

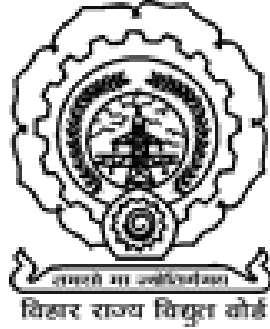


**BHEL-ISG  
BANGALORE**

2X250 MW TPP BSEB Barauni  
**Technical Enquiry Specification for  
Variable Speed Scoop Controlled Fluid  
Coupling for Ash Slurry Pump For Ash  
Handling System**

**DOCUMENT NUMBER**

**IS-1-10-2013/AHP-005**



**BIHAR STATE ELECTRICITY BOARD  
2X250 MW THERMAL POWER PROJECT, BARAUNI**

**CUSTOMER'S CONSULTANT: STEAG ENERGY SERVICES (INDIA) PVT. LTD., NOIDA**

## **TECHNICAL ENQUIRY SPECIFICATION**

OF

VARIABLE SPEED SCOOP CONTROLLED FLUID COUPLING FOR ASH SLURRY PUMP

OF


ASH HANDLING SYSTEM



**BHARAT HEAVY ELECTRICALS LIMITED  
INDUSTRIAL SYSTEMS GROUP  
BANGALORE**

	<b>Prepared By</b>	<b>Checked by</b>	<b>Approved by</b>
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**1.00 PROJECT INFORMATION:**

The specification has been prepared for supply of Variable Speed Fluid Coupling for Ash Slurry Pump for 2X250 MW TPP, Unit 8&9 for BSEB, Barauni for which Steag Energy System Pvt. Ltd., Noida is the consultant for the customer BSEB. BHEL is the principal contractor who is responsible for the establishment of the power project for unit 8 & 9.

Industrial Systems Group (ISG) of BHEL located at Bangalore will be executing the Ash Handling System of the 2X250 MW, BSEB, Barauni Unit 8 & 9.

Project information for the 2X250 MW BSEB Barauni project is as per enclosed Annexure –I.

**2.00 SCOPE OF SUPPLY:**

The scope of supply and works includes design, manufacture, supply, testing at shop, inspection at manufacturer’s work, delivery at site and supervision of erection & commissioning & PG test of Variable Speed Fluid Coupling for ash slurry pump application. The bidder shall include in their offer for number of man days at site for erection & commissioning & PG test of fluid coupling as 6 days (i.e approx. 2days x 3visits) and the visit is inclusive of expenses towards travel, accommodation etc..


The variable speed fluid coupling with manual scoop shall be supplied with all equipments/accessories like fusible plug, pressure switch, pressure gauge, SS mesh Y-Strainer, Temperature gauge, temperature switch, isolation valves, oil circulation pump with motor, shell and tube type heat exchanger with copper tubes, shaft input and output side multi disc flexible coupling with nuts and bolts and spacer plates (as applicable), required lubricating oil, oil level gauge, hose pipe (oil service), drain plug etc as per this Specification. Fluid Coupling manufacturer shall make their own arrangement for testing of Fluid Coupling at shop floor. One number of fluid coupling shall be dispatched to ash slurry pump manufacturer’s works for assembly test as required.

Items and accessories which are not mentioned specifically but are essential for sound performance of the equipment shall be supplied by bidder without any cost implication to BHEL.

**3.0 BIDDER’S QUALIFICATION REQUIREMENT :**

3.1 The bid is open for participation to those bidders who satisfy the following requirements

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3.1.1 Bidder should have designed, engineered, manufactured, tested & supplied at least two (2) numbers of Fluid couplings of similar rating as given below for Ash slurry disposal pumping application for Ash Handling plant of two different thermal power stations of min. 250MW rating.

These Fluid couplings should be in successful operation in India for a period of at least Two (2) years in the preceding 7 years on the date for submission of bid.

Type : Variable speed Fluid coupling with manual scoop.

Drive Motor : 160KW, 1500rpm.

Range of speed regulation : +10% to -40%

Max. slip permissible : 3%

Cooling arrangement : Water cooled Oil cooler with oil circulation pump.

3.1.2 Bidder should have service facilities (incl. assembly/ testing) in India and the same shall be indicated in the offer.


3.1.3 Bidder shall provide documentary evidence in support of his claim for having experience in design, manufacture, testing and supply, performance of Fluid couplings meeting the requirements mentioned in sl. nos 3.1, 3.1.1 & 3.1.2 for Ash Handling Plants which are in operation on the date of submission of bid.

3.1.4 The Make of offered Fluid coupling shall be subjected to approval by Customer / Customer's consultant. The bidder whose make not approved by customer/ customer's consultant will not be considered for evaluation of their offer.

3.2 BHEL-ISG reserves the right to assess the capabilities and capacity of the Bidder / Bidder's associates to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.


BHEL-ISG reserves the right to reject any or all bids or cancel/withdraw the Bids without assigning any reason whatsoever and in such case no bidder / intending bidder shall have any claim arising out of such action.

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**4.00 SPECIFICATION FOR FLUID COUPLING:**

4.01	Type	:	Variable Speed Fluid Coupling
4.02	Applicable codes	:	As per manufacturer's standard
			Any other relevant International / DIN standard.
4.03	Quantity	:	4 Nos.
4.04	Performance Parameters	:	Variable Speed Fluid Coupling
i)	Range of Speed Regulation Provided	:	(+) 10% to (-) 40 %
ii)	KW/RPM Rating of Motor	:	160 KW/1500 RPM
	Maximum Slip Permissible		3%
iii)	Mounting Arrangement	:	Horizontal- Foot Mounted
iv)	Type	:	Variable Manual Scoop Type
v)	Duty	:	To be designed for continuous duty
vi)	Application	:	Ash Slurry Disposal Pump Stage I
4.05	Design Standard		As Per Manufacturer's Standard (Bidder to specify the design standard followed)
4.06	Site Data	:	Refer Annexure-I
4.1	Material of Construction	:	
4.1.1	Variable Speed Fluid Coupling		
i)	Impeller	:	Aluminium Alloy LM4/LM6 BS 1490
ii)	Runner	:	Aluminium Alloy LM4/LM6 BS 1490
iii)	Scoop Housing	:	Cast iron FG-200 to IS:210/MS Fabricated

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iv)	Scoop Housing Bracket	:	MS Fabricated
v)	Coupling Box & Cover	:	IS 2062 GR-B Fabricated
vi)	Shaft		IS 1875 CL4/ EN 8 to BS 970 /C-40
vii)	Scoop Casing		Aluminium Alloy/ LM6 BS 1490
viii)	Back Casing		Aluminium Alloy/ LM6 BS 1490
4.1.2	Oil Cooler		
i)	Type		Water operated oil cooler, Shell and Tube type Heat exchanger with copper tubes.
ii)	Shell		ERW Pipe
iii)	Tubes		Copper
4.1.3	Oil Circulation Pump and motor		Gear Pump with relief valve/ As per proven standard of manufacturer.
4.1.4	Pressure and Temperature Gauge		
i)	Make		As per Annexure -II
ii)	Type		Glycerin filled Bourdon type/As applicable for oil application.
iii)	Scale		Linear 270 deg arc angle graduated in metric units
iv)	Safety Feature		Blowout-cum-glycerin filling facility at top of gauge
v)	Adjustment		Micro meter screw for zero adjustment.
vi)	Sensing element material		SS316
vii)	Movement material		SS316
viii)	Case material		Die cast Aluminium
4.1.5	Pressure and		


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	Temperature Switch		
i)	Make		As per Annexure -II
ii)	Type		Bellow type/As applicable for oil application.
iii)	Set point adjustment		Provided over full range
iv)	Switch type		Snap action dry contact, shock & vibration proof micro switch.
v)	Repeatability		+/- 0.5% of full range
vi)	Sensing element material		SS316
vii)	Case material		Die Cast Aluminium with epoxy coated
4.1.6	Isolation ball valve, Y-Strainer, Flow gauge, orifice, fusible plug, oil level indicator ,shaft input and output side multi disc flexible coupling with nuts and bolts and spacer plates (as applicable) etc.		As per proven standard of manufacturer.


4.2	Design & Construction Features:
i)	The operating pressure of clarified water of fluid coupling cooler shall be 6.5 Kg/cm2(g). The oil cooler shall be tested to withstand min. 10 Kg/cm2(g) water pressure during inspection.
ii)	Oil cooler shall be designed to withstand hydro test pressure of 1.5 times the working pressure of the liquid.

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iii)	Ultrasonic test for shaft shall be carried out as per ASTM 388 and the log report shall be submitted during final stage inspection.
iv)	The Material test certificates/lab report/supplier's TC for mechanical and chemical properties of raw materials like impeller, runner, back casing, scoop casing, shaft, oil cooler tubes, parts of oil pump, bearing, oil pump motor, scoop tube, HT bolts, fabrication box shall be submitted.
v)	The stage inspections which shall be carried out by the manufacturer shall include Balancing of impeller, runner, back casing as per ISO 1940 GR 6.3, DP test for shaft, runner, impeller etc for surface defect. The manufacturer shall submit the log report/inspection report for stage inspection tests during final stage inspection.
vi)	The final stage inspection shall be witnessed by BHEL/customer/customer's consultant at manufacturer's factory. The witness shall include the check of overall dimensions, temperature rise, oil leak test, performance test (torque Vs Slip Regulation), Run test (free running for noise and vibration), Overspeed test for soundness, hydro test for the cooler.
vii)	Pressure switches, pressure gauges, temperature switches and temperature switches shall be weather and dust proof as per IP65. Certificate for the same shall be submitted for review during inspection.
viii)	The dial size of the pressure/temperature gauge shall be 150 mm with white background and black lettering.
ix)	The model no. and maximum operating range of pressure/temperature gauges/switches shall be as per manufacturer's standard. The over range protection for gauges/switch shall be 150% of the maximum design pressure. The maximum operating temperature shall be as per system requirement.
x)	Performance test certificates shall be submitted for oil circulating feed pump and the motor.
xi)	Painting shall be as per manufacturer standard, however the total DFT should not be less than 100DFT.

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xii)	Vibration level of fluid coupling shall be limited to as per the stipulations prescribed in relevant standards.
xiii)	Maximum noise level shall not exceed 85 dB (A) when measured at 1m away from noise emission source.

4.3	<b>ACCESSORIES:</b>
	<p>Each fluid coupling to include following minimum accessories as part of each fluid coupling.</p> <ul style="list-style-type: none"> <li>• Companion couplings (gear box side and motor side) along with nuts &amp; bolts and spacer plates (as applicable).</li> <li>• During commissioning of fluid coupling, the oil present in fluid coupling shall be drained and fresh oil shall be filled in presence of BHEL. The supply of this first fill fresh oil shall be in the scope of bidder.</li> <li>• HT bolts for fixing fluid coupling on base frames.</li> <li>• All necessary instruments to ensure smooth and satisfactory operation of the fluid coupling and also for the safe and reliable operation of the equipment.</li> <li>• Tool kit for operation and maintenance of the fluid coupling.</li> <li>• Lubrication fittings as necessary for proper and easy lubrication of the equipment.</li> <li>• Commissioning spares and all other accessories, which are not mentioned specifically but are essential for sound performance of the equipment.</li> </ul>

**Note :** No technical deviation to specifications is acceptable.

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5.00 TECHNICAL DATA SHEET TO BE FILLED BY THE BIDDER

SI.No.	Description	
1.00.00	Variable Speed Fluid Coupling	
1.01.00	General	
1.01.01	Make/Manufacturer	:
1.01.02	Model No.	:
1.01.03	Maximum Power Transmission Capacity	:
1.01.04	Motor rating (KW/RPM)	:
1.01.05	Total Weight of Unit without Oil	:
1.01.06	Oil Capacity of Fluid Coupling	
1.01.07	Acceptable Vibration Limit	:
1.01.08	Acceptable Noise Level	
1.01.09	Type of Cooling	
1.01.10	Type of Lubricant	
1.01.11	Speed Regulating Range	
1.01.12	Coupling Speed	
1.01.13	Percentage of Slip	
1.01.13.1	At duty point	
1.01.13.2	At (-)40% speed	
1.01.13.3	At (+) 10 % speed	
1.01.14	Maximum Slip at any point	
1.01.15	Moment of Inertia, GD <sup>2</sup> of	
1.01.15.1	Of Primary parts(Input side)	
1.01.15.2	Of Secondary parts	

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	(Output side)	
1.01.15.3	Of oil in circuit (Circuit full)	
1.01.15.4	Total GD <sup>2</sup> of rotating assembly with circuit full of oil	
1.01.16	Windage Losses	
1.01.17	Oil Specification	
1.01.18	Length and specification of connecting hose pipe (oil service).	
2.01.00	Oil Cooler	
2.01.01	Type	
2.01.02	Oil Flow designed	
2.01.03	I/L & O/L Oil Temperature	
2.01.04	Water Flow required	
2.01.05	I/L & O/L Water Temperature	
2.01.06	Inlet Water Pressure	
2.01.07	Water Pressure Drop	
2.01.08	Working Design pressure for Shell Side(Oil)	
2.01.09	Test pressure for Shell Side	
2.01.10	Working Design pressure for Tube Side(Water)	
2.01.11	Test pressure for Tube Side.	
2.01.12	Diameter and thickness of Tube	
2.01.13	Number of Tubes	


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2.02.00	Material of Construction		
2.02.01	Shell		
2.02.02	Tubes		
3.01.00	Oil Circulation Pump		
3.01.01	Make		
3.01.02	Capacity		
3.01.03	Head		
3.01.04	Motor Rating		
3.01.05	Motor Specifications		
3.02.00	Material of Construction		
3.02.01	Impeller		
3.02.02	Back casing		
3.02.03	Runner		
3.02.04	Scoop Casing		
3.02.05	Shaft		
3.02.06	Coupling Box and Cover		
3.02.07	Fusible Plug		
3.02.08	Scoop housing		
3.02.09	Scoop housing bracket		
4.01.00	Pressure Gauge		
4.01.01	Model No.		
4.01.02	Make		
4.01.03	Type		
4.01.04	Range		
4.01.05	Enclosure Class/Protection		
4.01.06	Over range protection		
4.01.07	Size of Dial gauge		
4.01.08	Colour and lettering		
4.01.09	Scale		
4.01.10	Safety Feature		

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4.01.11	Adjustment		
4.02.00	Material Specification		
4.02.01	Sensing element material		
4.02.02	Movement material		
4.02.03	Case material		
5.01.00	Pressure Switch		
5.01.01	Model No.		
5.01.02	Make		
5.01.03	Type		
5.01.04	Range		
5.01.05	Enclosure Class/Protection		
5.01.06	Over range Protection		
5.01.07	Set point adjustment		
5.01.08	Switch Configuration		
5.01.09	Switch Rating		
5.01.10	Switch type		
5.01.11	Repeatability		
5.01.12	Maximum operating temperature		
5.02.00	Material Specification		
5.02.01	Sensing element material		
5.02.02	Case material		
6.01.00	Temperature gauge		
6.01.01	Model No.		
6.01.02	Make		
6.01.03	Type		
6.01.04	Range		
6.01.05	Enclosure Class/Protection		
6.01.06	Over range protection		
6.01.07	Size of Dial gauge		

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6.01.08	Colour and lettering	
6.01.09	Scale	
6.01.10	Safety Feature	
6.01.11	Adjustment	
6.02.00	Material Specification	
6.02.01	Sensing element material	
6.02.02	Movement material	
6.02.03	Case material	
7.01.00	Temperature Switch	
7.01.01	Model No.	
7.01.02	Make	
7.01.03	Type	
7.01.04	Range	
7.01.05	Enclosure Class/Protection	
7.01.06	Over range Protection	
7.01.07	Set point adjustment	
7.01.08	Switch Configuration	
7.01.09	Switch Rating	
7.01.10	Switch type	
7.01.11	Repeatability	
7.01.12	Maximum operating temperature	
7.02.00	Material Specification	
7.02.01	Sensing element material	
7.02.02	Case material	
8.01.00	Ball Valve (for oil isolation)	
8.01.01	Type	
8.01.02	Make	
8.01.03	Size	
8.02.00	Material Specification	

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8.02.01	Body material		
9.01.00	Y-Strainer		
9.01.01	Type		
9.01.02	Make		
9.01.03	Size		
9.02.00	Material Specification		
9.02.01	Body material		
9.02.02	Mesh material		
10.01.00	PAINTING:		
10.01.01	Please indicate type of paint used / total paint DFT / Final RAL color shade of outside surface.	:	

**6.00 INSPECTIONS & TESTING:**

Inspection and testing shall be carried out in presence of BHEL-ISG and customer (BSEB)/ customer's consultant (STEAG) / representatives. The vendor shall furnish inspection & testing procedure & QAP for due approval from BHEL/Customer/customer's Consultant. Vendor is responsible for getting the Inspection & Test procedures and Quality Assurance Plans approved from the main Customer. Inspection & Test procedure, QAP will be furnished by vendor along with their offer.

All Quality plans shall be submitted in soft copy (word file/excel file/ and pdf file) for BHEL/Customer/customer's Consultant approval. As per the hold points mentioned in QAP, Vendor shall submit the inspection calls by E-mail with clear notice of 10-15days followed by hard copy to be sent by courier so as to reach BHEL desk within 3-4 days from the date of E-mailing of the document. BHEL shall inform within 7-10 days of receipt of inspection call whether inspection shall be carried out or waived off. After completion of inspection the material will be treated as cleared for dispatch

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by BHEL/Customer/customer's Consultant inspector, if inspection is OK as observed by Inspection Engineers.


Vendor shall maintain strict quality norms and standards for Bought out/self manufactured items through its wide network of quality departments throughout the country who carryout stage and final inspection of the product as per quality standards agreed by engineering/quality specialists.

**7.00 TECHNICAL INPUTS TO BE FURNISHED/ CONFIRMED ALONG WITH THE OFFER:**

Following documents are to be necessarily enclosed for each type of fluid coupling by the Bidder as a part of the Offer:

- a) Manufacturer's QAP.
- b) GA drawing.
- c) Sectional assembly drawings complete with bill of material.
- d) Duly filled in Bidder's Data Sheet.
- e) Catalogues for the offered models.
- f) Minimum 2 Nos. installations of similar type/rating/duty of Fluid couplings in Thermal Power Plant meeting the qualification requirement to be indicated by the bidder in their offer with details of location of installation & contact personnel etc.
- g) Bidder shall submit signed copy of all the pages of enquiry specification.
- h) List of Commissioning Spares other than mentioned of this specifications.
- i) The list of tools in the Tool Kit for operation and maintenance of the fluid coupling.
- j) Bidder to specify the design standard followed for design of Fluid coupling and also specify the equivalent Indian Standard/MOC for foreign standards)
- k) Painting Schedule.

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 <p><b>BHEL-ISG BANGALORE</b></p>	<p>2X250 MW TPP BSEB Barauni  <b>Technical Enquiry Specification for  Variable Speed Scoop Controlled Fluid  Coupling for Ash Slurry Pump For Ash  Handling System</b></p>	<p><b>DOCUMENT NUMBER</b>   <b>IS-1-10-2013/AHP-005</b></p>
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8.00 List of Drawings/Documents to be furnished after placement of L.O.I.


i)	Sectional assembly drawings complete with bill of material and its part numbers for approval.
ii)	GA drawings for approval.
iii)	Technical Data sheet and performance curves for approval
iv)	Manufacturer's QAP for approval.
v)	Operational and maintenance manual for information.
vi)	Lubrication schedule for information
vii)	Painting Schedule for approval.
viii)	Storage and Installation Manual
ix)	Load Data for designing Civil Foundation.
x)	Any other relevant document which may be felt necessary during execution of Contract.
xi)	Successful bidder shall submit all the above with proper title block within a week of receipt of LOI. Bidder's LD on account of delay on submission and revised submission of these documents/drawings shall not be entertained.
xii)	The approval time for Drawings/ Documents from BHEL/Customer shall be considered by bidder as three weeks for their planning of supply of equipment within time frame.

8.1 OPERATION & MAINTENANCE MANUAL:

O & M manual shall contain the following:

1. Principle of operation of the equipment.
2. Details of preventive / repair maintenance for equipment and accessories used.
3. Details about the general specifications, design capacities of equipment and their function.
4. Equipment Bidder's address, telephone nos., contacts person details to be furnished.
5. Required Dismantling devices, tools etc.,
6. List of DO's and DO NOT's.

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	<p style="text-align: center;">2X250 MW TPP BSEB Barauni  <b>Technical Enquiry Specification for  Variable Speed Scoop Controlled Fluid  Coupling for Ash Slurry Pump For Ash  Handling System</b></p>	<p style="text-align: center;"><b>DOCUMENT NUMBER</b>   IS-1-10-2013/AHP-005</p>
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7. Test certificates.
8. All drawings.
9. O& M Manual for Fluid coupling.
10. O& M Manual for oil circulating pump and motor.
11. O& M Manual for oil cooler.
12. Storage and erection instructions.
13. Proper procedures & sequence of operation.
14. Details of consumable.

Note: i) All manual shall be supplied in proper bound books or in folders, preferably in A4 size.

ii) The volume and section number shall be intimated by the Bidder.

iii) Prospective Bidder will submit the regular progress reports for self manufacturing & their bought out items equipment ordering /manufacturing status, drgs status once in fifteen days.

iv) Bidder shall directly send O&M Manuals to BHEL-ISG HQ as per distribution schedule given in specification with covering letter copy to Project Manager, BHEL-ISG, Bangalore. BHEL Project Manager shall coordinate and ensure submission to Customer/customer's Consultant for the equipments as per BHEL standard practice.

## 8.2 DISTRIBUTION OF DRAWINGS/ DOCUMENTS DURING DETAIL

### ENGINEERING:

#### a) Distribution of drawings/ documents:

For Approval and Information category drgs :

Initial submission –Soft copy (AutoCAD version and Pdf version)


Commented copies back to the sender- Soft copy (Pdf version)

Resubmission of revised drg – Soft copy (AutoCAD version and Pdf version).

Final approved drawings/documents – 5 nos. hard copies.

#### b) BHEL / Customer / customer's Consultant shall review and furnish their comments/approval within 15 days from the date of receipt of

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drawings/documents. M/s BHEL/Customer/customer's Consultant will furnish Comments /approval to the Vendor after review of each drawing/document.

c) Considering the criticality of the project requirement, all efforts shall be made to re-submit the drawings/documents as early as possible. However, the commented drawings shall be re-submitted by successful Bidder within 7 days from the date of receipt of commented drawings/ documents from BHEL/Customer/customer's Consultant.

d) Drawings approved under Cat-B shall hold good for construction/execution subject to taking care of comments of M/s BHEL/Customer/customer's Consultant.

e) In case, successful Bidder does not agree with any specific comments, successful Bidder shall furnish the explanation for the same to M/s BHEL/Customer/customer's Consultant within the framework of contractually agreed specification for consideration, acceptance and formal approval under Category A, as per specifications.

f) For Category C, BHEL/Customer/customer's Consultant will send soft copies of marked up drawings for further action by successful Bidder.


g) Final distribution of copies of all Category A approved drawings/documents shall be submitted by successful Bidder to BHEL/Customer/customer's Consultant as per distribution schedule given above.

**9.0 COMMISSIONING SPARES:**  
The following minimum commissioning spares shall be included in bidder's scope:

a) 3 nos. Rubber spacer between couplings of oil pump and motor.  
b) 2 Nos. Fusible plug.

**10.0 ESSENTIAL SPARES:**  
Bidder to furnish the list of essential spares required for initial 3 years of operation of Fluid coupling.

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## 11.0 PROJECT INFORMATION

Bihar State Electricity Board (BSEB) is setting up a Coal fired Thermal Power plant at Barauni, in Begusarai (Bihar). The capacity of the proposed Thermal power project is **2 X 250 MW** configurations with sub – critical steam parameters. The proposed units is expansion to the existing Barauni TPS, Begusarai.

Owner/Purchaser (or Customer)	BIHAR STATE ELECTRICITY BOARD (BSEB)
Customer's Consultant	STEAG Energy Services (India) Pvt Ltd., Noida
Project Title	BSEB - 2 X 250 MW BARAUNI TPS, UNIT 8 & 9
Project location	BARAUNI , BIHAR
Existing station	BARAUNI TPS UNIT 1 To 7.
Longitude / latitude	86 <sup>0</sup> 01'36"E / 25 <sup>0</sup> 23'36"N
Elevation (above Sea level)	41.76 m above MSL
Transport facilities	By Rail / Road
a) Nearest Railway station /Gauge	Barauni
Ambient Air Temperature	Temperature - maximum 42.4 deg C minimum 8.4 deg C
<b>Design Ambient Temperature</b>	<b>50° C</b>
Relative humidity	73%
Design Relative humidity	100%
Maximum Wind speed	17 m/ sec
Maximum Rainfall	352.8 mm in 24 hrs

### Plant location.

The Proposed Plant is 8 Km from Barauni town within Barauni TPS closed to Barauni- Mokama section of national highway (NH-31).


### Access to Site.

Approach to the site by road is from Barauni- Mokama section of national highway (NH-31).

### **Seismological Parameters**

The proposed project is located in seismic Zone IV, accordingly Seismic forces should be considered as per IS: 1893.

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### 12.0 VENDOR LIST OF ELECTRICAL ITEMS

Sl.No	ITEM DESCRIPTION	Sl.No	VENDORS
1	PRESSURE GAUGES	1	MANOMETER INDIA PVT LTD., THANE
		2	BELLS CONTROLS LIMITED
		3	KROHNE MARSHALL PVT LTD., PUNE
		4	A. N. INSTRUMENTS PRIVATE LIMITED
		5	GENERAL INSTRUMENT CONSORTIUM
		6	WAREE INSTRUMENTS LIMITED,
		7	Hirlekar Precision Engg. Pvt. Ltd.
2	PRESSURE SWITCHES	1	ROTORK CONTROLS (I) LTD., CHENNAI
		2	TOSHBRO CONTROLS (P) LIMITED.,
		3	ENDRESS + HAUSER(INDIA ) PVT LTD
		4	SAAB TANK CONTROLS INDIA PVT LTD
		5	SWITZER INSTRUMENTS LTD.
		6	S B E M PVT LTD.
		7	NIVO CONTROLS, INDORE
		8	D.K.INSTRUMENTS PVT LTD.,
		9	EMERSON PROCESS MANAGEMENT
		10	Meritech
		11	Delval Flow Controls Pvt. Ltd.
		12	Limitorque india limited
		13	LEVCON CONTROLS PVT.LTD., KOLKATA
		14	HoneyWell Automation India Ltd.
3	TEMPERATURE GAUGE		Not present in PMD vendor list. Manufacturer's standard to be followed. However the credentials of the supplier to be submitted.
4	TEMPERATURE SWITCH		Not present in PMD vendor list. Manufacturer's standard to be followed. However the credentials of the supplier to be submitted.