1. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING. 2. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE/THICKNESS. 3. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY. 4. BLANK. 5. BLANK. 6. NDT REQUIREMENTS AS PER BHEL STD. DOC. NO. GT 57124 7. ALL PIPES, FITTINGS, VALVES, FLANGES STRAINERS, ETC SHALL BE TESTED & TEST CERTIFICATES IN FORM IIIA FOR PIPES & FORM IIIC FOR OTHERS SHALL BE REQUIRED DULY COUNTER SIGNED BY IBR AUTHORITY OR THEIR APPROVED REPRESENTATIVE. 8. VENT, DRAIN AND PRESSURE TAPPING SHALL BE PROVIDED WITH BUTT WELDED TYPE DOUBLE ISOLATION GATE VALVES ONLY. 9. BLANK 10. FOR GENERAL NOTES ON PMS, PIPING & VALVES REFER STD. NO GT 69959. 11. BLANK.															
BRANCH CONNECTION CHART																
LEGEND																
E	TEES BUTT WELD															
H	HALF COUPLING															
P	PIPE TO PIPE															
R	REINFORCED															
S	SOCKLETS															
T	TEES SW/SEW															
W	WELDOLETS															
																

 PE&SD-Mech.		PIPING MATERIAL SPECIFICATION								51C	
Customer:		DCM SHRIRAM									
ANSI CLASS:		#1500									
MATERIAL:		CARBON STEEL									
CORR.ALL.		1 mm									
Special requirement		IBR									
ITEMS	TYPE	ENDS	DIA. RANGE (INCH)		SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL CARBON STEEL		NOTE	Revision
			LOW	HIGH				DESCRIPTION	BHEL SPEC		
PIPES	SEAMLESS	BE	½	6	S 160		B 36.10	ASTM A106 GRC			
	SEAMLESS	BE	8	8	S 160		B 36.10	ASTM A106 GRC			
	SEAMLESS	BE	10	10	S 160		B 36.10	ASTM A106 GRC			
	SEAMLESS	BE	12	12	S 160		B 36.10	ASTM A106 GRC			
FLANGES	WELD NECK	RJ	½	1½	1500	63 AARH	B 16.5	ASTM A 216 Gr. WCC			
	WELD NECK	RJ	2	12	1500	63 AARH	B 16.5	ASTM A 216 Gr. WCC			
	BLIND	RJ	½	1½	1500	63 AARH	B 16.5	ASTM A 216 Gr. WCC			
	BLIND	RJ	2	12	1500	63 AARH	B 16.5	ASTM A 216 Gr. WCC			
	FIGURE8 BLANK	RJ	½	1½	1500	63 AARH	B 16.48	ASTM A 216 Gr. WCC			
	FIGURE8 BLANK	RJ	2	4	1500	63 AARH	B 16.48	ASTM A 216 Gr. WCC			
FITTINGS	SPACER & BLIND	RJ	6	12	1500	63 AARH	B 16.48	ASTM A 216 Gr. WCC			
	ELBOWS 90 DEG	BW	½	12	M		B 16.9	ASTM A 234 GR WPC		2	
	ELBOWS 45 DEG	BW	½	12	M		B 16.9	ASTM A 234 GR WPC		2	
	EQ. TEE	BW	½	12	M		B 16.9	ASTM A 234 GR WPC		2	
	CON. RDCR	BW	½	12	M,M		B 16.9	ASTM A 234 GR WPC		2	
	CAP	BW	½	12	M		B 16.9	ASTM A 234 GR WPC		2	
VALVES	WELDOLET	BW	½	12	M		MSS-SP97	ASTM A 216 Gr. WCC		2	
	GATE	BW	½	2	1500		API 602	B:A 216 GR. WCC; T:13% Cr;St			
	GATE	BW	3	12	1500		ANSI B16.34	B:A 216 GR. WCC; T:13% Cr			
	GLOBE	SW	½	1½	1500		BS 5352	B:A 216 GR. WCC; T:13% Cr;St			
	GLOBE	BW	2	12	1500		ANSI B16.34	B:A 216 GR. WCC; T:13% Cr			
	Reg GLOBE VLV	SW	½	1½	1500		BS 5352	B:A 216 GR. WCC; T:13% Cr;St			
	Reg GLOBE VLV	BW	2	12	1500		BS 1873	B:A 216 GR. WCC; T:13% Cr			
	CHECK (PISTON LIFT)	BW	½	2	1500		BS 5352	B:A 216 GR. WCC; T:13% Cr;St			
CHECK	BW	3	12	1500		ANSI B16.34	B:A 216 GR. WCC; T:13% Cr				
BOLT & GASK	B: BODY, T: TRIM, BB: BOLTED BONNET, St: STELLITED										
	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	PY52070		
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	PY52071		
	O-RING GASKET		½	12	1500		B 16.20	SOFT IRON	PY52157		
MISC	STRAINER	SW	½	1½	1500		MNF. STD.	B:A 216 WCC; INT: SS 304			
	Y-TYPE STRAINER	BW	2	12	1500		MNF. STD.	B: A 216 WCC; INT: SS 304			
B : BODY; INT : INTERNALS											



PE&SD-Mech.

PIPING MATERIAL SPECIFICATION

21C

Customer: DCM SHRIRAM

ANSI CLASS: 300 #

MATERIAL:	CS (A106 Gr. B)
------------------	-----------------

CORR.ALL.	1 mm
-----------	------

Special requirement	IBR
---------------------	-----

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

[illegible]

SERVICE

BFP SUCTION (DO NOT USE THIS PMS BEYOND 17 KG/CM²G AND 250°C)

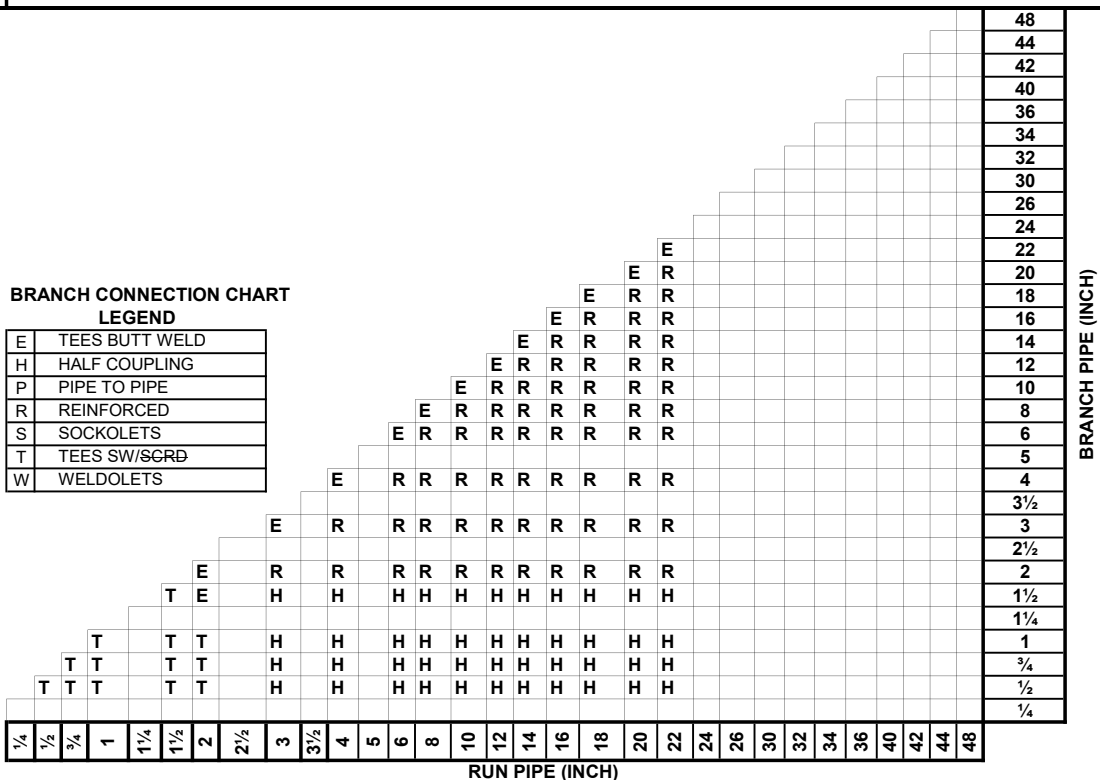
ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	1½" AND BELOW	SW COUPLING (REF NOTE-5)
	2" AND ABOVE	BUTT WELDED AS PER ANSI B16.25
DRAINS	ALL	1" & AS PER PROJECT REQUIREMENTS
VENTS	ALL	1" & AS PER PROJECT REQUIREMENTS
TEMP. CONN.	M33 X2	PLEASE ALSO REFER 'PIPE-INSTRUMENT INTERFACE' DOCUMENT ISSUED BY C&I GROUP
PRESS. CONN.	1/2" SW	PLEASE ALSO REFER 'PIPE-INSTRUMENT INTERFACE' DOCUMENT ISSUED BY C&I GROUP

NOTES

- | |
|---|
| 1. NDT REQUIREMENTS AS PER BHEL STD DOC NO GT 57124 |
| 2. ALL PIPES, FITTINGS, VALVES, FLANGES STRAINERS, ETC SHALL BE TESTED & TEST CERTIFICATES IN FORM IIIA FOR PIPES & FORM IIIC FOR OTHERS SHALL BE REQUIRED DULY COUNTER SIGNED BY IBR AUTHORITY OR THEIR APPROVED REPRESENTATIVE. |
| 3. FOR GENERAL NOTES ON PMS, PIPING & VALVES REFER STD. NO GT 69959. |
| 4. BLANK. |
| 5. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY. |
| 6. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING. |
| 7. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE/THICKNESS. |
| 8. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL. |

BRANCH CONNECTION CHART LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW/SGRD
W	WELD OLETS



 PE&SD-Mech.		PIPING MATERIAL SPECIFICATION							21C		
Customer: DCM SHRIRAM											
ANSI CLASS: 300 #											
MATERIAL: CS (A106 Gr. B)											
CORR.ALL. 1 mm											
Special requirement IBR											
ITEMS	TYPE	ENDS	DIA. RANGE (INCH)		SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL CARBON STEEL		NOTE	Revision
			LOW	HIGH				DESCRIPTION	BHEL SPEC		
PIPES	SEAMLESS	PE	½	1½	S 80		B 36.10	A106 GRB	PY52097		
	SEAMLESS	BE	2	8	S 40		B 36.10	A106 GRB	PY52097		
	SEAMLESS	BE	10	12	S30		B 36.10	A106 GRB	PY52097		
	SEAMLESS	BE	14	18	S STD		B 36.10	A106 GRB	PY52097		
	EFSW	BE	20	22	S STD		B 36.10	A672 GRB60	PY52098		
FLANGES	WELD NECK	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	PY52086		
	WELD NECK	RF	2	22	300	125AARH	B 16.5	ASTM A 105	PY52086		
	BLIND	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	PY52090		
	BLIND	RF	2	22	300	125AARH	B 16.5	ASTM A 105	PY52090		
	FIGURE'8' BLANK	RF	½	1½	300	125AARH	B 16.48	ASTM A 105			
	FIGURE'8' BLANK	RF	2	8	300	125AARH	B 16.48	ASTM A 105			
	SPACER & BLIND	RF	10	22	300	125AARH	B 16.48	ASTM A 105			
FITTINGS	ELBOWS 90 DEG	SW	½	1½	3000		B 16.11	ASTM A 105	PY52110		
	ELBOWS 90 DEG	BW	2	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	PY52101	7	
	ELBOWS 90 DEG	BW	16	22	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	PY52101	7	
	ELBOWS 45 DEG	SW	½	1½	3000		B 16.11	ASTM A 105	PY52110		
	ELBOWS 45 DEG	BW	2	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	PY52112	7	
	ELBOWS 45 DEG	BW	16	22	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	PY52112	7	
	EQ. TEE	SW	½	1½	3000		B 16.11	ASTM A 105	PY52111		
	EQ. TEE	BW	2	14	M		B 16.9	ASTM A 234 GR WPB	PY52108	7	
	EQ. TEE	BW	16	22	M		B 16.9	ASTM A 234 GR WPB-W	PY52108	7	
	CON. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB	PY52103	7	
	CON. RDCR	BW	16	22	M,M		B 16.9	ASTM A 234 GR WPB-W	PY52103	7	
	CAP	BW	2	14	M		B 16.9	ASTM A 234 GR WPB		7	
	CAP	BW	16	22	M		B 16.9	ASTM A 234 GR WPB-W		7	
	FULL COUPLING	NPT/NPT	½	¾	3000		B 16.11	ASTM A 105	PY52094	5	
	FULL COUPLING	NPT/NPT	1	1½	3000		B 16.11	ASTM A 105	PY52094	5	
	FULL COUPLING	SW	½	¾	3000		B 16.11	ASTM A 105	PY52094		
	FULL COUPLING	SW	1	1½	3000		B 16.11	ASTM A 105	PY52094		
	VI (HALF CPLG)	SW	½	¾	3000		B 16.11	ASTM A 105	PY52093		
	VI (HALF CPLG)	SW	1	1½	3000		B 16.11	ASTM A 105	PY52093		
	NIPPLE	BW /NPT	½	¾	S 80		B 16.11	A106 GRB		5	
	NIPPLE	BW /NPT	1	1½	S 80		B 16.11	A106 GRB		5	
	NIPPLE	NPT/NPT	½	¾	S 80		B 16.11	A106 GRB		5	
	NIPPLE	NPT/NPT	1	1½	S 80		B 16.11	A106 GRB		5	
VALVES	GATE	SW	½	2	800		API 602 / BS 5352	B:A 105; T:13% Cr;St	PY52151		
	GATE	BW	3	22	300		API 600	B:A 216 GR. WCB; T:13% Cr	PY52049		
	GLOBE	SW	½	2	800		BS 5352	B:A 105; T:13% Cr;St	PY52160		
	GLOBE	BW	3	22	300		BS 1873	B:A 216 GR. WCB; T:13% Cr			
	Reg GLOBE VLV	SW	½	2	800		BS 5352	B:A 105; T:13% Cr;St	PY52187		
	Reg GLOBE VLV	BW	3	22	300		BS 1873	B:A 216 GR. WCB; T:13% Cr	PY52171		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	PY52150		
	CHECK	BW	2	22	300		BS 1868	B:A 216 GR. WCB; T:13% Cr	PY52048		
B:BODY, T:TRIM, BB:BOLTED BONNET, St:STELLITED											
BOLT & GASKET	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	PY52070		
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	PY52071		
BOLT & GASKET	GASKET		½	22	300		B 16.20	NAB MSW (SS304)+ GRAPHITE	PY52079	8	
MISC	STEAM TRAP	SW	½	2	800	THERMODYNA MIC	MNF. STD.	B:A 105; INT: SS 304	PY52015		
	Y-TYPE STRAINER	SW	½	2	800		B 16.11	B: A 105; INT: SS 304			
	Y-TYPE STRAINER	FL	3	22	300		B 16.5	B: A 216 WCB; INT: SS 304			

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				Annexure-2	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

DATA SHEET FOR BOILER FEED PUMPS - MOTOR DRIVEN

Sl.no.	Description	BHEL Requirement	Details
General Data			
1	Service	BFP's envisaged to transfer feed water from De-aerator to Boiler	
2	Number of Pumps	3 Nos. (2W+1S)	
3	Location	Outdoor	
4	Duty	Continuous	
5	Drive	Motor	
6	Pumping fluid	Feed water and un-deaerated feed water during start-up	
7	Mechanical Design Temperature, degree C	200	
8	Pumping fluid temperature, Deg C	171 to 175.9	
9	Deaerator pressure (suction tank) Kg/cm ² (a)	8.28 to 9.3	
10	Low Low water level of Deaerator	25.8 mtr from top of pump foundation	
11	Pump Type	Horizontal, Centrifugal, Multistage, Outer casing Barrel design pump	
12	Pump Model No.	To be mentioned by Bidder	
13	No. of Stages of pump	To be mentioned by Bidder	
14	Rated Speed of Pump (rpm)	To be mentioned by Bidder	
15	Rated speed of drive (rpm)	To be mentioned by Bidder	
16	Design Standard of pump	Non API, and as per enclosed customer/consultant Specification (Annexure-5) & datasheet (Annexure-2).	
17	Sealing arrangement	Cartridge type Mechanical seal with cooling system	
Pump Design Parameters			
Rated Condition			
18	Flow (m ³ /hr)	268	
19	Differential Head (mlc)	2010	
20	Temperature of pumping fluid in Deg C	175.9	
21	Design temperature of Pump in Deg C	200	
22	Sp. Gravity of pumping fluid	0.891	
23	Efficiency (Hot) in %	To be mentioned by Bidder	
24	Available pressure on suction side of BFP ,Kg/cm ² (a)	10.93	
25	NPSH(A) at pump suction nozzle(mlc)	18.34	
26	NPSH(R) (mlc)	To be mentioned by Bidder	
27	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
28	Pump BkW (Hot) kw	To be mentioned by Bidder	
Guaranteed Case			
29	Flow (m ³ /hr)	239	
30	Differential Head (mlc)	1767	
31	Temperature of pumping fluid in Deg C	171	
32	Design temperature of Pump in Deg C	2000	
33	Sp. Gravity of pumping fluid	0.896	
34	Efficiency (Hot) in %	To be mentioned by Bidder	
35	Available pressure on suction side of BFP ,Kg/cm ² (a)	10.03	
36	NPSH(A) at pump suction nozzle(mlc)	19.53	
37	NPSH(R) (mlc)	To be mentioned by Bidder	
38	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
39	Pump BkW (Hot) kw	Auxiliary power for Pump shall be limited to 1465 kW while running at guarantee condition including gear box losses in case gear box is applicable. Auxiliary power for Pump above 1465 kW while running at guarantee condition is not acceptable and bidder's offer shall be liable for rejection. Note: Above Auxiliary power shall be pump shaft power + Gear Box losses (if applicable) at guaranteed condition.	

	Capability Condition-1		
40	Flow (m ³ /hr)	295	
41	Differential Head (mlc)	1799	
42	Temperature of pumping fluid in Deg C	175.9	
43	Design temperature of Pump in Deg C	205	
44	Sp. Gravity of pumping fluid	0.891	
45	Efficiency (Hot) in %	To be mentioned by Bidder	
46	Available pressure on suction side of BFP ,Kg/cm ² (a)	10.93	
47	NPSH(A) at pump suction nozzle(mlc)	18.34	
48	NPSH(R) (mlc)	To be mentioned by Bidder	
49	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
50	Pump BkW (Hot) kw	To be mentioned by Bidder	
	Capability Condition-2		
51	Flow (m ³ /hr)	264	
52	Differential Head (mlc)	1940	
53	Temperature of pumping fluid in Deg C	171	
54	Design temperature of Pump in Deg C	200	
55	Sp. Gravity of pumping fluid	0.896	
56	Efficiency (Hot) in %	To be mentioned by Bidder	
57	Available pressure on suction side of BFP	9.94	
58	NPSH(A) at pump suction nozzle(mlc)	18.56	
59	NPSH(R) (mlc)	To be mentioned by Bidder	
60	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
61	Pump BkW (Hot) kw	To be mentioned by Bidder	
	Capability Condition-3		
62	Flow (m ³ /hr)	264	
63	Differential Head (mlc)	1989	
64	Temperature of pumping fluid in Deg C	171	
65	Design temperature of Pump in Deg C	200	
66	Sp. Gravity of pumping fluid	0.896	
67	Efficiency (Hot) in %	To be mentioned by Bidder	
68	Available pressure on suction side of BFP ,Kg/cm ² (a)	9.94	
69	NPSH(A) at pump suction nozzle(mlc)	18.34	
70	NPSH(R) (mlc)	To be mentioned by Bidder	
71	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
72	Pump BkW (Hot) kw	To be mentioned by Bidder	
	Capability Condition-4		
73	Flow (m ³ /hr)	209	
74	Differential Head (mlc)	1676	
75	Temperature of pumping fluid in Deg C	152.5	
76	Design temperature of Pump in Deg C	200	
77	Sp. Gravity of pumping fluid	0.914	
78	Efficiency (Hot) in %	To be mentioned by Bidder	
79	Available pressure on suction side of BFP ,Kg/cm ² (a)	7.07	
80	NPSH(A) at pump suction nozzle(mlc)	20.63	
81	NPSH(R) (mlc)	To be mentioned by Bidder	
82	NPSH(A) - NPSH(R)	Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
83	Pump BkW (Hot) kw	To be mentioned by Bidder	
Pump Performance & other details			
84	Pump shut off head	The shut off head of the pumps shall be between 115% and 130% of total developed head (TDH) under rated condition. Note: Shut off head shall not exceed 2589 mlc inclusive of all tolerances.	

85	Pump shut off head/rated head:	Pump shall have stable head/flow curves(Continuous head rise to shutoff). Notes: 1. Two pumps running parallel should ensure steady flow control with the head variation throughout its range of operation, since resultant H-Q curve will be further flat. 2. There should not be any hunting effect in pump flow and H-Q curve should be continuously rising type throughout its operating range.	
86	Parallel operation	The pumps shall be capable of parallel operation without instability at all speeds and share equal load	
87	Suction Specific Speed	of first stage impeller shall be 8000 unit on 3 % head break down.	
88	Thermal minimum flow , m3/hr	To be mentioned by Bidder	
89	Stable minimum flow, m3/hr	To be mentioned by Bidder	
90	BEP of the offered pump, m3/hr	To be mentioned by Bidder	
91	Preferred operating range	To be mentioned by Bidder	
92	Allowable operating range	To be mentioned by Bidder	
93	Pump End of the curve flow, m3/hr	To be mentioned by Bidder	
94	Pump rated impeller dia, mm	To be mentioned by Bidder	
95	Pump max. impeller dia, mm	To be mentioned by Bidder	
96	Pump minimum impeller dia., mm	To be mentioned by Bidder	
97	Balance leak off connection & Recirculation connection	Back to feed water storage tank	
98	Back pressure at Pump recirculation line nozzle	During detailed engineering Stage	
99	Back pressure at Pump BLO line nozzle	During detailed engineering Stage	
100	BLO flow (m3/hr)	To be mentioned by Bidder	
101	BLO pressure (Kg/cm2 g)	To be mentioned by Bidder	
102	BLO line safety valve set pressure (Kg/cm2 g)	During detailed engineering Stage	
103	Material of construction		
	Base Plate	Structural Steel/Equivalent material/Superior material	
	Casing	Forged Steel/Equivalent material/Superior material	
	Shaft	ASTM-A-276, Type 410/Equivalent material/Superior material	
	Impeller	ASTM-A-743/744, Grade CA-6NM /Equivalent material/Superior material	
	Diffusers	ASTM-A-743/744, Grade CA-6NM/Equivalent material/Superior material	
	Wearing ring	ASTM-A-276, Type 420/Equivalent material/Superior material	
	Balancing drum	ASTM-A-276, Type 420 /ASTM-A-743/744, Grade CA-6NM/Equivalent material/Superior material	
	Balancing head	ASTM-A-276, Type 420 /ASTM-A-743/744, Grade CA-6NM/Equivalent material/Superior material	
	Shaft Sleeves	ASTM-A-176, Type 410/Equivalent material/Superior material	
	Barrel	Forged carbon steel with austenitic stainless steel inlay in high velocity zones and sealing surface.	
	Bearings		
	Radial	Sleeve type (Babbit metal)	
	Thrust	Tilting pad, double acting	
	Pressure bolting	Chrome-molybdenum steel.	
104	Type of axial thrust balancing arrangement	Balancing Drum	
105	Type of main bearings for pump	During detailed engineering Stage	
106	Main bearings lubrication	During detailed engineering Stage	
107	Type of thrust bearings for pump	During detailed engineering Stage	
108	Thrust bearing lubrication	During detailed engineering Stage	
	Note: Plain cylindrical pressure fed journal type bearings and tilting pad, double acting 100% thrust bearing shall be provided. The sleeve bearings shall be horizontally split type.		
109	Direction of rotation of Pump as seen from DE	During detailed engineering Stage	
110	Direction of rotation of Motor as seen from DE	During detailed engineering Stage	

111	Coupling	Couplings shall be of metallic, non-lubricated, flexible element type (i.e. either diaphragm or discs) with spacer, for all equipment. All coupling models shall be selected for a minimum service factor of 1.5 over driver rating. DBSE shall be more than the seal cartridge length, as specified in respective pump data sheet such that cartridge of seal shall be removed without disturbing of pump and motor mounting.	
112	Coupling standard	As per Manufacturing Standard.	
113	Coupling Guard	Removable coupling guard shall be provided which shall be fabricated from nonsparking material, and shall be open at the bottom to permit manual shaft rotation. The guard shall be sufficiently rigid to withstand deflections as a result of bodily contact of nominally 100 kgs.	
114	LO System	As per manufacturing standard, a complete self-contained lubricating oil system including tanks, pumps (MOP, AOP), Duplex coolers, Duplex filters, PSVs, strainers, piping, etc. along with all necessary instrumentation and control hardwares for the lubrication of the main pump, drive motor and other accessories of the skid. Note: refer PY51624, cl no. 6.6 and annexure-1 for details	
115	Flushing Plan - API-610 plan no.	SS tubing shall be used for seal flushing plans	
116	Cooling Plan (API-610 plan no.)	To be mentioned by Bidder	
117	Total Cooling Water Quantity required for Pump, Motor, LO Skid, Gear Box (if applicable), m3/hr	To be mentioned by Bidder	
118	ARC valve type	Modulating type	
119	ARC valve material of construction	Body:CS body ,Internals:SS	
120	ARC Valve size	The ARC valve size shall be as per Bidder's recommendation, however not less than Pump discharge nozzle size.	
121	ARC valve pressure drop	1.0 Kg/cm2 (maximum) & ARC Valves to be selected in such a way that the increase in pressure drop through the ARC Valve for 130% of the rated flow shall be limited to 1.0 kg/cm2 only. This is to ensure flexibility of operating system at marginally higher flows as per site conditions if any.	
122	IBR certification	IBR certification is required for ARC valve	
123	Provision for VMS items	As per clause 6.7 of specification PY51624	
124	Bearing & winding instruments & JB for Pumps , Motors, Gear Box & Hydraulic coupling	As per clause 6.7 of specification PY51624	
125	Casing skin temperature monitoring system	As per clause 6.7 of specification PY51624	
126	Warm up arrangement	As per clause 6.7 of specification PY51624	
127	Dry critical speed (rpm)	During detailed engineering Stage	
128	Wet critical speed (rpm)	During detailed engineering Stage	
Drive Motor details			
129	BKW at the rated point	To be mentioned by Bidder	
130	BKW at end of curve	To be mentioned by Bidder	
131	Recommended drive rating, KW	Duly meeting clause no 6.2 of tender specification PY51624	
Other Details			
132	Performance test standard & tolerance	As per clause no 9.3 of specification PY51624	
133	Noise level	As per IS/ISO standard	
134	Maximum vibration level at all operating conditions		

135	Maximum Allowed Working Pressure (MAWP) Kg/cm ² g	Maximum allowable working pressure & temperature of the equipment shall not be less than the design pressure & temperature specified in the data sheet nor less than those specified in specifications, codes & standards. The pump casing shall also be suitable for operation at max. discharge pressure developed at pump minimum flow with sp. Gr. 1.0 (i.e. water), this is required during shop performance test with water at rated speed.	
136	Hydraulic test pressure of casing Kg/cm ² (g)	1.5XMAWP	
137	Pump Suction nozzle - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
138	Pump Discharge nozzle - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
139	ARC valve inlet/outlet/recirculation sizes - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
140	BLO nozzle - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
141	Pump Cooling water inlet/outlet sizes - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
142	LO Skid Cooling water inlet/outlet sizes(if applicable) - Size - Rating - Standard - Facing - Location	To be mentioned by Bidder	
143	For BHEL Pipe sizes & other terminal point details please refer Annexure-1B	To be mentioned by Bidder	

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				Annexure-3	
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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

Annexure-3

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032					
PROJECT ENGINEERING & SYSTEMS DIVISION						
PRICE FORMAT (R00) FOR BOILER FEED PUMP WITHOUT DRIVE 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					
A	MATERIAL SUPPLY: BOILER FEED PUMP WITHOUT MOTOR ALONG WITH ALL ACCESSORIES AS PER SPECIFICATION INCLUDING COMMISSIONING SPARE AND SPECIAL TOOL AND TACKLES [MATERIAL CODE: 'PY9751624010']			100		
	Boiler Feed Pump without motor along with all accessories (Coupling, Mechanical Seal, Base Plate, ARC Valve, Lube Oil skid, Gear Box(if applicable), Instruments etc.) including commissioning spare and special tool and tackles as per specification.	3	Sets			
	TOTAL			100		
3 TAXES AND DUTIES: (Packing and Forwarding, Freight, Insurance, Taxes & Duties as applicable to be quoted below separately for main Supply)						
(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					
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. 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-3) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-3A) 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 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 evolution 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 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) Reference document: BHEL Tender Specification (PY51624) & all its annexures.						
16) 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.						
17) In case the systems are being supplied from outside India , reputed Third Party Inspection like Llyods or equivalent has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency.						

Annexure-3A-1

	BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032					
	PROJECT ENGINEERING & SYSTEMS DIVISION					
	PRICE FORMAT (R00) FOR BOILER FEED PUMP WITHOUT DRIVES					
SL NO	ITEM DESCRIPTION	QTY	UNIT	Lump Sum 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	Supervision charges for erection & commissioning of BFP at site Per day charge of an Engineer for supervision of erection & commissioning of Pump assembly. 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. [For details please Refer Note]	1 Days & 1 Visit	Set			
Note: i) With respect to Supervision charges, prices quoted by bidder shall not be considered for L1 bidder evaluation. ii) Bidder to provide total price against sl. no A, that include per diem supervision charge including insurance charge of 1 service person (50 % of sl. No. A price) + To and fro Travel expenses (30% sl. No. A price) + 1 day boarding and lodging and local convenience etc charge (20 % sl. No. A price). iii) Referring to Sl no A- Supervision charges for Pump, 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 A 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.						
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			

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20



Bidder's reply/ confirmation as furnished in this annexure shall supersede the stipulations mentioned elsewhere in their bid.

DESCRIPTION	BIDDER'S REPLY/
Bidder to confirm that Performance requirement, Design and construction of the Pump shall as per tender specification&customer specifications.	
Bidder to confirm to the scope of supply as per clause no 6.0.0 of BHEL specification PY51624.	
Bidder to confirm that IBR Certification is considered for ARC Valve.	
Bidder to confirm that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point.	
<u>Cable Glands & Lugs:</u> As per Cl. No. 6.2. of Tender Specification, PY51624, suitable power cable glands & lugs shall be included in bidder scope of supply.	
<u>Coupling :</u> As per Cl. No. 6.3 of Tender Specification, PY51624, Coupling between Pump and Drives [Motor] shall be as per BHEL Tender Specification.	
Bidder to confirm that IBR Certification is considered for all piping, valves etc.(Applicable in Suction ,Discharge,Recirculation line,BLO Line,Warmup Line).	
Bidder to confirm that all the Suitable reducers/expanders, Flanges & counter flanges along with gaskets & stud nuts at all the terminal point shall be in their scope as per tender specification.	
Bidder to furnish duly filled Pump datasheet.	
Bidder to furnish Reference list/Equipment Qualification criteria as per clause no 8.0.0 of BHEL specification PY51624. Bidder to furnish dully filled in proforma as per Annexure-6.	
Auxiliary power for Pump shall be limited to 1465 kW while running at guarantee condition including gear box losses in case gear box is applicable. Auxiliary power for Pump above 1465 kW while running at guarantee condition is not acceptable and bidder's offer shall be liable for rejection. Note: Above Auxiliary power shall be pump shaft power + Gear Box losses (if applicable) at guaranteed condition. Please confirm.	
MOP shall be designed for pump minimum speed (as per OEM recommendation) to the pump rated speed. Accordingly, bidder to select suitable MOP. Pls confirm	

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Bidder to note that the Motors (Motors Not in Bidders Scope) for HRSG BFP are VFD Driven(VFD Not in Bidders Scope). Bidder to take care of the same while	
Bidder to furnish a list of commissioning spares. (Refer Cl no 6.15 of BHEL specification PY51624.	
Bidder to furnish a list of special tools & tackles. (Refer Cl no 6.17 of BHEL specification PY51624.	
Bidder's confirmation required for furnishing a list of 2 year recommended spares in their offer separately with optional price as per 7.0 of BHEL specification PY51624.	
Bidder to Confirm that all Inspection & acceptance, type Tests as required for each equipment, as per specification and Codes attached.	
Bidder to highlight any deviation w.r.t the sub vendor list with proper justification. (Refer Cl no 14.0.0 of BHEL specification PY51624.)	
Bidder to confirm that all rotating equipment shall be procured from the approved vendors listed in the bid package. [Refer Annexure-8]. Sub vendor list furnished by the bidder shall be ignored by us.	
Bidder to check the master document list and submit all the required documents as per the master document list (Annexure-10) without fail and take the approval of	
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 the same and include in their scope of supply.	
Deviation list to the specification. Deviations Bidders to furnish deviations [if any] only as per the format enclosed as annexure-10. Any deviations in the scope of supply, works and specifications if listed elsewhere shall be neither be reviewed nor accepted. Bidder to categorically confirm this. All other requirements except for the deviation brought out under deviation list, have been taken into consideration. Pl confirm	
Bidder to quote as per BHEL price 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.	
Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to confirm the same.	



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 datasheet [Annexure: 2]
- b) Tentative GAD for Pump & Drive assembly
- c) T-S Curve for Pump at valve open conditon
- d) Performance curves for Pump
- e) Un-priced copy of attached BHEL price bid formats indicating quoted/not quoted against each row & column.
- f) Equipment qualification criteria / PTR / Reference Lists [Annexure: 6]
- g) Checklist [Annexure: 4]
- h) Deviation list [if any] [Annexure: 10]

Bidders Sign and stamp

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				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

VOLUME: II

SECTION-II

SUB-SECTION-II/3

POWER CYCLE PUMPS, DRIVES AND ACCESSORIES

1.00.00 GENERAL INFORMATION

The boiler feed pumps and the condensate extraction pumps are the main power cycle pumps covered under this section. The condensate extraction pumps will take suction from condenser hot well and pump the condensate to deaerator through L.P. heaters while the boiler feed pumps will take suction from the Deaerator and pump the feed water to boiler through the high-pressure heaters.

The specific design criteria for Power Cycle Pumps, Drives and Accessories have been presented in Annexure-I to this section.

2.00.00 CODES AND STANDARDS

In addition to the requirements spelt out in Lead Specification, Section-I, Sub-section-I/6 of Volume: II all the equipment systems and work covered by this section shall conform to the latest editions of following codes and standards :

- i) American National Standard Institute (ANSI), as specifically referred to.
- ii) PTC 8.2 : ASME Performance Test Codes for Centrifugal Pumps.
- iii) Electrical Power Research Institute (EPRI).

All equipment covered by this specification shall comply with all applicable laws and statutory regulations, Indian Electricity Act etc.

3.00.00 BOILER FEED PUMPS, DRIVES AND ACCESSORIES

3.01.00

3 x 50% capacity electric motor driven pumps, variable frequency drives and accessories shall be installed for supplying feed water to steam generating unit. Two (2) motor driven pumps will be operating normally while the third motor driven pump remains as standby unit and will come into operation automatically in case any of the working pumps fail and also during starting of BTG unit. However, two BFPs shall be capable of meeting the feed water flow required at VWO condition with 3% makeup.

- 3.02.00 The pumps shall be of the horizontal multistage centrifugal type supported in such a manner as to permit free expansion both axially and radially whilst maintaining alignment. Therefore, the Bidder shall ensure that all materials and terminal connections are suitable for such terminal forces and moments.
- 3.03.00 Each boiler feed pump set specified herein together with all accessory equipment, required to make a complete and well integrated unit to satisfy the scope of this specification shall include but not limited to the following (for each pump unless indicated otherwise) :
- a) Pump warm-up orifice(s) for boiler feed pump, if required.
 - b) Balance chamber leak-off flow orifice for boiler feed pump, if required.
 - c) Suitable seal system as required by the design of the main feed pump shaft seals along with cooling system.
 - d) Flexible spacer type shaft couplings with coupling guard.
 - e) Sole plates, pin and key blocks or other support structure, and a common base plate (with foundation anchor bolts/inserts, drip and drain) for the TG unit consisting of the main pump and motor drive.
 - f) Inter-stage bleed connection to supply water to reheat steam de-superheater.
 - g) Removable lagging and insulation for boiler feed pumps.
 - h) A complete self-contained lubricating oil system including tanks, pumps, coolers, strainers, piping, etc. along with all necessary instrumentation and control hardwares for the lubrication of the main pump drive motor.
 - i) Duplex RTD / thermocouples / Vibration sensors in all journals, thrust bearings and pump barrels.
 - j) Simplex cylindrical type strainer for installation ahead of the feed pump suction along with differential pressure switch. Pressure relief valve on pump suction, downstream of the isolation valve.
 - k) Automatic Recirculation control valves and pressure break down orifices, as necessary to pass the minimum flow required for the pump.
 - l) Local instruments, local gauge board and instruments to be mounted on the gauge board as required.
 - m) Variable Frequency Drive motors for the boiler feed pumps.

n) Special tools and commissioning spares.

- 3.04.00 The pumps shall be designed for efficient and reliable operation and shall be of proven design with at least ten years of satisfactory operating experience.
- 3.05.00 Capacity and discharge pressure of the pumps shall be selected to meet the requirements of the steam generator in line with the requirements specified in Annexure-I of this section. The Bidder shall furnish the pump sizing calculation with the Bid.
- 3.06.00 Each boiler feed pump shall be provided with a variable frequency drive. The main pump shall be connected to the motor and shall be connected at other end of the motor.
- 3.07.00 The pumps shall be capable of parallel operation without instability at all speeds and share equal load. Shut-off head shall not, be less than as specified in Annexure-I of this sub-section.
- 3.08.00 The deaerator storage tank should to be located at higher elevation. Bidder shall check the requirement of NPSH against available NPSH considering the worst transient situation of load dump. Bidder to ensure that NPSH (R) at 3% head drop for feed pump shall be 0.4 times of NPSH (A) at design point with lowest deaerator level and maximum pressure drop across the strainer. The head developed by the feed pump shall be sufficient to give adequate NPSH at the pump suction. Bidder shall furnish necessary calculations to establish the availability of excess NPSH over the actual NPSH requirement of the pump. Suction specific speed for B.F.P. must not exceed the specified values indicated in Annexure-I of this section.
- 3.09.00 The capacity, head and efficiency of the pumps shall be guaranteed within the tolerances stipulated by Hydraulic Institute Standards, USA or any other International Standard.
- 3.10.00 Speed control range of the motor driven B.F. Pump drive unit shall cover the entire range of boiler feed pump operation, from minimum flow (i.e. pumps on recirculation) to the design head-capacity point with at least 5% margin on pump speed both on the high and low sides.
- 3.11.00 The pumps shall be capable of safe, proper and continuous operation at speeds upto 10% above full rated speeds, provided that the minimum discharge flow shall not be less than that required to prevent overheating.
- 3.12.00 Bidder shall guarantee the power consumption for feed pumps at the rated condition. This guarantee figure shall account for all losses in the driven etc. The drive motor shall be so selected that a margin of at least 10% is provided over the total power required by the B.F. Pump, Oil Pump at the rated condition of the pump. Detailed calculation for sizing of motors shall be submitted to the Owner for approval.

- 3.13.00 Plain cylindrical pressure fed journal type bearings and tilting pad, double acting 100% thrust bearing shall be provided. The sleeve bearings shall be horizontally split type.
- 3.14.00 Simplex type cylindrical strainers shall be provided on the boiler feed pump suction to protect the fine clearances of the pump. The screening area of the strainer shall be 4-5 times the cross-sectional area of the inlet pipe.
- 3.15.00 The Boiler Feed Pump set shall be capable of continuous safe, and trouble free operation under upset condition, like under and over frequency (47.5 to 51.5 Hz), abnormal pressure decay in deaerator, VWO with estimated make-up, over pressure of TG (if envisaged), H.P. heaters out of service, sudden load throw-off, start-up of unit, HP-LP bypass operation, rapid starting and load changes during cyclic two shift and peaking operation.

4.00.00 CONDENSATE EXTRACTION PUMPS, DRIVES AND ACCESSORIES

- 4.01.00 The STG Unit shall be provided with 2 x 100% capacity Vertical "can" centrifugal type condensate extraction pumps (1 working + 1 standby). Any one of the pumps shall be capable of handling the full condensate from the condenser to the deaerator through L.P. heaters, gland steam condenser etc. Each Pump capacity shall be calculated considering equal flow sharing by the one running pump and the maximum condensate flow which may be encountered in the various modes of operation specified in Annexure-I of this Section.
The Bidder shall submit pump-sizing calculations for approval of the Owner.
- 4.02.00 Condensate Extraction pumps together with all accessories required to make complete and well integrated units to satisfy requirements of the specification, including but not limited to the following (for each pump, unless otherwise noted).
- a) Drive motor.
 - b) Pump and motor coupling.
 - c) Strainer before pump suction.
 - d) All instrumentation and control as specified and/or as required. The scope shall also include initiating contacts for the alarms and interlocks.
- 4.03.00 The pump impellers shall be so designed that wear due to cavitation will not restrict its service life to less than 40,000 running hours when operating under steady state design suction conditions.
- 4.04.00 The condensers and condensate extraction pumps have been proposed to be located as shown in the Tender drawing. The condensate extraction pumps

shall be suitable (without cavitation) for handling saturated water, at the maximum possible flow rate from the condenser hot-well, with the NPSH available at hot-well "Low- Low" level. Suction specific speed for condensate extraction pumps must not exceed the specified value as mentioned in Annexure-I of this section.

4.05.00 Pumps shall be capable of operating either single or in parallel. Suitable Automatic Starting devices shall be provided to bring the standby pump into operation in case of failure of any operating pump.

4.06.00 Rating of the motor shall be selected with at least 10% margin over the maximum power required within the range of operation. The shut-off head of the pump shall not be less than as specified in Annexure-I of this sub-section.

5.00.00 GENERAL REQUIREMENTS

The plant is designed for base load service. However, frequent operation will occur down to 40% load. It is expected that only one condensate pump and one boiler feed pump unit will be in service at loads of 60% and lower.

6.00.00 ~~DRIVE MOTORS~~

Design and Construction of all drive motors shall confirm to Specifications for Electrical Equipment & Accessories, Volume II, Section-III of this specification.

SPECIFIC DESIGN CRITERIA FOR POWER CYCLE PUMPS

SL.NO.	ITEM	CRITERIA
1.00	Boiler Feed Pump	
1.01	Type	Horizontal, Centrifugal type, Multistage, outer casing Barrel type.
1.02	Number	3 x 50% Capacity electric motor driven, variable frequency drive
1.03	Rating	a) Design Capacity – (Maximum flow rate through turbine in VWO condition with 3% make-up) + 10% margin + Design R/H attemperation flow from intermediate stage bleed + Design S/H attemperation flow requirement. b) Total dynamic head – Frictional loss to the above design capacity + 10% margin + discharge pressure demand at economizer inlet corresponding to lowest safety valve set pressure of boiler dynamic head. Moreover, motor driven boiler feed pumps shall be capable of meeting the Emergency Point requirement at 50 Hz grid frequency, i.e. generating the discharge pressure not less than steam generator highest safety valve set pressure corresponding to 100% of BMCR flow. BFP discharge pressure shall be approximately 172 Kg/cm² (g) at discharge flange. However, the value shall be finalized after receipt required data from SG vendor.

Annexure-I

SL.NO.	ITEM	CRITERIA
		c) Pumps shall deliver BMCR flow & head at rated steam pressure at 47.5 Hz. Also VWO output at 3% make-up, worst condenser pressure at 47.5 Hz. d) Shut off Head – The shut off head of the pumps shall be between 120% and 130% of total developed head (TDH) under rated condition. e) Speed - Variable (stepless).
1.04	Suction Speed	Specific The suction specific speed of first stage impeller for main pump and booster pump shall not exceed 8000 US units and 9500 US units respectively based on 3% head break down.
1.05	General requirements	a) One pump shall be capable of handling the flow and head corresponding to 60% of Unit load. b) Heads developed at the interstage bleed and intermediate stage discharge shall be adequate for meeting the attemperation requirement of the boiler. c) The pumps shall be capable of safe, proper and continuous operation at speeds upto 10% above full rated speeds, provided that the minimum discharge flow shall not be less than that required to prevent overheating. d) The first critical speed in water shall be above the speed corresponding to turbine over speed trip condition and internal clearances being 150% of new clearance or 130% of design speed whichever is higher. e) On-off type minimum recirculation valve shall be provided with valve body designed for 40% of

Annexure-I

SL.NO.	ITEM	CRITERIA
		design flow.
1.06	Minimum Flow	The minimum flow of the booster pump and main pump shall not be less than 25% of their respective design flow or on set recirculation (discharge/suction) whichever is higher.
2.00	Condensate Extraction Pump	
2.01	Type	Vertical canister type centrifugal design.
2.02	Number	2 x 100% Capacity.
2.03	Rating	a) Capacity - Maximum steam flow at exhaust during VWO (with 3% make-up) operation of turbine with maximum steam inlet pressure plus all heater drains and vents + 5% margin. b) Head - Maximum deaerator pressure plus static and dynamic head under maximum capacity condition + 10% margin. c) Speed – Constant Speed.
2.04	Margin on Capacity	10% over calculated rated capacity. Further, One pump shall be capable of handling the flow and head corresponding to maximum condensing load with 5% margin on flow and 10% margin on head.

Annexure-I

SL.NO.	ITEM	CRITERIA
		The pumps shall be capable of handling the flow and head corresponding to unit TMCR, all HP heaters out, 3% make up, and worst condenser pressure at 47.5 HZ.
2.05	Suction Specific Speed	Suction specific speed of 1 st stage impeller shall not exceed 11,0000 U.S units based on 3% head break of 1 st stage impeller.
2.06	General requirements	a) The pumps shall also be capable of sustaining emergency transient conditions like H.P. heater(s) out, Turbine H.P. & L.P. bypass in operation etc. b) The shut-off head of the pump shall not be less than 115% of design head. c) The first critical speed in water shall not be within the 20% of design speed.

Annexure-II

**MATERIAL OF CONSTRUCTION
FOR
POWER CYCLE PUMPS**

1.0 Boiler Feed Pump:

Each pump shall be constructed preferably with the following listed materials. The Bidder shall offer equivalent or better materials with suitable heat treatment as per the standard of the manufacturer for similar duty.

Part	Material
a) Base Plate	Structural Steel.
b) Casing	Forged Steel.
c) Shaft	ASTM-A-276, Type 410.
d) Impeller	ASTM-A-743/744, Grade CA-6NM.
e) Diffusers	ASTM-A-743/744, Grade CA-6NM.
f) Wearing ring	ASTM-A-276, Type 420.
g) Balancing drum	ASTM-A-276, Type 420.
h) Balancing head	ASTM-A-276, Type 420.
i) Shaft Sleeves	ASTM-A-176, Type 410.
j) Barrel	Forged carbon steel with austenitic stainless steel inlay in high velocity zones and sealing surface.
k) Bearings	
i) Radial	Sleeve type (Babbitt metal)
ii) Thrust	Tilting pad, double acting, 100% thrust bearing (suitable material)
l) Pressure bolting	Chrome-molybdenum steel.

Between rubbing faces a minimum difference in hardness of 50 BHN may be maintained.

Annexure-II

2.0

Condensate Extraction Pump:

The following material of constructions are suggested for guidance only:

Bowl/Pump casing	:	Cast Iron.
Impeller / Wear Rings	:	12% Cr Stainless steel.
Stage impeller	:	Bronze or chromium steel.
Shaft/Shaft sleeves	:	12% Cr Stainless steel.
Can	:	Fabricated steel.

VOLUME-II

SECTION-IV

CONTROL & INSTRUMENTATION

VOLUME: II

SECTION-IV

CONTROL & INSTRUMENTATION

1.00.00 INTENT OF SPECIFICATION

- 1.01.00 This section describes Control & Instrumentation equipment, material and services to be provided for Steam Turbine Generator & its auxiliary packages for 1x120 MW thermal power project of DCM Shriram Ltd. at Jhagadia District, Bharuch, Gujrat, India.
- 1.02.00 Bidder shall provide all material, equipment and deliverables so as to make a totally integrated control and instrumentation system together with all accessories, auxiliaries and associated equipment ensuring operability, maintainability and reliability. The control and instrumentation system shall be consistent with modern power plant practices and shall be in compliance with all applicable codes, standards, guides, statutory regulations and safety requirements in force.
- 1.03.00 Bidder shall also include in his proposal and shall furnish all equipment, devices and deliverables which may not be specifically stated in the specification but are needed for completeness of the equipment/ systems furnished by the Bidder and for meeting the intent and requirements of the specification.
- 1.04.00 It is not the intent to completely specify all details of design and construction features here-in. Nevertheless, the instruments/ equipment and their installation shall conform to high standards of engineering design and workmanship in all respects.

2.00.00 SYSTEM CONTROL PHILOSOPHY

- 2.01.00 Microprocessor based state-of-the-art distributed digital control with open system architecture has been envisaged for control & monitoring of the Turbine-Generator (TG) set and its auxiliaries.
- 2.02.00 The control system indicated above shall broadly cater to the following sub-systems:
- (a) Steam Turbine integral controls like Turbine Protection System (TPS), Turbine Digital Electric-Hydraulic Control System (D-EHC), Turbine Supervisory Instrumentation (TSI) System, Turbine Over-speed Detection system (OSD), Turbine Run-up system, Control Oil/ Lube Oil/ Jacking Oil system, gland steam control system etc. shall be implemented in dedicated microprocessor based control system (to be supplied by Bidder) with suitable interfacing with Plant Distributed Control System (DCS).
 - (b) The balance steam turbine- generator controls, HP & LP Bypass system control, turbine regenerative cycle controls including modulating & binary/ sequence control of feed water/ condensate cycle etc., other TG auxiliary

system controls like TG DMCW system (under Bidder's scope of equipment supply) etc. shall be implemented in Plant DCS supplied by Owner.

- (c) Standalone PLC based/ proprietary local control systems may be envisaged by Bidder for few sub-systems such as Oil Purification System, LP Dosing System etc. with suitable connectivity with Plant DCS.

2.03.00 The entire operation and monitoring under all regimes of operation i.e., start-up, normal operation, shutdown etc. shall be possible from operator's consoles in Plant Control Room. Operation of generator, generator auxiliary systems and breakers for SWGR associated with the TG System shall also be performed through control room operator console.

2.04.00 Operator consoles shall be located in the existing Plant Control Room at +8.5 Mtr. elevation. Engineering stations, Turbine Control/ Protection Panels, Generator Control Panels etc. shall also be suitably located in the existing control room. DCS I/O Room shall be located in the second floor of the new SWGR Building.

3.00.00 SCOPE OF WORK

Scope of work covers design, engineering, manufacture, assembly, shop testing, packing, transport to site, unloading at site, storage, erection, site testing & pre-commissioning, commissioning, initial & successful operation and performance testing.

3.01.00 THE SCOPE OF SUPPLY SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

3.01.01 Complete Steam Turbine Generator integral control, monitoring, supervision and protection system implemented in a proven microprocessor based state-of-the-art distributed digital control system having its own process interface units, controllers and necessary operator's interface units and having suitable hardware and software interfaces with the Plant DCS (under Owner's scope).

Two (2) nos. Operator Work Stations (OWS), one (1) no. Engineering Work Station (EWS) and one (1) no. A4 B/W Laser Jet Printer shall be included under Bidder's scope of supply. **Redundancy in power, controller & communication shall be considered.**

3.01.02 Turbine-Generator proper supervisory instrumentation system (TSI) complete with sensors, junction boxes, special cables, transmitters, panel mounted remote monitoring with alarm contacts & communication capabilities with microprocessor based control & monitoring system. A laptop loaded with all necessary software for configuration of TSI system shall also be included in the scope of supply by the Bidder.

3.01.03 A common Global Positioning System (GPS) synchronized Master & Slave Clock System for time synchronization of Turbine Control System, TSI and other microprocessor based systems under Bidder's scope shall be provided by Owner.

Exact quantity and format of outputs required for synchronization of Bidder's system shall be indicated by Bidder during detail engineering.

3.01.04 Programmable Logic Controller (PLC)/ proprietary local control systems shall be provided for a few sub-systems with interface with Plant DCS for supervisory control and monitoring of parameters. The sub-systems shall include but not limited to Central Oil Purification System, LP Dosing System etc.

3.01.05 Field mounted instruments & primary elements viz. process transmitters, handheld calibrators, temperature elements (Thermocouple & RTD), temperature transmitters, local indicators & gauges, thermowell, process switches, sensors, converters, totalizer, flow elements etc. required for control, operation and monitoring of the system/ equipment being supplied by the Bidder in this package, shall be provided on as required basis meeting functional redundancy, availability and reliability requirements of the specification subject to minimum quantities as indicated in corresponding mechanical sections and in line with Owner approved P&IDs.

All the instruments which are required but not specified, to implement the control philosophy as specified in corresponding mechanical sections or as finalized during detail engineering shall be provided by Bidder within his quoted lump-sum price.

Pressure, temperature and flow test points shall be provided in line with latest performance test code requirements.

3.01.06 Pneumatic Control Valves along with pneumatic actuators and accessories such as Smart Positioner with input, output and supply gauges, Air Filter Regulator, Solenoid valve, Position feedback instruments etc. For system like Governing Control etc., depending on manufacturer's recommendation, hydraulically controlled final control element shall be used.

3.01.07 All Instrumentation & Control cables twisted & shielded, **armoured**, PVC insulated & sheathed with FRLS properties, including thermocouple extension/ compensating cables and pre-fabricated cables with plug-in connectors, power supply distribution cables, Optical Fiber cables/ communication/ special cables with accessories as applicable shall be supplied, terminated and laid by the Bidder on as required basis.

Broadly, the philosophy for cabling scope shall be as follows:

- When both end terminals are within Bidder's scope of supply, the corresponding cables, accessories and associated works are also under scope of Bidder.
- When one end terminal is in the scope of Bidder and other end belongs to Owner's instruments/ systems/ cabinets/ equipment etc., corresponding cable shall be supplied by Owner.

3.01.08 Bidder shall provide C&I Earthing up to their system/ panel end. Further connectivity to respective area Electronic Earth Pit/ Electrical Risers shall be done by Owner.

- 3.01.09 All Erection hardware including process connection and piping materials comprising of stub, root valves, impulse pipes of different grades & stainless steel tubes, isolation & drain valves, valve manifolds, gauge valves, condensate pots, fittings, stands, brackets etc. as required for satisfactory installation of all field instruments, pneumatic hook-up materials like stainless steel grade pneumatic tubes, fittings and isolating valves as required, junction boxes, canopies, structural steel, gauge boards etc. and consumables as required, conduit and accessories like all flexible & rigid conduits, perforated branch cable trays (if required), pull boxes, inspection covers, bends, elbows, mounting brackets, clamps, nuts & bolts, glands, lugs, ferrules, connectors, markers, tray supports, tie wraps etc., rating plates, tag/ nameplates and labels for all C&I items shall be included under Bidder's scope of supply.
- 3.01.10 Electrical power supply system (Plant UPS, 110V AC, 50 Hz)) for various loads for Bidder supplied systems shall be provided by Owner at one point as bulk redundant feeders (cabled).
- Further downstream distribution to individual load points shall be done by Bidder. 24V DC power supply shall be used wherever applicable for control system and shall be derived by Bidder from UPS supply. Any other voltage level required by the Bidder in their system along with all required hardware shall be the responsibility of the Bidder.
- 230V AC Non-UPS supply shall also be provided by Owner for auxiliary loads like panel fans/ lights etc.**
- Bidder shall furnish tentative load requirement along with the Bid. The exact requirements and terminal points shall be decided during detail engineering stage.
- 3.01.11 Erection, maintenance, calibration, commissioning, site testing and troubleshooting equipment including special tools & tackle, start-up and commissioning spares in addition to recommended spares, consumables like printer cartridge, printer paper etc. shall be provided by Bidder.
- 3.01.12 Instrument quality air shall be provided by the Owner at one point at the maximum pressure of **5-6 Kg/cm²**. Distribution from this point onward to each consumer shall be covered under the scope of the Bidder. The Bidder shall include in his scope distribution header, pneumatic piping, fittings, valves, air filters, regulators and other accessories. Bidder shall indicate the quality and itemized consumption of instrument air required.
- 3.01.13 Complete Steam & Water Analysis System (SWAS) shall be provided by Owner. Bidder shall provide necessary tapping points with isolation valves **and necessary sample piping up to bulk-head of the SWAS (Wet) Panel (at +8.5 Mtr. in Power House Building)** for the services as defined by relevant P&IDs/ mechanical section of the specification.
- 3.01.14 Other items as described in various section of this part of the specification and any other control and instrumentation system felt necessary by the Bidder for reliable and

- fail-safe operation of the steam turbine-generator and auxiliaries shall also be included.
- 3.02.00 **THE SCOPE OF SERVICES SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:**
- 3.02.01 Design and engineering coordination for proper integration and interfacing of Bidder's control system with Plant DCS supplied by Owner. This shall include signal linkage with Plant DCS for smooth operation of these systems without time delay, transferring all the necessary inputs to Plant DCS for total automation, maintenance of Master Historian for the entire plant control, common SOE for entire plant. Supply and laying of the signal/ communication cables along with accessories shall be provided by Owner.
- 3.02.02 Bidder shall provide necessary information/ data/ documents to Owner for implementing control & protection logics for Turbine Auxiliary Systems for implementation in Plant DCS. Bidder shall also coordinate with Plant DCS Supplier for example, meeting, site visit etc. and also during erection & commissioning. Bidder shall be present at FAT/ SAT of Plant DCS and vet all TG related Plant DCS documents on as required basis.
- 3.02.03 Providing engineering drawings, documents, licensed copy of software & development tools, data, instruction, operation and maintenance manual etc. for Owner/ Consultant's review/ approval/ record in printed and electronic medium for approval of Owner / Consultant in multiple sets.
- 3.02.04 Participation of Bidder's personnel and experts from their collaborator in discussion with Owner/ Consultant and other equipment Vendors during various stages of contract implementations required by Owner to achieve desired C&I system configuration and performance.
- 3.02.05 Arranging for Owner's/ his representative's inspection and testing of manufactured as well as bought-out items at the respective works. The Bidder shall conduct all shop & site tests (FAT/ SAT) as per requirements of this specification & Owner/ Consultant approved Quality Assurance Plan (QAP) to be finalized during detailed engineering.
- 3.02.06 Packing and transportation of instrumentations, equipment, accessories and erection hardware from the Manufacturer's works to the site, including transit insurance.
- 3.02.07 Receipt, storage, preservation and conservation of instruments, equipment, erection hardware at the site
- 3.02.08 In general, all items supplied by Bidder shall be erected by Bidder. Sound engineering practice of international standard shall be adopted through out. All erection drawings shall be furnished by Bidder. Erection services shall be verified by the Owner site engineer/ consultant on the basis of the approved Field Quality Plan (FQP).
- 3.02.09 Testing, Calibration & Commissioning

Site modifications shall be documented and issued to Owner as design change notification and signed by Owner. Subsequently, all such approved and agreed changes shall be incorporated in relevant design documents to elevate all documents to "As Built" status.

- 3.02.10 Commercial operation, performance liabilities, guarantees
- 3.02.11 Training of Operators, Systems Engineers and Maintenance Engineers
- 3.02.12 Warranty & Maintenance Support

4.00.00 **DESIGN CRITERIA**

- 4.01.00 The entire Control & Instrumentation system shall be designed, supplied and commissioned to enable the operator to operate the Turbine-Generator set and its auxiliaries in a safe, efficient and reliable manner, without exceeding plant operational limits and ensuring the overall performance guarantee conditions.
- 4.02.00 The C&I System shall be designed utilizing state-of-the-art technology to ensure:
 - (a) High degree of System availability and reliability, taking into consideration proper redundancies as applicable.
 - (b) Low downtime and high meantime between failures.
 - (c) System flexibility and modular expansion facility both in terms of hardware and software.
 - (d) Extensive Diagnostic facilities to pin point failure areas.
 - (e) Failsafe design considering the safety of personnel, process and main equipment.
 - (f) Uniformity of instrumentation, control and automation including high degree of simplicity, operability and maintainability.

4.03.00 **REDUNDANCY CRITERIA**

- 4.03.01 2 out of 3 measurements shall be adopted for critical analog signals and 1 out of 2 measurements shall be adopted for non-critical analog signals for all closed loops. However, for those analog inputs which are also required for protection in addition to CLCS, triple sensing devices shall be provided.
- 4.03.02 2 out of 3 measurements shall be adopted for tripping/ protection of all equipment and interlock of critical equipment where non-availability may result in loss of generation. 1 out of 2 measurements shall be adopted for interlocks of non-critical equipment.
- 4.03.03 Single sensor measurement shall be envisaged for monitoring of process value.

- 4.03.04 Measurement system, CLCS, OLCS shall all be configured with redundancy at processor modules, communication modules, data bus and power supply modules.
- 4.03.05 Wherever redundant sensors are employed each sensor shall be wired to a separate input module.
- 4.03.06 Redundancy in I/O module shall be provided for all modulating control drives so that any single failure of the I/O module shall not lead to the failure/ disturbance of process.
- 4.04.00 All equipment, system and accessories furnished shall be from latest proven product range of established / reputed manufacturers and shall conform to applicable national and international standards. Any predictable or planned deterioration and/ or obsolescence of equipment shall be clearly brought out in the Bid.
- 4.05.00 Latest version of hardware and software available at the time of system designing shall be provided. In case of future up-gradation of software, Bidder shall remain committed to upgrade the supplied system with the new version within the warranty period, without any additional cost. Beyond the warranty period and during the remaining life of the plant, any upgradation in hardware and software shall be brought to the notice of Owner and shall indicate whether it shall be possible to upgrade the system by replacing certain pieces/ components of hardware/ software.
- 4.06.00 Bidder shall ensure that supplied controls and instruments should be supported by the Supplier such that spare parts are guaranteed to be available for purchase for a period of Ten (10) years. Similarly, the service shall also be guaranteed for a period of Ten (10) years.
- 4.07.00 Control & Instrumentation System shall be suitable for continuous operation in the environmental condition as per the project meteorological data provided else where in the specification and shall meet the minimum design requirement of 50°C and 95% RH. Equipment which can not meet the stipulated environmental condition shall be installed in air-conditioned environment. **All hardware shall be certified for ISA G3 class corrosion level.**
- All field Cabinets / Enclosures in outdoor area shall be IP-65. Enclosure class for I/O cabinets / panels located in non-air-conditioned indoor area shall be IP-55 or better. All cabinets located inside air-conditioned room shall be IP-32 or better.
- 4.08.00 C&I equipment furnished shall incorporate necessary techniques for protection against electrostatic discharge and radio frequency interference, as per international codes and standards.
- 4.09.00 Bidder shall follow the KKS Tag numbering philosophy while preparing all control & instrumentation related documents.
- 4.10.00 DRIVE CONTROL PHILOSOPHY**

4.10.01 Binary control shall be implemented in hierarchical structure. It is proposed that the following points of control shall be available.

- Local Push Button Station for Local Start & Emergency Stop operation
- Remote Operator's Terminal for normal operation in Auto/ Manual
- Local Control Panel (wherever applicable)

4.10.02 Local Push Button Station (LPBS) for drives shall be provided for local start/emergency stop operation. In Local mode, drives shall be operated from Local Push Button Station provided near the drive. Local/ Remote Selection shall be in Local Pushbutton Station.

Local emergency stop pushbutton shall always be activated irrespective of the position of Local/ Remote Selection Switch. Drives shall have latchable & key resettable type emergency stop pushbutton.

In Remote mode, drives shall be operable from Remote (i.e. Operator's Terminal at Control Room). The drives which are part of a sequence shall be operable in sequence mode from the Operator's Terminal. Remote manual operation of all drives shall also be done from the Operator's Terminal. During operation from remote all process, sequence and basic safety related permissive and interlocks shall be in place.

4.10.03 Remote control commands i.e. start/ stop shall be issued from DCS through interposing relays located in the respective SWGR/MCC/ Integral Starter unit. Interposing relays shall be rated at 24V DC driven directly from DCS.

4.10.04 Motor current for drives shall be hard wired for monitoring in DCS and suitable transducers for the same shall be located in respective electrical SWGR/ MCC.

4.10.05 Necessary Electrical protections shall be realized at SWGR/MCC whereas process/protection interlock shall be realized in DCS.

4.10.06 Winding/ Bearing Temperature and Vibration of Drives/ Motors shall be measured and configured for alarm, monitoring and interlocking in DCS.

Typical signal interfaces for different types of Drives have been detailed below:

4.10.07 BIDIRECTIONAL DRIVES WITH INTEGRAL STARTER

Following signal exchange shall take place between Actuator Integral Starter & DCS.

- Open, Close & Stop Command
- Valve Status Feedback by means of Limit Switches (Open/Close)
- Valve Status Feedback by means of Torque Switches (Open/Close)
- Valve Position Feedback (4-20mA) for Inching Duty Drives.

- Integral Starter Disturbed Feedback (Control Supply Failed/ Thermal Overload Operated/ Actuator Local/ Remote Selector Switch in Local or Off Mode/ Emergency Stop Pushbutton Operated)

4.10.08 UNIDIRECTIONAL LT DRIVES (CONTACTOR OPERATED)

Following signal exchange shall take place between MCC & DCS.

- Drive Start & Stop Commands
- Local Start Permit Command
- Drive ON & OFF Feedback
- Emergency Stop Pushbutton Operated Feedback
- MCC Healthy Feedback (Thermal O/L not Operated, Control Supply On, MCC Power Supply On, Selector Switch in Remote)
- Electrical Trip (Overload Relay Operated)
- Current measurement (For motor rating 3.7 KW & above)

4.10.09 UNIDIRECTIONAL HT/LT DRIVES (BREAKER OPERATED)

SWGR has two positions of operation i.e. Service and Test. Service position is the normal mode of operation. The test position is envisaged to test the SWGR operation under racked - out condition.

Following signal exchange shall take place between SWGR and DCS: -

- Drive Start & Stop Commands
- Local Start Permit Command
- Breaker ON & Off feedback.
- Circuit Breaker Disturbed (Control Supply Failed/Trip Circuit Unhealthy)
- Circuit Breaker Available (Breaker in Service Position, Breaker Spring Charged, Breaker S/S in Remote & Trip Circuit Healthy)
- Emergency Stop PB operated.
- Electrical Protection Operated (Trip Relay 86)
- Current measurement

4.10.10 Drive control function residing in DCS controllers shall be used to position the pneumatically operated control valves/Dampers through SMART positioner. Interlock and protection Open/Close commands, originating from field or generated internally in Control Logics, shall be interfaced with the drive control function residing in processors.

4.10.11 Control Valve actuator design shall take care of fail safe condition i.e. bringing valve to full open/full close or stay put mode, on signal (pneumatic/electric) failure. Auto/Manual operator control and display for various control loops shall be provided through OWS, using Analog Displays.

Analog Displays have following functionality:

- Auto/Manual selection with control device “Raise/Lower Buttons”

- **Set point indication with “Raise/Lower Buttons”**
- **Indication for deviation between set point and measured value**
- **Measured value indication**
- **Final control element position indicators**

4.11.00 **Units of field instruments shall be as below:**

- **Temperature: Degree Celsius (°C)**
- **Pressure: Kg/cm² (g)**
- **Flow: T/Hr**
- **Level: mm WC**

5.00.00 **GENERAL TECHNICAL REQUIREMENTS**

5.01.00 **STEAM TURBINE GENERATOR CONTROL SYSTEM**

- 5.01.01 The system shall be able to achieve maximum availability and reliability using fault-tolerant and fail-safe architecture with a redundant configuration for closed loop control and two-out of-three (2oo3) voting for turbine protection.
- 5.01.02 The integrated Turbine-Generator Control System shall be divided into two parts - one for control and the other for protection. A clear separation between control and protection shall be provided. All data acquisition functions shall be integral to the system.
- 5.01.03 Bidder shall design the proposed system keeping 20% spare I/O capacities and 20% additional rack space all pre-wired for future expansion of the plant.
- 5.01.04 The Steam Turbine Control System shall be synchronized to a GPS Master Clock System for uniform time synchronization and stamping throughout the plant.
- 5.01.05 The sequence of events (SOE) and alarm annunciation shall be integral functions of the system. Each alarm and event shall be logged with a high resolution time tag including contact inputs to 1 ms.
- 5.01.06 The system shall have its own Historical Storage facility which can store data up to one month and archive data older than one month. In addition transmission facility for transferring historical data to Plant DCS may also be provided.

Suitable redundant full duplex soft communication link shall be provided by Bidder for this purpose. In addition, hardwired signal interfacing shall also be provided for any signal required for time critical interlock control & protection.

5.02.00 **TURBINE SUPERVISORY INSTRUMENTATION (TSI)**

Vital parameter of the TG shall be continuously supervised and monitored in order to provide information related to operating conditions of the TG during various stages of operation. The measurement as minimum shall include the following:

- (i) Bearing vibrations (X-Y direction)
- (ii) Shaft vibration (X-Y direction)
- (iii) Absolute shaft vibrations (X-Y direction) [computed]
- (iv) Axial shaft position of the rotor
- (v) Relative expansion
- (vi) Absolute expansion
- (vii) Valve position.
- (viii) Eccentricity
- (ix) Key phasor
- (x) Speed
- (xi) Bearing Metal Temperature

The system shall be adequate for providing necessary information for balancing various sections of the turbine-generator, shall be from the latest proven range of reputed manufacturer with proven experience in similar application and shall have seamless interface with turbine control system for integrated data archiving and display.

5.03.00 MEASUREMENT SYSTEM & CONTROL ELEMENT

5.03.01 FIELD INSTRUMENTS

- (a) Analog signal transmission shall be in current mode at the level of 4-20 mA DC, thermocouple or RTD. For binary signal exchange potential free contacts of appropriate rating shall be provided. Contact interrogation voltage level shall be 24 Volts DC.
- (b) Unless otherwise impractical, Instrument range shall be selected in such a way so that the normal reading lies within 50% to 70% of full scale for linear parameters and within 70% to 90% of full scale for flow measurements.
- (c) Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided for gauges and remote seal with capillary shall be provided for process transmitters.
- (d) Die cast aluminium or stainless steel casing shall be used as case material in general.
- (e) All the Process Transmitters shall be 2-wire Smart type with facility for remote calibration. Transmitters shall also have 4-20 mA DC output with driving capacity up to 500 Ohms. Transmitters shall be provided with Local Digital Indicator. The sensing elements and internal parts shall be constructed with material resistant to the corrosion of process fluid. In general AISI 316L may be used in all applications. Suitable valve manifolds, along with facilities for zeroing, shall be provided with each transmitter. Transmitters shall generally be

installed on Instrument Stands made of 2" MS pipes located at convenient points.

For continuous level measurement Radar, Ultrasonic, Displacer or DP type level transmitter shall be provided as per process condition. Radar type level transmitters shall be used for Condenser Hotwell and HP/ LP Heater service.

Hand held configurator kit (**1 no.**) for calibration shall be provided.

- (f) Temperature measurement shall be achieved by thermocouples or resistance temperature detectors. All temperature elements shall be Duplex ungrounded type with SS-316 sheath & MgO filled. Both the elements shall be terminated at junction box. Outer diameter of the sheath shall be minimum of 6 mm dia. For temperature ranges below 200°C, Pt-100 3 wire Resistance Temperature Detectors (RTD) shall be envisaged. For temperature range above 200°C, K-type (Chromel-Alumel) thermocouples shall be used depending on operating temperature range.

Temperature transmitters shall be of two-wire type, with 4-20 mA DC signal as output. Transmitter shall be "true smart", based on HART protocol along with capability of on line calibration. The power supply shall be 24 VDC. Local LCD indication of temperature shall be provided.

Motor winding temperature of HT motors and bearing temperature of HT motors & driven equipment shall be measured in all cases. In general bearing & winding temperature shall be measured with duplex RTD. Instead of a duplex type temperature element, two (2) simplex type temperature element can also be provided.

- (g) Temperature stub to be welded on process pipe / vessel and shall match with thermowell process connection and size. Thermowell shall be drilled out of bar stock and the length & construction shall comply with process requirement / relevant standards. Material of construction of thermowell shall be SS 316 / Hastelloy etc. suitable for the application.

Thermowell design shall be as per ASME PTC 19.3 - TW latest standard. All Thermowells in high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safer size and design of Thermowells.

- (h) Process switch function shall in generally be derived from analogue process transmitters. Process actuated switches may be accepted only in very few cases if the same is as per standard and proven practice of equipment Supplier subject to Owner's approval.

Switches shall be the snap acting & shock proof type 1 DPDT or 2 SPDT with contacts rated for 60V DC, 6VA or as required by control system. Set points shall be adjustable throughout the range with a calibrated scale indicating set point. Switching differential shall be adjustable.

Capacitance type, float type, conductivity type, RF type, ultrasonic type level switches shall be used as per process application. Capacitance type level

switch shall be used for oil and dirty medium application. Capacitance/ Conductivity/ Ultrasonic type switch shall be used for acid/ alkali application.

- (i) Local instruments shall be provided in cases where these are required for maintenance, commissioning and recommissioning of major equipment for calibration and setting of other instruments and for equipment safety.

Dial size for all pressure and temperature gauges shall be 150 mm and any lower size selection specific to the application shall be subject to the Owner / Engineer's approval.

Pressure gauge sensing element shall be Bourdon / Bellow / Diaphragm type in general depending upon the process condition. Direct reading Pressure / Differential Pressure gauges shall be used of SS 316 sensing element and SS 304 movement material. All pressure gauges shall be provided with proper isolating valve.

Inert gas/ Mercury filled-in system shall be used for local temperature measurement and shall be provided with thermowell.

Temperature gauges may be direct mounted type or with SS capillary extension (at least 3 Mtrs.) as per the application area.

The sensing element / bulb / capillary etc. shall be of SS 316 for temperature gauges.

- (j) All high capacity tanks shall have float & tape type level indicator. Smaller non-critical tanks shall have float & board type level indicators. **Reflex** type level indicators shall be provided for low pressure and temperature critical application such as condenser hotwell, LP heaters, chemical dosing tanks etc. All other applications shall have either reflex or transparent gauges depending on the fluid. Gauges shall be arranged so that the visible length is in excess of the maximum operating range.
- (k) Sight glass flow indicators shall be flap type and be used only where quantitative measurements are not required. Rotameters shall also provided for local flow measurement.
- (l) Process transmitters shall have an accuracy of $\pm 0.1\%$ of span or better. Local gauges shall be provided with accuracy of $\pm 1\%$. RTD accuracy shall as per DIN-43760/ IEC 60751 Class-A. Thermocouple accuracy shall be in accordance with IEC-751/ ANSI-MC-96.1 (Special class).
- (m) Redundant sensors/ transmitters shall be provided for all inputs related to the protection of turbine and generator. Bidder may suggest any critical measurement or protection area for which redundant measurements are required.
- (n) All instruments shall be supplied with valid calibration and test certificates provided by OEM.

5.03.02 FLOW MEASUREMENT



- (a) For measurement of steam flow, where high fluid velocity is involved, weld-in type Flow Nozzles shall be used. The flow nozzles shall conform to ASME PTC 19.5. Diameter ratio shall be between 0.4 and 0.7.
- (b) For low fluid velocity measurement, Orifice Plate flow element shall be used. The Orifice Plate shall conform to BS 1042 Part-I. Diameter ratio shall be between 0.34 and 0.7.
- (c) The flow elements shall be supplied as assemblies with high/low taps, root valves as required. Material of accessories shall be as per process conditions.
- (d) Bidder shall submit certified flow calculation and differential vs flow curves for each element for Owner's approval.
- (e) **Turbine inlet flow nozzle shall be wet calibrated by FCRI or IIT.**
- (f) **All primary flow elements (orifice/ flow nozzles) shall have one spare set of tappings, ready for future connection with proper isolation valves and plugs.**

5.03.03 CONTROL VALVES

- (a) Control valve body and trim type and material shall be selected to meet their individual service conditions. Control valves in throttling service shall generally be the globe-body type with body materials, pressure rating, and valve trims suitable for the service involved. Other style valve bodies (e.g. butterfly, angle, eccentric disk) may also be used when suitable for the intended service.
- (b) Valve sizing procedure shall conform to the latest edition of ISA on control valves.
- (c) The control valves with linear characteristics shall permit the maximum rated flow between 65% and 70% of full opening and those with equal percentage characteristics shall permit maximum rated flow between 75% to 85% of full opening. The valve rangeability at minimum and maximum flows shall be 10% to 80% of opening.
- (d) Control valve actuators shall generally be spring and diaphragm type. Piston type actuators shall be used for high shut-off pressure and/or quick response requirements. Electro-hydraulic control valves shall be used for HP /LP bypass, Turbine inlet and separator drain valve.
- (e) All control valves shall have smart type electro-pneumatic positioner with HART protocol that accepts 4-20mA DC signal from control systems.
- (f) Control Valves and its actuators shall be equipped with standard accessories like air filter regulator, valve positioner, position transmitters, hand-wheel, air failure lock, limit switches (non-contact type) etc.
- (g) For cavitation / flashing service, only valve with anti-cavitation trim, shall be provided.

- (h) The valve shall have minimum class-V leakage for all critical application . All other control valves shall have leakage rate as per leakage class-IV.
- (i) The actuator shall be designed for 150% thrust required for the valve (at shut-off pressure) at an air supply pressure **4.5 Kg/cm²**. All actuators shall be of fail-safe design.
- (j) The travel time of pneumatic actuators shall not exceed 10 seconds. **The travel time of HP/LP Bypass valves actuators shall not exceed 3 seconds.**
- (k) The control valve induced noise shall be limited to 85 dBA at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.
- (l) Bidder shall furnish the control valves data sheets and sizing calculation including inlet / outlet velocity with the proposal, which shall be subject to Owner's approval during detailed engineering.
- (m) Solenoid Valve coils shall be Class H high-temperature or Class F construction as applicable and shall be designed for continuous duty. Three-way solenoid valves shall be designed for universal operation so that the supply air may be connected to any port. Solenoid enclosures shall be IP-65 or equivalent.

5.04.00 VIBRATION MONITORING SYSTEM

Vibration transducers shall be provided on the DE and NDE bearings of HT motors and pumps (BFP, CEP etc.). In all cases, vibration shall be measured in both X-Y directions. For vertical pumps there shall be three bearing locations i.e. DE motor, NDE motor and pump thrust/ DE bearing.

Vibration Transducers shall be Eddy Current/ Piezoelectric type. The selection of transducer shall depend on each specific application. Vibration transducers shall be installed in accordance with API 670. The vibration monitoring shall have provision for interfacing with plant DCS to be supplied by Owner. The 4~20 mA signals from Vibration Transmitters shall be interfaced with Plant DCS for monitoring and protection purpose.

5.05.00 CONTROL PANEL/ CABINET

5.05.01 All system modules, power supply components as required for completeness of the systems shall be housed in Panels / Cabinets. The cabinets shall be totally enclosed freestanding vertical type equipped with full height front and rear lockable doors. Cabinets shall be designed for front access to system modules and rear access to wiring. Cabinets shall have minimum 20% spare capacity to accommodate future requirements. The cabinets shall be, in general, designed for bottom entry of cables.

5.05.02 The panel / cabinet sheet thickness shall be 3 mm on front side supporting instruments / electrical items and 2 mm for side / top and for doors. Neoprene rubber gaskets shall be used for doors to make the panel weatherproof and dustproof. The panel door latches shall be three-point type and the doors shall be provided with stainless steel hinges.

- 5.05.03 Removable type gland plates having minimum thickness of 4 mm shall be provided with cable glands / conduits at the bottom of the panel. Terminal blocks shall be complete with terminal accessories for cable connections.
- 5.05.04 The panel shall have internal illumination lighting fixtures. **Panels shall be provided with fluorescent illuminating lamps with door switch and 5A / 15A, 3/5 pin socket & switch unit.**
- 5.05.05 All panel exterior steel surfaces shall be sand blasted, ground smooth, and painted as finalized by Owner during detail engineering stage.
- 5.05.06 The panel shall be supplied complete with foundation bolts, anchoring fasteners, base channel, anti-vibration mountings, pedestals, removable lifting eye-bolts etc.
- 5.05.07 The panel shall be provided with 25 x 6 mm tinned copper earth bus running throughout the width of the panel.
- 5.05.08 The panels shall be provided with main name plate of suitable size having inscription clearly readable from the distance of approx. 3 meters. The individual devices on the panels shall be provided with separate name plates with inscription.
- 5.06.00 **CONTROL & INSTRUMENTATION CABLING SYSTEM**
- 5.06.01 All Instrumentation Cables i.e. twisted and shielded pair cables, control cables, prefabricated cables etc. shall be flame retardant low smoke (FRLS) type as per IEC 332-1. Fire resistance cables wherever required shall be as per IEC 331.
- 5.06.02 The conductor of Instrumentation and control cable shall be 650 / 1100 V grade, Stranded, annealed and tinned electrolytic grade copper of 1.0 mm² area as per IS 8130.
- 5.06.03 Shield shall be of aluminium mylar tape having thickness of 0.06 mm (minimum) with 25% overlap and 100% coverage and with annealed tinned copper drain wire of 0.8 mm dia. nominal continuously in contact with the shield.
- 5.06.04 The inner and outer sheath of cables shall be Extruded FRLS HR PVC type ST2 (anti-rodent, anti-termite & moisture resistant properties) as per IS 5831. The thickness shall be as per IS-1554, Part-I 1976. Non-metallic Rip Cord shall be provided under inner sheath. Filler shall be non-hygroscopic with FRLS property.
- 5.06.05 The C&I cables shall be suitable for continuous operating at 85°C minimum except for high temperature zones where heat resistant Teflon insulated cables shall be used.
- 5.06.06 The C&I cables shall be provided with galvanized wire armour construction as per IS 3975.
- 5.06.07 The cables shall conform to Oxygen Index as per ASTM D 2863, Acid gas generation according to IEC 754-1, temperature index not less than 250 deg C,

Smoke density as per ASTM D 2843, Flammability Test as per IEC 332 Part-I, Swedish Chimney Test as per SS-424-1475 F3 and Rodent & Termite repulsion test (Presence of lead shall be confirmed).

5.06.08 Following Electrical properties of cables shall be complied as minimum.

Insulation at 20 Deg.C	:	100 Mohms/Km [Min]
Capacitance at 800 Hz	:	120 nf/km
Cross talk	:	60 dB
Attenuation	:	1.2 dB/Km

5.06.09 Standard tests like continuity, insulation resistance, high voltage, tensile & elongation test and tests of cable electrical characteristics shall be performed according to relevant standards.

5.06.10 All interconnecting cables between cabinets shall be preferably pre-fabricated type with suitable prefab connectors.

5.06.11 Cable size & type shall be as below for different type of signals and control system.

- Cables for analog signals shall be instrumentation paired cable of 1.0 sq. mm tinned copper conductor size, with individual pair shielding & overall shielding.
- Cables for binary signals shall be instrumentation paired cable of 1.0 sq. mm tinned copper conductor size with overall shielding only.
- For interposing relay drive connection individual conductor cross section shall not be below 1.5 sq. mm.
- Cables for power supply to each solenoid valves shall be control cable of 3C x 2.5 sq. mm copper conductor size for all voltage level.
- For signal cables with single length more than 500 meters, the size of conductor shall be minimum 1.5 sq. mm irrespective of type of signals.

5.06.12 All cables shall generally be armoured, other than inter-panel cables within the control room area which may be unarmoured. Unarmoured cables shall run through conduits.

5.06.13 10% spare pairs or min 1 pair cable (whichever is more) shall be provided with all type of cables, except for pre-fabricated cables which shall be as per manufacturer's standard.

5.06.14 The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted group Junction Boxes (JBs) at strategic locations is done.

5.07.00 **ERECTION HARDWARE**

For erection hardware and procedures, the following guidelines shall be followed:

- 5.07.01 Instrument piping installation shall be as per standard "Fossil Fuel Power Plant Instrument Piping Installation, ANSI/ ISA- 77.70-1994 (R2010). All materials and installation thereof shall confirm to latest editions of American national Standard Code for pressure piping, ANSI B 31.1, ANSI B 16.1, ASME Boiler and pressure vessel codes, IBR and other applicable ASME, ANSI and local standards.
- 5.07.02 Temperature / Pressure Stub on equipment and pipelines shall preferably be of same material or higher grade of material. Suitable Root Valves shall be provided with every tap-off point. Double root valve/ blowdown valve shall be provided with pipe pressure more than 40 kg/cm² (g).
- 5.07.03 All impulse pipes shall be of seamless type conforming to ANSI B 36.10 for schedule numbers, sizes and dimensions etc. The material of impulse pipe shall be same as that of main process pipe.
- 5.07.04 Stainless tubing shall be furnished in accordance with the requirement conforming to ASTM A213 type, seamless, fully annealed. Wall thickness of the tube shall be in accordance with the ANSI B31.1 standard. Tubing fittings shall be of type 316 stainless steel.
- 5.07.05 For instrument air, **Class-C** G.I. pipe shall be used for air distribution from Battery Limit to the designated point of use. Take-off connections to instruments / actuators shall be with suitable size nipples and shut-off valves.
- 5.07.06 Individual air supply shall be provided by PVC coated SS/ Copper tube conforming to ASTM B75 through an isolating needle valve and air filter regulator. The fittings to be used with copper/SS tubes shall be of cast brass/SS, screwed type.
- 5.07.07 Rigid and flexible conduits along with necessary fittings shall be used for cable laying from instrument to JB or instrument to trays etc. Conduits shall be of rigid steel, hot-dip galvanized, furnished in standard lengths (3 meters) threaded at both ends. Conduits shall be complete with all accessories such as bends, ties, couplers etc.
- 5.07.08 The junction box shall be provided with 4 mm min. thick FRP (Fiberglass Reinforced Polyester)/ 3 mm min. thick CRCA/ Die-Cast Aluminium. Gland plates shall be minimum 3 mm thick. Terminals for body and shield ground shall be provided. All Junction box shall be supplied with enclosure protection class of IP 65. Screw less rail mounted cage clamp type spring loaded suitable for conductor size up to 2.5 sq. mm terminal block shall be provided in the junction box. Number of terminals in each junction box shall be provided including 20% spare capacity. Double Compression type cable gland made of Brass (nickel plated) shall be considered with Junction boxes. For hazardous areas the protection class for junction boxes shall be in accordance with the requirements of the relevant NEC code. Junction box for skid mounted systems shall be provided as per package supplier standard.
- 5.07.09 Erection materials shall have 20% spare capacity for future accommodation.

6.00.00 SPARES



- 6.01.00 Adequate spares for commissioning, operation and maintenance of the TG unit shall be provided. The Bidder shall also furnish a list of recommended spare parts along with their itemized prices for three (3) years operation & maintenance of all the equipment / instrument supplied under this package.
- 6.02.00 Mandatory spares shall be as per owner's requirement.
- 7.00.00 **DRAWINGS/ DOCUMENTS**
- 7.01.00 Bidder shall furnish system description, operation write-up, Bill of Materials, drawings, data information, technical catalogues, test certificates and other details to establish the provenness, capability and performance of the equipment and systems offered.
- 7.02.00 The following document as minimum shall be furnished with the Bid:
- (a) Detailed P & ID covering complete scope of instruments and valves.
 - (b) Control System Architecture Drawing
 - (c) Technical features/ write-up of critical items including critical valves indicating Make, Model
 - (d) Brief description of type and routine tests proposed to be carried out at shop and at site and write-up on the in-house quality assurance practice
 - (e) Sub-Vendor's List
 - (f) Inspection categorization plan
 - (g) Details of training of Owner's personnel specifying duration of each course, number and category of personnel proposed to be trained in each course, location etc.
 - (h) Details of post commissioning services
 - (i) Lists of maintenance and calibration test, spare parts (erection / commissioning & recommended), special tools & tackle.
 - (j) List of Deviation from Specification document.
 - (k) Filled-in Bid Proposal Sheets
- 7.03.00 After award of contract Contractor in association with Owner shall draw-up a list of drawings, documents, deliverables with corresponding submission schedule and shall assign review status (approval (A)/ Information (I) to each deliverable. Note that whether the review status is either "A" or "I". the Bidder shall submit the same for approval. The review status "I" shall not deter the Bidder from getting approval or revising the drawings/ document in line with Owner's comments.

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				Annexure-6	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

Enquiry No.	
Item	BOILER FEED PUMP ASSEMBLY
Project	1 X 120 MW COAL BASED REHEAT TPP JHAGADIA, BHARUCH, GUJARAT
End Customer	DCM SRIRAM LTD. BHARUCH, GUJARAT
Customer's Consultant	DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA
Contract Duration	
S.no	PRE QUALIFICATION CRITERIA
1.0	-----
2.0	Technical Criteria - At least 1 pump of the offered pump model should have completed TEN (10) Years of satisfactory operation at site, as on enquiry submission due date. - The reference(s) furnished by the bidder against Sl.No. 1 should also meet the following criteria: - Flow variation between offered pump model and reference furnished should be within 70% to 130% - Differential head variation between offered pump model and reference furnished should be within 70% to 130% - Difference in the number of stages between offered pump model and reference furnished should be within -2 to +2 stages - Flow medium shall be boiler feed water - The bidder should have designed, engineered, manufactured, packaged, tested and supplied at least one pump of offered pump model from his manufacturing plant. The offered model shall be of proven design. The bidders shall furnish following documents for assessing Bidder's pre-qualifications as indicated at Sl. No.1, 2 and 3 above along with technical offer: - Bidder's reference list in enclosed format –Annexure-1 - Documentary evidence like copies of Purchase Order and Inspection Release Note (IRN) or Satisfactory Performance feedback certificates from End User indicating salient features like Project name, date of supply & commissioning.
3.0	-----
4.0	ADDITIONAL REQUIREMENTS

NOTES:	
A	-----
B	-----
C	-----
D	-----
E	-----
H	-----

EXPERIENCE RECORD PROFORMA
CENTRIFUGAL PUMP (HORIZONTAL MULTISTAGE)

ITEM NO.: _____

NOTES TO BIDDERS:

1. Prototype pump model/ model series shall not be considered.
2. It is mandatory that all references furnished for pump model/ model series should have similar parameters.

DESCRIPTION OF MODEL DESIGNATION: _____

SL. NO.	PARAMETER	INFORMATION ON PROPOSED MODEL	INFORMATION ON REFERRED EXISTING INSTALLATIONS			REMARKS
			Ref.- 1	Ref.-2	Ref.-3	
1.	2.	3.	4.	5.	6.	7.
1	GENERAL					
1.1	Make / Model Number					
1.2	Number of units supplied					
1.3	Type of driver / Driver rated kW / Speed(rpm)					
1.4	Drive (Fixed Speed / Variable Speed / Variable Frequency)					
1.5	Shop where pump is designed, manufactured, packaged, tested & supplied with address					
2	OPERATING CONDITIONS					
2.1	Fluid handled / Fluid temperature (Min / Max) Deg C					
2.2	Capacity (m ³ /hr) / Differential Head Rated (m)					
2.3	Maximum Suction pressure (kg/cm ² ,a)					
2.4	Differential Pressure, Rated (kg/cm ²)					
2.5	NPSHR (m)					
2.6	Efficiency (%) / BkW (kW) / Rated Speed (rpm)					
2.7	Minimum Continuous Stable Flow, (m ³ /hr)					
2.8	MAWP outer casing (kg/cm ² G) @ 15°C / @ pumping temperature					
3	CONSTRUCTION					

**EXPERIENCE RECORD PROFORMA
CENTRIFUGAL PUMP (HORIZONTAL MULTISTAGE)**

ITEM NO.: _____

3.1	No. of stages / Pump Type					
3.2	Casing split - Outer casing (Axial / Radial)					
3.3	Casing split - Inner casing (Axial / Radial)					
3.4	First Impeller Type (Single flow / Double flow)					
3.5	Impeller diameter - Rated/ Maximum / Minimum (mm)					
3.6	Impeller mounting (Inline / Back to back)					
3.7	Balancing Device used (Balance drum / Balance disc / Others)					
3.8	Type of Radial Bearings (Antifriction / Sleeve / Tilting Pad / Others)					
3.9	Type of Thrust Bearings (Taper land / Tilting Pad / Others)					
3.10	Span between bearings (mm) / Shaft diameter under: Seals / Bearings (mm)					
3.11	Shaft Sleeve provided between impeller (interstage bushings) - Yes / No					
3.12	Whether the proposed model and reference models have identical hydraulic design (for impeller / diffuser / volute)					
3.13	Type of lubrication (Pressurised / Splash / Ring / Oil mist / Grease)					
3.14	Lubrication system (API-610 / API-614 / Manufacturer Standard)					
3.15	Type of mechanical seal (Single / Double) / API Sealing Plan No.					
4	MATERIAL OF CONSTRUCTION					
4.1	Outer Casing / Inner Casing / Impellers / Shaft					
5	OTHER INFORMATION ON INSTALLATIONS					
5.1	Date of supply and commissioning					
5.2	Whether ten year of successful field operation completed after commissioning as on bid due date					
5.3	Purchaser's Name, Address, Contact No. & email ID					

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				Annexure-7	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

ESP- 001-2A		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-8	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

VENDOR LIST - PE&SD					
Project: 1 x 120 MW REHEAT STG UNIT , BHARUCH, GUJARAT					
Sl No	Item Description (as per MIPP)	BHEL PMD No.	Vendors List approved during KOM dtd. 09.08.2019	Vendor's as per BHEL PMD	Additional Vendors proposed for approval DCM Comments
MECHANICAL					
C & I					
3	CONTROL VALVES PACKAGE	PE.IN.515	MIL CONTROL	KSB MIL CONTROLS LIMITED	
			INTRUMENTATION LTD.	INTRUMENTATION LTD.	
			EMERSON	EMERSON PROCESS MANAGEMENT	
				SAMSON CONTROLS PVT LTD.,	SAMSON CONTROLS PVT LTD., Rejected
				GE OIL & GAS INDIA PVT. LTD.	GE OIL & GAS INDIA PVT. LTD. Accepted.
				KOSO INDIA PRIVATE LIMITED	KOSO INDIA PRIVATE LIMITED Accepted.
				CIRCOR FLOW TECHNOLOGIES INDIA	CIRCOR FLOW TECHNOLOGIES INDIA Rejected
				FORBES MARSHALL ARCA LTD.,	FORBES MARSHALL ARCA LTD., Rejected
3	DESUPERHEATER PACKAGE	PE.IN.522		SEVERN GLOCON INDIAN PVT. LTD.	SEVERN GLOCON INDIAN PVT. LTD. Rejected
			CIRCOR FLOW	CIRCOR FLOW TECHNOLOGIES INDIA	
			CHEMTROL	CHEMTROLS INDUSTRIES PVT LTD.	
			KOSO	KOSO INDIA PRIVATE LIMITED	
			EMERSON	EMERSON PROCESS MANAGEMENT	
				FORBES MARSHALL ARCA LTD.,	FORBES MARSHALL ARCA LTD., Rejected
				BOMAF A SPECIAL VALVE SOLUTIONS	BOMAF A SPECIAL VALVE SOLUTIONS Rejected
				INDITECH VALVES PVT. LTD.	INDITECH VALVES PVT. LTD. Rejected
4	TURBINE BYPASS VALVE PACKAGE	PE.IN.017	KOSO	KOSO	
			CCI	CIRCOR FLOW TECHNOLOGIES INDIA	CIRCOR FLOW TECHNOLOGIES INDIA Rejected
			HORA	KOSO PARCOL SRL	KOSO PARCOL SRL Rejected
				CHEMTROLS INDUSTRIES PVT LTD.	CHEMTROLS INDUSTRIES PVT LTD. Rejected
				FORBES MARSHALL ARCA LTD.,	FORBES MARSHALL ARCA LTD., Rejected
				BOMAF A SPECIAL VALVE SOLUTIONS	BOMAF A SPECIAL VALVE SOLUTIONS Rejected
				EMERSON PROCESS MANAGEMENT	EMERSON PROCESS MANAGEMENT Rejected

Y. D. Borkar
07/03/2020
(C & I)

(Yogesh / Dcm Siram)

For mechanical
items
07/03/2020
N.S. Chawla

(N.S. Chawla)

5	SIGNAL CABLES	PE.EP.043	KEI	KEI INDUSTRIES LIMITED		
			DELTON CABLES	DELTON CABLES LIMITED		
			POLYCAB WIRES PVT.LTD	POLYCAB INDIA LIMITED		
			UNIVERSAL CABLES	ASSOCIATED FLEXIBLES AND WIRES	ASSOCIATED FLEXIBLES AND WIRES	Rejected
				ASSOCIATED CABLES PVT. LTD.	ASSOCIATED CABLES PVT. LTD.	Accepted.
				ADVANCE CABLE TECHNOLOGIES PVT.LTD.	ADVANCE CABLE TECHNOLOGIES PVT.LTD.	Rejected
				LAPP INDIA PVT. LTD.	LAPP INDIA PVT. LTD.	Accepted.
				ELKAY TELELINKS LIMITED	ELKAY TELELINKS LIMITED	Rejected
				SUYOG ELECTRICALS LTD	SUYOG ELECTRICALS LTD	Rejected
				T C COMMUNICATION PVT. LTD.	T C COMMUNICATION PVT. LTD.	Accepted.
				SPECIAL CABLES PVT. LTD.	SPECIAL CABLES PVT. LTD.	Rejected
				GUPTA POWER INFRASTRUCTURE LTD.	GUPTA POWER INFRASTRUCTURE LTD.	Rejected
				TEMPSENS INSTRUMENTS (I) PVT.LTD.	TEMPSENS INSTRUMENTS (I) PVT.LTD.	Rejected
				UDEY PYROCABLES PVT. LTD.	UDEY PYROCABLES PVT. LTD.	Accepted.
				LEONI CABLE SOLUTIONS (INDIA)	LEONI CABLE SOLUTIONS (INDIA)	Accepted.
				PARAMOUNT COMMUNICATIONS LTD	PARAMOUNT COMMUNICATIONS LTD	Rejected
				CMi LIMITED	CMi LIMITED	Rejected
				CORDS CABLE INDUSTRIES LTD.	CORDS CABLE INDUSTRIES LTD.	Rejected
				MIDDLE EAST SPECIALIZED CABLES CO.	MIDDLE EAST SPECIALIZED CABLES CO.	Rejected
				KEC INTERNATIONAL LIMITED	KEC INTERNATIONAL LIMITED	Rejected
				THERMO CABLES LIMITED	THERMO CABLES LIMITED	Accepted.
6	FLOW NOZZLE(IF APPLICABLE)	PE.IN.527	MINCO INDIA PVT. LTD.	MINCO INDIA PVT. LTD.		
			INSTRUMENTATION LTD	INSTRUMENTATION LTD		
			MICRO PRECISION PRODUCTS (P) LTD.	MICRO PRECISION PRODUCTS (P) LTD.		
				HYDROPNEUMATICS PRIVATE LIMITED	HYDROPNEUMATICS PRIVATE LIMITED	Accepted.
				MINCO (INDIA) FLOW ELEMENTS	MINCO (INDIA) FLOW ELEMENTS	Rejected
				ASIAN INDUSTRIAL VALVES AND	ASIAN INDUSTRIAL VALVES AND	Rejected
				STAR-MECH CONTROLS (I) PVT. LTD.	STAR-MECH CONTROLS (I) PVT. LTD.	Accepted.
7	FLOW ORIFICE	PE.IN.528	MINCO INDIA PVT. LTD.	MINCO INDIA PVT. LTD.		
			MICRO PRECISION PRODUCTS (P) LTD.	MICRO PRECISION PRODUCTS (P) LTD.		
			INSTRUMENTATION LTD	INSTRUMENTATION LTD		
				STAR-MECH CONTROLS (I) PVT. LTD.	STAR-MECH CONTROLS (I) PVT. LTD.	Rejected
				MINCO (INDIA) FLOW ELEMENTS	MINCO (INDIA) FLOW ELEMENTS	Rejected
				HYDROPNEUMATICS PRIVATE LIMITED	HYDROPNEUMATICS PRIVATE LIMITED	Accepted.
				DYNAFLUID VALVES AND FLOW CONTROLS	DYNAFLUID VALVES AND FLOW CONTROLS	Rejected
				SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Rejected
				EUREKA INDUSTRIAL EQUIPMENTS	EUREKA INDUSTRIAL EQUIPMENTS	Accepted.
				ASIAN INDUSTRIAL VALVES AND	ASIAN INDUSTRIAL VALVES AND	Rejected
8	GUIDED WAVE RADAR LEVEL INSTRUMENT	PE.IN.010	ENDRESS+HAUSER INSTRUMENTS INTL., INDIA	ENDRESS+HAUSER INSTRUMENTS INTL., INDIA		
			ENDRESS+HAUSER (I) PVT LTD., INDIA	ENDRESS + HAUSER (INDIA) PVT. LTD.		
			MAGNETROL INTERNATIONAL N.V.	MAGNETROL INTERNATIONAL N.V.		
			VEGA INDIA	VEGA INDIA LEVEL & PRESSURE		
				V AUTOMAT AND INSTRUMENTS PVT LTD	V AUTOMAT AND INSTRUMENTS PVT LTD	Rejected
9	JUNCTION BOXES (WEATHER PROOF)	PE.IN.537	FCG FLAMEPROOF CONTROL GEARS	FCG FLAMEPROOF CONTROL GEARS		
			FLAMEPROOF EQUIPMENTS PVT.LTD.	FLAMEPROOF EQUIPMENTS PVT.LTD.		
			FLEXPRO	PYROTECH ELECTRONICS PVT. LTD.	PYROTECH ELECTRONICS PVT. LTD.	Accepted.
			PROMPT	EX-PROTECTA	EX-PROTECTA	Accepted.
			ELECTROMAX INDUSTRIES			
10	LIQUID LEVEL FLOAT SWITCH	PE.IN.541	PUNE TECHTROL PVT LTD	PUNE TECHTROL PVT LTD		
			CHEMTROLS INDUSTRIES PVT LTD.	CHEMTROLS INDUSTRIES PVT LTD.		
			V AUTOMAT AND INSTRUMENTS PVT LTD	V AUTOMAT AND INSTRUMENTS PVT LTD		
			LEVCON	D.K. INSTRUMENTS (P) LTD.,	D.K. INSTRUMENTS (P) LTD.,	Rejected
				GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.	Accepted.
				SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Accepted.
				IGEMA GmbH	IGEMA GmbH	Rejected


 07/03/2020
 (C&I)

11	LIQUID LEVEL GAUGES	PE.IN.542	NISAN SCIENTIFIC PROCESS	NISAN SCIENTIFIC PROCESS		
			IGEMA GmbH	IGEMA GmbH		
			ASIAN INDUSTRIAL VALVE	Sigma Instruments Company	Sigma Instruments Company	Rejected
			TANSA	GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.	Accepted.
			PROTOLINA	PUNE TECHTROL PVT LTD	PUNE TECHTROL PVT LTD	Accepted.
			SAMIL	CHEMTROLS INDUSTRIES PVT LTD.	CHEMTROLS INDUSTRIES PVT LTD.	Accepted.
			PROCESS INSTRUMENT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Accepted.
12	PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES	PE.IN.550		D.K. INSTRUMENTS (P) LTD.,	D.K. INSTRUMENTS (P) LTD.,	Rejected
				BLISS ANAND PVT. LTD.,	BLISS ANAND PVT. LTD.,	Accepted.
				V AUTOMAT AND INSTRUMENTS PVT LTD	V AUTOMAT AND INSTRUMENTS PVT LTD	Rejected
			PRECISION MASS PRODUCTS PVT LTD	PRECISION MASS PRODUCTS PVT LTD		
			SWITZER PROCESS INSTRUMENTS	SWITZER PROCESS INSTRUMENTS		
			DANFOSS	SOR INC	SOR INC	Rejected
				GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.	Accepted.
13	PRESSURE GAUGES	PE.IN.552		KAUSTUBHA UDYOG	KAUSTUBHA UDYOG	Rejected
				BAUMER TECHNOLOGIES	BAUMER TECHNOLOGIES	Accepted.
				TRAFAG CONTROLS INDIA PVT LTD	TRAFAG CONTROLS INDIA PVT LTD	Rejected
			PRECISION MASS PRODUCTS PVT LTD	PRECISION MASS PRODUCTS PVT LTD		
			H.GURU INSTRUMENTS(S.I)PVT.LTD	H.GURU INSTRUMENTS(S.I)PVT.LTD		
			GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.		
			SWITZER PROCESS INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	Rejected
14	PR. & DIFF. PR. TRANSMITTERS (ELECTRONIC - SMART)	PE.IN.555	GOA INSTRUMENT	A.N. INSTRUMENTS PVT. LTD.	A.N. INSTRUMENTS PVT. LTD.	Rejected
			ASHCROFT GAUGE	FORBES MARSHALL (HYD) PVT LIMITED,	FORBES MARSHALL (HYD) PVT LIMITED,	Accepted.
				ALTOP INDUSTRIES LIMITED	ALTOP INDUSTRIES LIMITED	Accepted.
				WALCHANDNAGAR INDUSTRIES LIMITED	WALCHANDNAGAR INDUSTRIES LIMITED	Rejected
				SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Rejected
				BAUMER TECHNOLOGIES	BAUMER TECHNOLOGIES	Accepted.
15	ROTAMETER	PE.IN.559	EMERSON PROCESS MGT (I) PVT LTD	EMERSON PROCESS MGT (I) PVT LTD		
			YOKOGAWA INDIA LIMITED	YOKOGAWA INDIA LIMITED		
			ENDRESS + HAUSER (INDIA) PVT. LTD.	ENDRESS + HAUSER (INDIA) PVT. LTD.		
				ABB INDIA LIMITED, HYD	ABB INDIA LIMITED, HYD	Rejected
				HONEYWELL AUTOMATION INDIA LIMITED	HONEYWELL AUTOMATION INDIA LIMITED	Accepted.
			INSTRUMENTATION ENGINEERS PVT LTD	INSTRUMENTATION ENGINEERS PVT LTD		
			YOKOGAWA	FLOW STAR ENGINEERING PVT. LTD.	FLOW STAR ENGINEERING PVT. LTD.	Accepted.
16	RTD & THERMOCOUPLES WITH THERMOWELLS	PE.IN.561	PLACKA INSTRUMENT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Accepted.
				CHEMTROLS INDUSTRIES PVT LTD.	CHEMTROLS INDUSTRIES PVT LTD.	Accepted.
				D.K. INSTRUMENTS (P) LTD.,	D.K. INSTRUMENTS (P) LTD.,	Rejected
			THERMAL INSTRUMENT INDIA	THERMAL INSTRUMENT INDIA		
			TOSHNIWAL INDUSTRIES PVT. LTD.	TOSHNIWAL INDUSTRIES PVT. LTD.		
			GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.		
			PRECISION MASS PRODUCTS PVT LTD	PRECISION MASS PRODUCTS PVT LTD		
17	TEMPERATURE GAUGES WITH THERMOWELL	PE.IN.574	TM TECHNOMATIC	PROTECH CONTROL INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	Rejected
			NESSTECH INSTRUMENT	TEMPSSENS INSTRUMENTS (I) PVT.LTD.	TEMPSSENS INSTRUMENTS (I) PVT.LTD.	Accepted.
			THE RMO ELECTRIC	DETRIV INSTRUMENTATION	DETRIV INSTRUMENTATION	Accepted.
			INDUSTRIAL INSTRUMENT	BAUMER TECHNOLOGIES	BAUMER TECHNOLOGIES	Accepted.
				PYRO ELECTRIC INSTRUMENTS GOA	PYRO ELECTRIC INSTRUMENTS GOA	Accepted.
				ALTOP INDUSTRIES LIMITED	ALTOP INDUSTRIES LIMITED	Accepted.
17	TEMPERATURE GAUGES WITH THERMOWELL	PE.IN.574	GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.		
			H.GURU INSTRUMENTS(S.I)PVT.LTD	H.GURU INSTRUMENTS(S.I)PVT.LTD		
			PRECISION MASS PRODUCTS PVT LTD	PRECISION MASS PRODUCTS PVT LTD		
			SWITZER PROCESS INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	Rejected
			GOA INSTRUMENT	A.N. INSTRUMENTS PVT. LTD.	A.N. INSTRUMENTS PVT. LTD.	Rejected
			ASHCROFT GAUGE	THERMAL INSTRUMENT INDIA	THERMAL INSTRUMENT INDIA	Accepted.
				WIKA INSTRUMENTS INDIA PVT. LTD.,	WIKA INSTRUMENTS INDIA PVT. LTD.,	Accepted.
				BAUMER TECHNOLOGIES	BAUMER TECHNOLOGIES	Accepted.
				SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Accepted.
				WALCHANDNAGAR INDUSTRIES LIMITED	WALCHANDNAGAR INDUSTRIES LIMITED	Accepted.
				ALTOP INDUSTRIES LIMITED	ALTOP INDUSTRIES LIMITED	Accepted.
				FORBES MARSHALL (HYD) PVT LIMITED,	FORBES MARSHALL (HYD) PVT LIMITED,	Accepted.

Y. B. Kulkarni
07/03/2020
(CKZ)

18	THERMOWELLS	PE.IN.577	THERMAL INSTRUMENT INDIA	THERMAL INSTRUMENT INDIA		
			PRECISION ENGINEERING INDS.	PRECISION ENGINEERING INDS.		
			PRECISION MASS PRODUCTS PVT LTD	PRECISION MASS PRODUCTS PVT LTD		
			PYRO ELECTRIC INSTRUMENTS GOA	PYRO ELECTRIC INSTRUMENTS GOA		
			TM-TECHNOMATIC S.R.I.	TEMP-TECH		
			H.GURU INSTRUMENTS(S.I)PVT.LTD	H.GURU INSTRUMENTS(S.I)PVT.LTD		
			MICRO PRECISION PRODUCTS (P) LTD.	MICRO PRECISION PRODUCTS (P) LTD.		
			DETRIV INSTRUMENTATION	PROTECH CONTROL INSTRUMENTS	PROTECH CONTROL INSTRUMENTS	Rejected
			TOSHNIWAL INDUSTRIES PVT. LTD.	TEMPSENS INSTRUMENTS (I) PVT.LTD.	TEMPSENS INSTRUMENTS (I) PVT.LTD.	Accepted.
			INDUSTRIAL INSTRUMENTATION	NAV DURGA FORGING AND FITTINGS	NAV DURGA FORGING AND FITTINGS	Rejected
			CALRO DYNAMIC	GAUGES BOURDON INDIA PVT. LTD.	GAUGES BOURDON INDIA PVT. LTD.	Accepted.
			GOA INSTRUMENT	CHEMTROLS INDUSTRIES PVT LTD.	CHEMTROLS INDUSTRIES PVT LTD.	Accepted.
			ASHCROFT	BAUMER TECHNOLOGIES	BAUMER TECHNOLOGIES	Accepted.
				SCIENTIFIC DEVICES (BOMBAY) PVT. LT	SCIENTIFIC DEVICES (BOMBAY) PVT. LT	Accepted.
19	TEMPERATURE TRANSMITTER	PE.IN.579	EMERSON PROCESS MGT (I) PVT LTD	EMERSON PROCESS MGT (I) PVT LTD		
			YOKOGAWA INDIA LIMITED	YOKOGAWA INDIA LIMITED		
			SIEMEN	ABB INDIA LIMITED, HYD	ABB INDIA LIMITED, HYD	Rejected
				HONEYWELL AUTOMATION INDIA LIMITED	HONEYWELL AUTOMATION INDIA LIMITED	Accepted.
20	LEVEL TRANSMITTER (RADAR, NON-CONTACT TYPE)	PE.IN.586	ENDRESS + HAUSER (INDIA) PVT. LTD.	ENDRESS + HAUSER (INDIA) PVT. LTD.		
			VEGA INDIA LEVEL & PRESSURE	VEGA INDIA LEVEL & PRESSURE		
			MAGNETROL INTERNATIONAL N.V	EMERSON PROCESS MGT (I) PVT LTD	EMERSON PROCESS MGT (I) PVT LTD	Accepted.
			ENDRESS+HAUSER GMBH	EIP Enviro Level Controls Pvt Ltd	EIP Enviro Level Controls Pvt Ltd	Rejected
				PUNE TECHTROL PVT LTD	PUNE TECHTROL PVT LTD	Rejected
21	HOOKUP MATERIAL PACKAGE	PE.IN.580	Customer approved Vendor Not available	HONEYWELL AUTOMATION INDIA LIMITED	HONEYWELL AUTOMATION INDIA LIMITED	Rejected
				HAVI ENGINEERING INDIA PVT LTD	HAVI ENGINEERING INDIA PVT LTD	Accepted.
				NAV DURGA FORGING AND FITTINGS	NAV DURGA FORGING AND FITTINGS	Accepted.
				SWASTIK ENGINEERING WORKS	SWASTIK ENGINEERING WORKS	Accepted.
				PANAM ENGINEERS LTD.	PANAM ENGINEERS LTD.	Accepted.
				DYNAFLUID VALVES AND FLOW CONTROLS	DYNAFLUID VALVES AND FLOW CONTROLS	Accepted.
				P.K. TUBES & FITTINGS PVT. LTD.	P.K. TUBES & FITTINGS PVT. LTD.	Accepted.
				TRUE FAB ENGINEER (P) LTD.	TRUE FAB ENGINEER (P) LTD.	Accepted.
				TRUE FORGE PVT.LTD.,	TRUE FORGE PVT.LTD.,	Accepted.
				COMFIT AND VALVES PVT LTD	COMFIT AND VALVES PVT LTD	Accepted.
				PRESHZINGER ENGINEERING	PRESHZINGER ENGINEERING	Accepted.
				UNIQUE ENGINEERING ENTPS. PVT. LTD.	UNIQUE ENGINEERING ENTPS. PVT. LTD.	Accepted.
				KWALITY FORGED FITTINGS	KWALITY FORGED FITTINGS	Accepted.
				BENTLY NEVADA, LLC	BENTLY NEVADA, LLC	Accepted.
22	VIBRATION & DISPLACEMENT MOTORING SYSTEM	PE.IN.581	Customer approved Vendor Not available	MEGGITT SA	MEGGITT SA	Accepted.
				SENSONICS LIMITED	SENSONICS LIMITED	Accepted.
				SHINKAWA ELECTRIC CO LTD.,	SHINKAWA ELECTRIC CO LTD.,	Accepted.
					CONCOMATIC AUSTRIA GMBH	Accepted.
23	SOLONOID VALVE (TRIP)				ASCO NUMATICS	Accepted.
					IMI NORGREEN-HARJON	Accepted.
					TYCO	Accepted.
					BHEL	Accepted.
					FAINGER LESER	Accepted.
24	SMART POSITIONER				SIEMENS	Accepted.
					MESTO	Accepted.
					FISHER	Accepted.
					DRESSER	Accepted.

Notes:-

1. All other items shall be sourced from BHEL standard Vendors
2. Vendor list shall not be referred for scope demarcation/clarity.
3. All raw Materials will be sourced from BHEL standard vendor only

Y. Z. Hovesia
07/03/2020
(CEKI)

07/03/2020
W. S. Chaudhary

ESP- 001-2A		PROJECT ENGINEERING & SYSTEMS DIVISION		Std. / Doc. Number	
				Annexure-9	
				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

[illegible]

MASTER DOCUMENT LIST - Boiler Feed Pump assembly																	
	Vendor Name:				PROJECT: DCM SRIRAM							Supplier Doc- No:					
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:		Rev- No.	0			Rev: 01	
	Vendor contact No.				Supplier's Job No.							Date:					
	SYSTEM/PACKAGE:	BFP assembly				TODAY-DATE	10/Apr/20			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			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	Date	
16	LOS-Instruments:DPI			I	N	N											
17	LOS-Instruments:DPT			I	N	N											
18	LOS-TSV			I	N	N											
19	LOS-PSV			I	N	N											
20	LOS-PCV [UP & DOWN]			I	N	N											
21	Instrument schedule			I	N	N											
22	JB schedule			I	N	N											
23	Logic Diagram			I	N	N											
24	Instrument BOM			I	N	N											
25	TRV- Plan 23 line			I	N	N											
26	PSV- BLO line			I	N	N											
27	Pump-JB			I	N	N											
28	Control philosophy/cause & effect diagram			I	N	N											
29	Datsheet for Instruments Gear Box (if applicable)			I	N	N											
C	MISCELLANEOUS																
1	Performance Test Procedure			A	Y	N											
2	Hydro Test Procedure			I	N	N											
3	Magnetic Particle Test			I	N	N											
4	PMI Test Procedure			I	N	N											
5	WELD MAP			I	N	N											
6	Painting proccedure			A	N	N											
7	Painting proccedure- Gear Box			A	N	N											
8	Packing List			I	N	N											
9	BILL OF MATERIAL			A	N	N											
10	BBU			A	N	N											
11	QUALITY ASSURANCE PLAN			A	N	Y											
12	COMMISSIONING SPARES LIST			A	N	N											
13	Mandatory Spares List			A	N	N											
14	LUBE OIL SCHEDULE			I	N	N											
15	Utility List			I	N	N											
16	Load List			I	N	N											
17	O& M Manuals(Soft Copies) including STARTUP PROCEDURE, ERECTION PROCEDURE & Comissioing procedure, INSPECTION/TESTS REPORTS/CERTIFICATE and all other documents as per specification			A	N	N											
18	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.			I	N	N											
							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 - Over Due.					TOTAL "OD"		0								

MASTER DOCUMENT LIST - Boiler Feed Pump assembly																			
	Vendor Name:				PROJECT:	DCM SRIRAM							Supplier Doc- No:						
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:			Rev- No.	0		Rev: 01			
	Vendor contact No.				Supplier's Job No.								Date:						
	SYSTEM/PACKAGE:	BFP assembly				TODAY-DATE	10 /Apr/ 20			Submission status to BHEL								REMARKS	
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			Final Rev-(R)			
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" %PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT	Date			
Vendor documentation status																			
Total No of Docs		Due as on Date	Submitt ed by vendor as on Dt.	Approve d by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/ Remarks									
(Nos)		(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N).-/ (If Y) put Dt.										
0		0	0	0	0	0	#DIV/0!	77.78%	Y										

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				Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

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

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				Annexure-11	
				Rev. No.	00

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Annexure-11

(Pre-bid clarification Format)

Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Ratish Kumar Thakur	Girish Prasad Palo	Surya Satya Nagesh M	08.04.20

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION				Std. / Doc. Number	
						Annexure-12	
						Rev. No.	00
						Sheet 1 of 2	

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Annexure-12

Prebid clarification

Revisions:	Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
		Ratish Kumar	Girish Prasad Palo	M.S.S. Nagesh	08.04.2020



PROJECT ENGINEERING & SYSTEMS DIVISION

Std. / Doc. Number

Annexure-12

Rev. No.

00

Sheet 2 of 2

DEVIATION SCHEDULE TECHNICAL

Bidder are requested to mark “✓” as applicable

☐ No Deviation required

☐ Deviation required

List of deviations (expectations and /or addition requested by Bidder) from specification, standards and /or drawing etc.

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

Note: Bidder to furnish this duly filled format along with SEAL & SIGN at pre-bid stage only and any deviations appearing elsewhere shall not be considered.

SIGNATURE : _____

NAME : _____

DESIGNATION : _____

COMPANY : _____

DATE : _____

COMPANY SEAL