

TECHNICAL SPECIFICATION
FOR
ULTRASONIC FLOW METERS

1 X 660 MW BHUSAWAL STPP, UNIT-6

VOLUME - IIB

SECTIONS-A, B, C & D

SPECIFICATION No: PE-TS-415-145-I916



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT DIVISION

NOIDA, INDIA

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Technical specification for
ULTRASONIC FLOW METERS
 1 X 660 MW BHUSAWAL STPP, UNIT-6

SPEC NO.: PE-TS-415-145-1916

DOCUMENT NO.

VOLUME II B

SECTION

REV. NO. 00

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	Technical specification for ULTRASONIC FLOW METERS 1 X 660 MW BHUSAWAL STPP, UNIT-6	SPEC NO.: PE-TS-415-145-I916
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SECTION – A

SCOPE OF ENQUIRY



Technical specification for
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VOLUME II B

SECTION A

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SCOPE OF ENQUIRY

1. SCOPE

- 1.1 This specification covers the Design, Manufacture, Inspection and testing at manufacturer's works, proper packing for transportation and delivery to site of the **Ultrasonic flow meters along with accessories** as mentioned in different sections of this specification for **1 X 660 MW BHUSAWAL TPP** project.
- 1.2 The quality plan enclosed forms the minimum requirement but not limited to be adhered to by the bidder. Bidder to sign and stamp the same and submit along with the offer as an acceptance.
- 1.3 Scope of supply shall be Ultrasonic flow meter along with accessories as indicated in specification.
- 1.4 Following signed & stamped documents with company seal to be submitted by bidder.
 - a) Complete offer including calculation sheets, catalogues etc.
 - b) Quality Plan
 - c) Datasheet A & B, duly filled

2 GENERAL TECHNICAL INSTRUCTIONS

- 2.1 It is not the intent here to specify all the details of design and manufacture. However, the equipment shall conform in all respects to high standard of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the customer / consultant, who will interpret the meaning of drawing and specification and shall be entitled to reject any component or material which in his judgment is not in full accordance herewith.
- 2.2 The omission of specific reference to any component / accessory necessary for the proper performance of the equipment shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.
- 2.3 BHEL' s / Customer' s representatives shall be given access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to them.
- 2.4 The Equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and Material Dispatch Clearance Certificate (MDCC) is issued by BHEL / Customer.



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SECTION – B

PROJECT INFORMATION

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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1.0 INTRODUCTION

The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder.

2.0 APPROACH TO SITE

Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway.

3.0 LAND

Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land.

4.0 SOURCE OF COAL

Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tippers and will be either bunkered or stacked in the stock pile at site.

5.0 SOURCE OF WATER

The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.

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6.0 ASH DISPOSAL AREA

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

7.0 PROJECT INFORMATION

7.1	Client / Owner	: Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	: Procon Engineers, Navi Mumbai (Division of Nimoto Consulting Engineers Pvt. Ltd.)
7.3	Project Title	: BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	: Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	: Bhusawal
7.6	Nearest Airport	: Aurangabad
7.7	Nearest Harbour	: Mumbai
7.8	Access Roads	: NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	: 210 M
7.10	Longitude/latitude	: 75° 51' 10" East / 21° 02' 30" North
7.11	Seismic Zone	: Zone III as per IS:1893
7.12	<u>AMBIENT TEMPERATURE</u>	
7.12.1	Mean of daily maximum temperature	: 48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	: 18 °C (during January)
7.12.3	Highest temperature recorded	: 48.7°C

CONSULTANT : PROCON ENGINEERS

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7.12.4	Lowest temperature recorded : 13°C	
7.13	Wet bulb temperature : 27°C (Maximum)	
7.14	Rainfall : 112 mm average annually	
7.15	Wind Speed : 0 to 39 Km/hr	
7.16	Wind direction : East North East to West South West	

CONSULTANT : PROCON ENGINEERS



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SECTION – C

- **SPECIFIC TECHNICAL REQUIREMENT**
 - **DATA SHEETS – A & B**
 - **QUALITY PLAN**
 - **BOQ-MAIN SUPPLY**



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SECTION – C

SPECIAL TECHNICAL REQUIREMENTS



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SPECIFIC TECHNICAL REQUIREMENTS

The requirements in this section are specific for this project and shall over-ride the specification under Section-D in case of any contradiction. BIDDER to comply the stringent requirement as per BHEL decision without any commercial implication.

- 1.0 Bidder to note that duly filled up Data Sheet-B and Quality plan enclosed in Section-C of Volume IIB, to be signed and stamped and submitted with the bid.
- 2.0 Inspection shall be carried out in line with pre-approved drawings/data sheet/QP.
- 3.0 Supplier supervision is required for 2 days for each Ultrasonic Flow Meter during it's E&C. Total 3 number of UFM's are required at site. Hence bidder may have to visit the site 3 times for 2 full days each time, for E&C of each UFM individually. All the expenses such as boarding, lodging and travel, Air fare etc. shall be in bidder's scope, BHEL shall provide supervision charges of E&C on lump sum basis as per rate contract purchase order.
- 4.0 DOCUMENTATION:
 - (A) Along with the bids
 - a) Duly filled, signed and stamped datasheet- A & B attached in Section-C of this Specification
 - b) Signed and stamped QP in BHEL's format attached in Section-C of this Specification
 - c) Documents pertaining to PQR
 - (B) After the award of contract: 10 sets of the following documents to be enclosed along with the contract documents for approval:
 - a) Technical data sheet for each UFM & accessories in the pro forma enclosed under Data Sheet-B
 - b) Quality plan duly signed and stamped.
 - c) Assembly drawing of each type of flow UFM complete with all accessories indicating detailed dimensions, B.O.M. and weights.
 - d) GA Drawing/ Installation drawings for the flow elements.

For Information

- a) Storage and Commissioning Instruction
- b) All relevant catalogues for the models of the UFM as well as accessories finalized.
- c) O&M manuals



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(C) Final documentation: The documentation as listed below shall be submitted as a part of final documentation.

- | | |
|--|--------------------------|
| 1. Approved final drawings/data sheets | – 10 sets with 2 CD-ROMS |
| 2. All Test certificates | – 10 sets. |
| 3. Operation & Maintenance Manuals for Ultrasonic flow meter | – 10 sets |
| 4. Assembly drawings and QP for approval | – 10 sets. |
| 5. “As built” drawings | – 10 sets. |

5.0 In case during erection/commissioning of the Ultrasonic flow meter, any spares are required which have not been specified in the Start-up/commissioning spares list, the same will have to be supplied by the vendor free of cost.

6.0 Design & Engineering details of all spares (make, model, rating, drawing, data sheet etc.) shall be submitted to the Owner prior to dispatch from manufacturers' works.

SPARES: The following spares are required to be offered

(A) Recommended Spares:

The bidder shall furnish a List of Recommended spares giving unit prices and total prices for 3 years of normal operation of the Ultrasonic flow meters / accessories to enable BHEL/BHEL's Customer to place a separate order later, if required. The price of recommended spares will not be used for the evaluation of bids.

(B) Start-up & Commissioning Spares:

Start-up and Commissioning spares are those spares, which may be required during the start-up and commissioning of the Ultrasonic flow meter. All spares used until the plant is handed over to the Owner shall come under this category.

All start-up spares, which are supplied under this contract, shall be strictly interchangeable with the parts for which they are intended for replacements.

The Start-up and commissioning spares indicated by the bidder shall be a part of the main Ultrasonic flow meter supply. However, bidder to indicate prices separately.



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DATA SHEETS - A&B



**DATA SHEET FOR ULTRASONIC FLOW METER
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GENERAL TECHNICAL REQUIREMENTS FOR ULTRASONIC FLOW METERS:

1. EACH ULTRASONIC FLOW METER SHALL BE OF TRANSIT TIME CLAMP ON TYPE WITH SINGLE PATH AND WITH ONE SET OF TRANSDUCER.
2. ALL TYPE OF ACCESSORIES I.E. CABLE GLAND, TRANSDUCER CABLE, ALL MOUNTING HARDWARE LIKE CLAMPING FIXTURES, INTERCONNECTING CABLES AND SS NAMEPLATE SHALL BE PROVIDED WHICH ARE REQUIRED FOR THE COMPLETENESS OF THE SYSTEM.
3. MATERIAL OF ALL FITTINGS SHALL BE SS-316.
4. CABLE GLAND, AS APPLICABLE SHALL BE OF SS-316 AND DOUBLE COMPRESSION TYPE.
5. EACH ASSEMBLY SHALL BE IDENTIFIED WITH THE FOLLOWING INFORMATION: TAG NO., SERVICE, LINE SIZE & THICKNESS AND DIRECTION OF FLOW.
6. ULTRASONIC FLOW METER ASSEMBLIES SHALL UNDERGO TESTS AS PER BHEL STANDARD QUALITY PLAN, PROJECT DOC NO. PE-QP-415-145-I011.
7. UFM TRANSMITTER SHALL BE CONNECTED TO DDCMIS THROUGH 2 WIRE CABLE.
8. IN UNDERGROUND PIPE, UFM SHALL BE INSTALLED IN PIT. BIDDER TO SUBMIT THE OPTIMISED PIT SIZE REQUIREMENT FOR UFM INSTALLED IN PIT.
9. IF REQUIRED, TRANSMITTER SHALL BE SUITABLY LOCATED AWAY FROM THE SENSOR FOR BETTER ACCESS AND VISIBILITY. HENCE MINIMUM DISTANCE OF 30 METER TO BE CONSIDERED BETWEEN SENSOR AND TRANSMITTER.



**DATA SHEET FOR UTRASONIC FLOW METER
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DATA SHEET – A & B

**DATA SHEET – A
(TO BE FILLED BY PURCHASER)**

**DATA SHEET – B
(TO BE FILLED UP
BY BIDDER)**

GENERAL	PROJECT	1X660MW BHUSAWAL STPP, UNIT-6	.....
	TAG NO.	GAC10CF001	.....
	QUANTITY	ONE (01)	.....
	SERVICE :	ASH WTR PUMP DISCH HDR FLOW	.....
	MAKE : MODEL	Bidder to indicate	.....
TECHNICAL	TYPE	☐ TRANSIT TIME CLAMP-ON ☐ SINGLE PATH ☐ 1 SET OF SENSORS ☐ Instantaneous Flow Rate ☐ Totalized Flow	.....
	FLOW MEASUREMENT	Isolated 4-20 mA DC linear output	.....
	OUTPUT		.....
	ACCURACY	± 1%	.....
	REPEATABILITY	± 0.2% of calibration span	.....
	RANGEABILITY	400:1	.....
	RESPONSE TIME	≤ 20 msec	.....
	LOAD RESISTANCE	MIN. 500 OHM	.....
	HART COMPATIBILITY	☐ YES	.....
	CONTACT RELAY OUTPUT	2 NO + 2 NC	.....
	DISPLAY/INDICATION	Flow meter with LCD screen backlight based local display and keypad.	.....
	OPERATING VOLTAGE	☐ 230V AC	.....
	TOTALIZING FACILITIES	☐ YES	.....
	VELOCITY MEASUREMENT	☐ YES	.....
	FLOW MEASUREMENT	☐ YES	.....
	PROTECTION CLASS	IP-67	.....
	ENCLOSURE MATERIAL	☐ SS 316	.....
	MOUNTING	SS 316 Chain or Strap	.....
	ELECTRICAL CONNECTION	☐ PLUG-IN SOCKET	.....
COMMUNICATION PORTS	RS 232 C	.....	
SOFTWARE	☐ YES	.....	
DIAGNOSTIC FEATURE	☐ YES	.....	
RECORDING /LOGGING	☐ YES	.....	
PROCESS DATA	RATE OF FLOW (T/HR)	NORMAL : 800 CuM/Hr MAXIMUM : 1040 CuM/Hr	
	UPSTREAM WORKING PRESS (Kg/cm2g)	3.3 Kg/cm2(g)	
	DESIGN PRESS (Kg/cm2g)	10.0 Kg/cm2(g)	
	NORMAL TEMP (Deg C)	33.0 Deg C	
	MAXIMUM TEMP (Deg C)	60.0 Deg C	
	PIPE LOCATION	☐ UNDERGROUND ☐ OVERGROUND	



DATA SHEET FOR ULTRASONIC FLOW METER 1X660MW BHUSAWAL STPP, UNIT-6

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PIPE LINE DATA	PIPE SIZE (OD x THK) mm	355.6 x 6.0	
	PIPE MATERIAL	CARBON STEEL AS PER IS-2062 ROLLED AND WELDED CONFIRMING TO IS:3589	
	AVAILABLE PIPE STRAIGHT LENGTH	UPSTREAM : 10D DOWNSTREAM: 5D	
SUPERVISION	SUPERVISION OF ERECTION AND COMMISSIONING	☒ YES	

NOTES: -

- 1) All Accessories required for the completeness of the system (like cable gland, Transducer cable, all mounting hardware, SS nameplate etc.) shall be provided.
- 2) Cable Gland, as applicable shall be of SS 316 and double compression type.
- 3) If required, Transmitter shall be suitably located away from the sensor for better access and visibility.
Hence minimum distance of 30 meter to be considered between sensor and transmitter.



**DATA SHEET FOR UTRASONIC FLOW METER
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DATA SHEET – A & B

**DATA SHEET – A
(TO BE FILLED BY PURCHASER)**

**DATA SHEET – B
(TO BE FILLED UP
BY BIDDER)**

GENERAL	PROJECT	1X660MW BHUSAWAL STPP, UNIT-6	.....
	TAG NO.	GAC20CF001	.....
	QUANTITY	ONE (01)	.....
	SERVICE :	RAW WTR PUMP DISCH HDR FLOW	.....
	MAKE : MODEL	Bidder to indicate	.....
TECHNICAL	TYPE	☒ TRANSIT TIME CLAMP-ON ☒ SINGLE PATH ☒ 1 SET OF SENSORS	.....
	FLOW MEASUREMENT	☒ Instantaneous Flow Rate ☒ Totalized Flow Isolated 4-20 mA DC linear output	.....
	OUTPUT	Isolated 4-20 mA DC linear output	.....
	ACCURACY	± 1%	.....
	REPEATABILITY	± 0.2% of calibration span	.....
	RANGEABILITY	400:1	.....
	RESPONSE TIME	≤ 20 msec	.....
	LOAD RESISTANCE	MIN. 500 OHM	.....
	HART COMPATIBILITY	☒ YES	.....
	CONTACT RELAY OUTPUT	2 NO + 2 NC	.....
	DISPLAY/INDICATION	Flow meter with LCD screen backlight based local display and keypad.	.....
	OPERATING VOLTAGE	☒ 230V AC	.....
	TOTALIZING FACILITIES	☒ YES	.....
	VELOCITY MEASUREMENT	☒ YES	.....
	FLOW MEASUREMENT	☒ YES	.....
	PROTECTION CLASS	IP-67	.....
	ENCLOSURE MATERIAL	☒ SS 316	.....
	MOUNTING	SS 316 Chain or Strap	.....
	ELECTRICAL CONNECTION	☒ PLUG-IN SOCKET	.....
	COMMUNICATION PORTS	RS 232 C	.....
	SOFTWARE	☒ YES	.....
	DIAGNOSTIC FEATURE	☒ YES	.....
	RECORDING /LOGGING	☒ YES	.....
PROCESS DATA	RATE OF FLOW (T/HR)	NORMAL : 2100 CuM/Hr	
		MAXIMUM : 2730 CuM/Hr	
	UPSTREAM WORKING PRESS (Kg/cm2g)	1.6 Kg/cm2(g)	
	DESIGN PRESS (Kg/cm2g)	10.0 Kg/cm2(g)	
	NORMAL TEMP (Deg C)	33.0 Deg C	
	MAXIMUM TEMP (Deg C)	60.0 Deg C	
	PIPE LOCATION	☐ UNDERGROUND ☒ OVERGROUND	



DATA SHEET FOR ULTRASONIC FLOW METER 1X660MW BHUSAWAL STPP, UNIT-6

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PIPE LINE DATA	PIPE SIZE (OD x THK) mm	610 x 6.0	
	PIPE MATERIAL	CARBON STEEL AS PER IS-2062 ROLLED AND WELDED CONFIRMING TO IS:3589	
	AVAILABLE PIPE STRAIGHT LENGTH	UPSTREAM : 10D DOWNSTREAM: 5D	
SUPERVISION	SUPERVISION OF ERECTION AND COMMISSIONING	■ YES	

NOTES: -

- 1) All Accessories required for the completeness of the system (like cable gland, Transducer cable, all mounting hardware, SS nameplate etc.) shall be provided.
- 2) Cable Gland, as applicable shall be of SS 316 and double compression type.
- 3) If required, Transmitter shall be suitably located away from the sensor for better access and visibility.
Hence minimum distance of 30 meter to be considered between sensor and transmitter.



**DATA SHEET FOR UTRASONIC FLOW METER
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DATA SHEET – A & B

**DATA SHEET – A
(TO BE FILLED BY PURCHASER)**

**DATA SHEET – B
(TO BE FILLED UP
BY BIDDER)**

GENERAL	PROJECT	1X660MW BHUSAWAL STPP, UNIT-6	.....
	TAG NO.	PAB10CF001	.....
	QUANTITY	ONE (01)	.....
	SERVICE :	CW PUMP DISCH HDR FLOW	.....
	MAKE : MODEL	Bidder to indicate	.....
TECHNICAL	TYPE	☒ TRANSIT TIME CLAMP-ON ☒ SINGLE PATH ☒ 1 SET OF SENSORS	.....
	FLOW MEASUREMENT	☒ Instantaneous Flow Rate ☒ Totalized Flow Isolated 4-20 mA DC linear output	.....
	OUTPUT	Isolated 4-20 mA DC linear output	.....
	ACCURACY	± 1%	.....
	REPEATABILITY	± 0.2% of calibration span	.....
	RANGEABILITY	400:1	.....
	RESPONSE TIME	≤ 20 msec	.....
	LOAD RESISTANCE	MIN. 500 OHM	.....
	HART COMPATIBILITY	☒ YES	.....
	CONTACT RELAY OUTPUT	2 NO + 2 NC	.....
	DISPLAY/INDICATION	Flow meter with LCD screen backlight based local display and keypad.	.....
	OPERATING VOLTAGE	☒ 230V AC	.....
	TOTALIZING FACILITIES	☒ YES	.....
	VELOCITY MEASUREMENT	☒ YES	.....
	FLOW MEASUREMENT	☒ YES	.....
	PROTECTION CLASS	IP-67	.....
	ENCLOSURE MATERIAL	☒ SS 316	.....
	MOUNTING	SS 316 Chain or Strap	.....
	ELECTRICAL CONNECTION	☒ PLUG-IN SOCKET	.....
	COMMUNICATION PORTS	RS 232 C	.....
	SOFTWARE	☒ YES	.....
	DIAGNOSTIC FEATURE	☒ YES	.....
	RECORDING /LOGGING	☒ YES	.....
PROCESS DATA	RATE OF FLOW (T/HR)	NORMAL : 68780 CuM/Hr	
	UPSTREAM WORKING PRESS (Kg/cm2g)	MAXIMUM : 89414 CuM/Hr	
	DESIGN PRESS (Kg/cm2g)	2.5 Kg/cm2(g)	
	NORMAL TEMP (Deg C)	5.0 Kg/cm2(g)	
	MAXIMUM TEMP (Deg C)	32.0 Deg C	
	PIPE LOCATION	60.0 Deg C	
		☒ UNDERGROUND ☐ OVERGROUND	



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PIPE LINE DATA	PIPE SIZE (OD x THK) mm	3240 x 20	
	PIPE MATERIAL	CARBON STEEL AS PER IS-2062 ROLLED AND WELDED CONFIRMING TO IS:3589	
	AVAILABLE PIPE STRAIGHT LENGTH	UPSTREAM : 10D DOWNSTREAM: 5D	
SUPERVISION	SUPERVISION OF ERECTION AND COMMISSIONING	☒ YES	

NOTES: -

- 1) All Accessories required for the completeness of the system (like cable gland, Transducer cable, all mounting hardware, SS nameplate etc.) shall be provided.
- 2) Cable Gland, as applicable shall be of SS 316 and double compression type.
- 3) If required, Transmitter shall be suitably located away from the sensor for better access and visibility.
Hence minimum distance of 30 meter to be considered between sensor and transmitter.



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QUALITY PLAN

 QUALITY PLAN FOR ULTRASONIC FLOWMETER		QUALITY PLAN NO.: PE-QP-415-145-I011										
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		SHEET 8		OF 8								
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	

1	Standard Certificates	Certificate of Compliance, Warranty Certificate,	Major	Visual	As applicable	Technical documents/Approved documents	Technical catalogue/Approved documents	Technical catalogue/Approved documents	2/3	---	2, 1	
2	Visual Check	Mechanical	Major	Visual	100%	Technical catalogue/Approved documents	Technical catalogue/Approved documents	Technical catalogue/Approved documents	2/3	1	1	
3	Functional test & power ON	Electrical	Major	Visual	100%	Functional test report for meter & transducer	Approved documents	Technical catalogue/Approved documents	2/3	-	1	
4	HART Communication	Electrical	Major	---	100%	Technical catalogue/Approved documents	Technical catalogue/Approved documents	Technical catalogue/Approved documents	-	-	1	

NOTE:

1. Type test certificates/Type test reports for "Accuracy" and "Protection class" shall also be verified by BHEL.

LEGEND:	^s P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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BOQ

BOQ FOR ULTRASONIC FLOW METER FOR 1X660 MW BHUSAWAL STPP

SL NO	TAG NO.	SERVICE	ASSEMBLY TYPE	UNIT	TOTAL QTY (FOR STATION)
1	2	3	4	5	6
A	Ultrasonic flow meter Assemblies complete with cable gland, transducer cable, all mounting hardware, SS name plate, SS chain etc.				
1	GAC10CF001	ASH WTR PUMP DISCH HDR FLOW	UFM	NO.	1
2	GAC20CF001	RAW WTR PUMP DISCH HDR FLOW	UFM	NO.	1
3	PAB10CF001	CW PUMP DISCH HDR FLOW	UFM	NO.	1
	TOTAL QTY OF A i.e. (1 to 3)				3
B	Cost of service				
1	-----	Mandays for supervision of E&C	SUPV.OF E&C	Man days	6
	TOTAL QTY OF B				6

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SECTION – D

EQUIPMENT SPECIFICATION



TECHNICAL SPECIFICATION FOR ULTRASONIC FLOW METER

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SHEET 1 OF 4

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Ultrasonic Flow Meter for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

- 2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.
- 2.2 The Ultrasonic Flow Meters shall be of proven reliability, accuracy and repeatability requiring a minimum of maintenance. The Design and Materials used for the components shall also comply with the relevant National and International standards.

3.0 TECHNICAL REQUIREMENT

The Ultrasonic Flow Meters and the accessories shall be suitable for continuous operation under an ambient temperature of 0-60°C and Relative Humidity of 0-95% unless specified otherwise in volume IIB Section-B or Section-C though not specifically asked for.

All accessories required for mounting/erection of these instruments shall be furnished as necessary for completeness of the system though not specifically asked for. Also the equipment shall include necessary cables, flexible conduits, junction boxes required for the purpose.

Flow meters shall be provided with suitable environment protection devices/structures such that they shall be suitable for continuous operation in the operating environment of a coal fired utility station without any loss of function or departure from the specifications requirements.

3.1 Flow measurement

The Ultrasonic Flow Transmitter shall be based on transit-time flow measurement technique uses a pair of transducers with each transducer sending and receiving coded ultrasonic signals through the fluid. When the fluid is flowing, signal transit-time in the downstream direction is shorter than in the upstream direction; the difference between these transit times is proportional to the flow velocity. The Ultrasonic Flow Transmitter measures this time difference and uses programmed pipe parameters to determine flow rate and direction. Clamp-on transducers are clamped onto the outside of the pipe and never come into contact with the process fluid. HART Compatibility for the transmitter shall be provided.

3.2 Accessories:

All mounting hardware like clamping fixtures, mechanism to remove the sensors on line, interconnecting cables etc is required to be supplied. Weather canopy for protection from direct sunlight and direct rain shall also be offered as an option. Material of all fittings shall be SS-316.

4.0 GUARANTEE AND PERFORMANCE

The guarantee of flow measuring assembly shall be 18 months from the date of dispatch or 12 months from commissioning whichever is earlier.



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5.0 TEST & INSPECTION

- 5.1 The bidder shall adopt suitable quality assurance plan to ensure that the equipments offered will meet the specification requirements in full.
- 5.2 The Quality Plan shall be discussed and finalized with the technically accepted bidders before opening the price bid. The stages where the purchaser would like to be associated for witnessing or verification would be indicated by the purchaser in the Quality Plan before approval. The quality plan forming part of this specification shall be the minimum requirements for the vendor's quality plan to be submitted with the offer. The vendor shall give at least 15 days written notice to purchaser for witnessing the tests/inspection at various stages. The expenses for all such tests/inspection shall be to manufacturer's account except for the expenses of purchaser's representatives witnessing the tests. The purchaser shall attend such tests/inspection within 15 days failing which the manufacturer may proceed with the tests which shall be deemed to have been made in purchaser's presence and shall furnish relevant test certificates to the purchaser.
- 5.3 Inspection will be conducted by BHEL and/or their authorized representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorized representatives or in independent Test House/Laboratory approved by BHEL.

6.0 SPARES AND CONSUMABLES

- 6.1 Commissioning Spares and consumables
- As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up,
- 6.2 Recommended Spares
- The bidder shall furnish a list of Recommended Spares along with the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation along with unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.
- 6.3 Special Tools & Tackles
- The bidder shall furnish a list of Special Tools & Tackles included in the bid.

7.0 DRAWINGS & DOCUMENTS

- 7.1 The offer shall include the following in 4 copies each along with 2 CDs after award of contract for owner approval:
- i. Technical data sheet for each UFM & accessories in the pro forma enclosed under Data Sheet-B.
 - ii. Assembly drawing of each type of flow UFM complete with all accessories indicating detailed dimensions, B.O.M. and weights.
 - iii. Installation drawings for the flow elements.
 - iv. Quality Plan duly signed and stamped.



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v. Calculation Sheet.

7.2 For Information

- i. Storage and Commissioning Instruction
- ii. All relevant catalogues for the models of the UFM as well as accessories finalized.
- iii. O&M manuals

7.3 Final documentation for a project specific contract:

Final documentation shall contain 10 sets with 2 CDROMS of each of the following:

- i. Verified test certificates.
- ii. Approved Quality Plan
- iii. Calibrations Reports
- iv. Quality Inspection Report
- v. Operation & Maintenance Manuals for Flow Element Assemblies and all the accessories (Containing storage & commissioning instructions).

8.0 PACKING & MARKING

8.1 Each item shall be properly packed with adequate protection against friction, stresses, vibration & shock during transportation. Each packing box shall have marking as per Purchase Order.

8.2 Each assembly shall be identified with the following information.

- Tag No.
- Service.
- Line size & thickness.
- Direction of flow.

9.0 APPLICABLE DATA SHEETS

This document shall be read in conjunction with Data Sheet - A & B.