

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

DATA SHEET A – MOTORS



TITLE

LV MOTORS DATA SHEET-A

1X660 MW BHUSAWAL TPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 23.07.2019

SHEET 1 OF 1

- | | | | |
|------|---|---|---|
| 1.0 | Design ambient temperature | : | 50 °C |
| 2.0 | Maximum acceptable kW rating of LV motor | : | 160KW |
| 3.0 | Installation (Indoors/ Outdoors) | : | As required |
| 4.0 | Details of supply system | | |
| a) | Rated voltage (with variation) | : | 415V $\pm$ 10% |
| b) | Rated frequency (with variation) | : | 50 Hz (+5% and -5%) |
| c) | Combined voltage & freq. variation | : | 10% (sum of absolute values) |
| d) | System fault level at rated voltage | : | 50 kA for 1 sec |
| e) | Short time rating for terminal boxes | | |
| | o 90 kW and upto 160kW (Breaker controlled) | : | 50 KA for 1 sec. |
| | o Below 90 kW (SFU + Contactor controlled) | : | 50 KA protected by fuse for 0.2 sec |
| f) | LV System grounding | : | Effectively grounded |
| 5.0 | Class of insulation | : | Class 'F', with temp rise limited to class B. |
| 6.0 | Minimum voltage for starting (As percentage of rated voltage) | : | 80% of rated voltage |
| 7.0 | Power cables data | : | Shall be given during Detailed engg |
| 8.0 | Earth Conductor Size & Material | : | Shall be given during Detailed engg |
| 9.0 | Space heater supply | : | 240 V, 1 ϕ , 50 Hz |
| 10.0 | Rating up to which Single phase motor | : | Acceptable below 0.20 kW |
| 11.0 | Additional tests | : | As per QP and customer motor spec |
| 12.0 | Flame-proof motor | | |
| a) | Enclosure suitable (As per IS:2148) | : | As per requirement |
| b) | Classification of Hazardous area (As per IS: 5572 part-I) | : | As per requirement |
| 13.0 | Makes | : | As per ANNEXURE-I |
| 14.0 | Paint shade | : | RAL 7032 |
| 15.0 | Degree of Protection of enclosure (motors): | | INDOOR IP-55
OUTDOOR IPW-55 |
| 16.0 | Energy efficiency | : | IE3 as per IS:12615: 2011 |

❖ **Also detail Customer spec. for Motors to be referred as enclosed with spec.**

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DATA SHEET C– MOTORS

	TITLE MOTOR DATA SHEET - C	SPECIFICATION NO.	
		VOLUME	II B
		SECTION D	
		REV NO. 00 I	
		SHEET	1 OF 7

LT MOTORS

A. GENERAL

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6.

(a) Whether motor is flame proof

(b) If yes, the gas group to which it conforms as per IS:2148

Yes/No
7. Type of mounting
8. Direction of rotation as viewed from DE END__
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

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- a.

Voltage (Volts)
- b.

Frequency (Hz)
- c.

Combined voltage and frequency
14.

Rated speed at rated voltage and frequency(RPM)
15.

At rated Voltage and frequency:

a.

Full load current

b.

No load current
16.

Power Factor at

a.

100% load

b.

NO load

c.

Starting.
17.

Efficiency at rated voltage and frequency,

a.

100% load

b.

75% load

c.

50% load
18.

Starting current (amps) at

a.

100 % voltage

b.

85% voltage

c.

80% voltage
19.

Minimum permissible starting Voltage (Volts)
20.

Starting time with minimum permissible voltage

a.

Without driven equipment coupled

b.

With driven equipment coupled

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21.

Safe stall time with 100% and 110% of rated voltage

a. From hot condition

b. From cold condition
22.

Torques :

a. Starting torque at min. permissible voltage(kg-mtr.)

b. Pull up torque at rated voltage.

c. Pull out torque

d. Min accelerating torque (kg.m) available

e. Rated torque (kg.m)
23.

Stator winding resistance per phase (ohms at 20 Deg.C.)
24.

GD² value of motors
25.

No of permissible successive starts when motor is in hot condition
26.

Locked Rotor KVA Input
27.

Locked Rotor KVA/KW
28.

Vibration limit :Velocity (mm/s)
29.

Noise level limit (dBA)

C. CONSTRUCTIONAL

FEATURES

1.

Stator winding insulation

a. Class & Type

b. Winding Insulation Process

c. Tropicalised (Yes/No)

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- d. Temperature rise over specified maximum ambient temperature of 50 deg C
- e. Method of temperature measurement
- f. Stator winding connection

2. Main Terminal Box

- a. Type
- b. Location (viewed from NDE side)
- c. Entry of cables(bottom/side)
- d. Recommended cable size (To be matched with cable size envisaged by owner)
- e. Fault level (MVA), Fault level duration (sec)
- f. Cable glands & lugs details (shall be suitable for power cable)

3. Type of DE/NDE Bearing

4. Motor Paint shade

5. Weight of

- a. Motor stator (KG)
- b. Motor Rotor (KG)
- c. Total weight (KG)

D. List of accessories.

- 1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)
- 2. Terminal Box for Space Heater (Yes/No)
- 3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch

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4. Insulation of bearing (Yes/No)
5. Noise reducer(Yes/No)
6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box
7. Vibration pads

i) Nos and size

ii) Location
8. Any other fitments

E. **List of curves.**

1. Torque speed characteristic of the motor
2. Thermal withstand characteristic
3. Starting. current Vs. Time
4. Starting. current Vs speed
5. P.F. and Effi. Vs Load

F. **Additional Data to be filled for each rating of DC Motor**

1. Rated armature voltage (Volt)
2. Rated field excitation (Amp)
3. Permissible % variation in voltage
4. Minimum Permissible Starting voltage (volt)
5. At rated voltage

i) Full load Armature current.(Amp)

ii) Full load Field current (Amp)

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- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Aramature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
 - i) Maximum permissible voltage
 - ii) Rated voltage
 - iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
 - i) Armature winding (Arm + IP + Series) at 25 deg.C
 - ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
 - i) Armature winding
 - ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
 - i) 220 V DC
 - ii) 250 V DC
 - iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

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16. Starter resistance design calculation
17. Electrical connection diagram of motor

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QUALITY PLAN (MOTOR)

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				SHEET 1 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		TITLE QUALITY PLAN		SPECIFICATION : TITLE :				
				SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

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CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) **SYSTEM VOLTAGE CODES:**

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) **CABLE VOLTAGE CODES:**

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

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SECTION-D3
(GENERAL TECHNICAL REQUIREMENT FOR C&I)

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
GENERAL REQUIREMENT 1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems. 2.0. The quantity of instruments for auxiliary system shall be as per tender P & ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication. 3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering. 4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes. 5.0 In case of any contradiction most stringent clause/condition shall prevail.		

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FIELD INSTRUMENT DATA

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

<u>SR. NO.</u>	<u>DESCRIPTION</u>	<u>UNITS</u>	
	(i) Level Gauge		(Level gauge)
	a. Number		One (1)
	b. Type		SS Tube Magnetically coupled. Each gauge not more than 1200mm. Multiple gauges with 300 mm overlap.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	ITEM	DESCRIPTION
1.0	<u>FIELD INSTRUMENTS</u>	
	This section provides general hardware guidelines for field instruments and equipment to be supplied under this specification.	
1.1	<u>PRESSURE TRANSMITTER</u>	
1.1.1	Working Principle	SMART, HART Protocol.
1.1.2	Type	2 – Wire.
1.1.3	Output Signal	4-20 mA DC.
1.1.4	Signal Processing	Silicon solid state electronic circuitry.
1.1.5	Measuring Element	Capsule/Diaphragm.
1.1.6	Element material	AISI-316 (Stainless Steel) or better.
1.1.7	Static Pressure	150 % of maximum span continuously, without affecting the calibration.
1.1.8	Turn-down ratio	100:1
1.1.9	Span and Zero	Locally adjustable non-interacting. Facility for elevation and suppression by 100% of span.
1.1.10	Enclosure Class	IP-65.
1.1.11	Output Indicator	LCD Type.
1.1.12	Nameplate	Tag number, service engraved in SS tag plate.
1.1.13	Body	Forged Carbon Steel for air and flue gas application and SS for other

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
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MAHARASHTRA, INDIA.**

SR. NO.	ITEM	DESCRIPTION
		application.
1.1.14	Operating Voltage	16 - 48 Volts D.C.
1.1.15	Load	600 Ohms (min.) at 24 Volts D.C.
1.1.16	Ambient Temperature	0 - 50 °C.
1.1.17	Performance :	
	(a) Accuracy	± 0.1% of Span or better.
	(b) Repeatability	± 0.05% of Span or better.
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)
1.1.18	Sealing/Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.
1.1.19	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.
		(b) High tensile carbon steel U- bolts.
		(c) Siphon for steam and hot water services.
		(d) ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	ITEM	DESCRIPTION
		(e) Companion flange with nuts, bolts and gaskets.
		(f) Hand held configuration kit for calibration of SMART Transmitter.
		(g) ½" NPT cable gland.
1.2	<u>DIFFERENTIAL PRESSURE TRANSMITTER/FLOW TRANSMITTER</u>	
1.2.1	Working Principle	SMART, HART Protocol.
1.2.2	Type	2-Wire.
1.2.3	Output signal	4-20 mA DC.
1.2.4	Signal Processing Unit	Silicon solid-state electronic circuitry.
1.2.5	Measuring element	Capsule/Diaphragm.
1.2.6	Element material	AISI-316 (Stainless Steel) or better.
1.2.7	Static Pressure/Overload Pressure	Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy.
1.2.8	Turn-down ratio	100 : 1 minimum.
1.2.9	Span and Zero	Locally adjustable, non-interacting.
1.2.10	Enclosure class	IP-65.
1.2.11	Zero suppression/elevation	At least 100% of Span.
1.2.12	Output Indicator	LCD Type.
1.2.13	Nameplate	Tag number and Service engraved in SS tag plate.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	ITEM	DESCRIPTION
1.2.14	Body	Forged Carbon Steel for air and flue gas application and SS for other application.
1.2.15	Ambient temperature	0 - 50 °C.
1.2.16	Operating Voltage	16 - 48 Volts DC.
1.2.17	Load	600 Ohms (min.) at 24 Volts DC.
1.2.18	Performance:	
	(a) Accuracy	±0.1 % of span or better.
	(b) Repeatability	± 0.05 % of span or better.
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)
1.2.19	Sealing / Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.
1.2.20	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.
		(b) High tensile carbon steel U-bolts.
		(c) Siphon for steam and hot water services.
		(d) Companion flange with nuts, bolts and gaskets.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	ITEM	DESCRIPTION
		(e) Hand held configurator kit for calibration of SMART Transmitter
		(f) ½" NPT cable gland.
		(g) ½" NPT generally 5-valve stainless steel manifold, constructed from SS316 bar stock. 3 valve manifold for DP application in flue gas and air.
1.3	<u>DISPLACER TYPE LEVEL TRANSMITTERS</u>	
1.3.1	Type	SMART, HART Protocol.
1.3.2	Stages of operation	Continuous.
1.3.3	Material -	
(a)	Displacer	AISI 316 SS.
(b)	Suspension wire	AISI 316 SS.
(c)	Torque tube housing	Carbon steel or SS as per application.
(d)	Torque tube	Inconel.
(e)	Displacer chamber	CS or SS as per process application.
(f)	Transmitter Housing	Die cast Aluminium or better.
1.3.4	Operating Voltage	16-48 Volts D.C.
1.3.5	Transmission	2-wire.
1.3.6	Output Signal	4-20 mA DC.
1.3.7	Signal processing	Solid-state electronic circuitry.

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SR. NO.	ITEM	DESCRIPTION
1.3.8	Static / overload pressure	Maximum static pressure without permanent deformation or loss of accuracy.
1.3.9	Turn-down ratio	10 : 1 or better.
1.3.10	Zero & Span	Easily accessible (local zero & span adjustment and non-interactive type).
1.3.11	Enclosure Class	IP-65.
1.3.12	Output Indicator	LCD type.
1.3.13	Nameplate	Tag number and Service engraved in stainless steel tag plate.
1.3.14	Ambient Temperature	0 - 50°C.
1.3.15	Load Impedance	600 Ohms at 24 Volts (minimum).
1.3.16	Process Connection	2" Companion flange with nuts, bolts and gaskets.
1.3.17	Performance -	
	(a) Accuracy	±0.5 % of span or better.
	(b) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)
1.3.18	Accessories	(a) Counter Flange, nuts, bolts, gaskets etc.

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SR. NO.	ITEM	DESCRIPTION
		(b) Weights for 5 point calibration of instruments.
		(c) Vent and drain plugs.
		(d) Special calibration tool / configuration, if any.
		(e) ½"NPT cable gland.
1.3.19	Preferred Features	(a) Test plug connection and cutout terminals physically separated from other electronics.
		(b) Electronic Damping facility (adjustable).
1.4	<u>MASS FLOW METER</u>	
1.4.1	Sensor	
1.4.1.1	Measuring Principle	Coriolis Mass flow.
1.4.1.2	Primary Element	Flow Tube of 316SS or better.
1.4.1.3	Heating Arrangement	Integral.
1.4.1.4	Temperature Control	For heavy fuel oil application.
1.4.1.5	Process Connection	Flanged of rating as per process requirement.
1.4.1.6	Drain	Self draining facility.
1.4.1.7	Enclosure	Stainless steel.
1.4.1.8	Accessories	Counter flanges, Mounting nuts, bolts, gaskets etc.
1.4.2	Transmitter	

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SR. NO.	ITEM	DESCRIPTION
		engineering units or 0-100%
1.6.10	Output	2 off isolated 4 20mA DC output
1.6.11	Load	< 750 ohms.
1.6.12	Power supply	240V AC, 50 Hz.
1.6.13	Turn Down	100:1.
1.6.14	Accuracy	± 0.2 % of measured value.
1.6.15	Enclosure	NEMA4X (IP67) aluminum, Epoxy coated
1.6.16	Nameplate	Tag number, service engraved in stainless steel tag plate.
	Notes:	
1.	The above on line flow meter shall not create any obstruction on flow.	
2.	Users' list shall be submitted to support on proven satisfactory performance for similar process applications.	
1.7	<u>PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE</u>	
1.7.1	Type	Bourdon / Bellows / Diaphragm.
1.7.2	Sensing & Socket	AISI-316 SS.
1.7.3	Movement Material	AISI-304 SS.
1.7.4	Case Material	Stainless steel, IP-65.
1.7.5	Dial Size	Generally 150 mm.
1.7.6	Scale	Black lettering on white in 270 ° arc.

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SR. NO.	ITEM	DESCRIPTION
1.7.7	Window	Shatterproof glass.
1.7.8	Range Selection	Normal process pressure: 50~70% of range.
1.7.9	Over-range Protection	125% of maximum range by internal stop. External stop at zero.
1.7.10	Adjustment	Micrometer screw for zero. Internal micrometer screw for range.
1.7.11	Element Connection	Argon welding.
1.7.12	Process Connection	1/2" NPT(M) Bottom for local, back for panel mounting.
1.7.13	Performance	Accuracy of ± 1.0 % of span or better.
1.7.14	Operating ambient	0 - 50 °C.
1.7.15	Safety Feature	Blow out disc /diaphragm at the back.
1.7.16	Accessories	(a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.
		(b) Stainless steel Diaphragm seals for viscous fluids
		(c) 3-Way SS316 Gauge cock for pressure gauges.
		(d) 5-valve SS316 manifold from barstock for differential pressure gauge.
		(e) Siphons for steam and hot water services.

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SR. NO.	ITEM	DESCRIPTION
		(b) Compression fittings / unions.
		(e) Flanges etc. (for flanged connections only)
		(d) Forged / barstock Thermowell as per ASME PTC code. Process connection M33 x 2 (M). Material of construction of Thermowell: SS 316: In general. Inconel: For flue gas application. Tungsten carbide: For coal mill application.
1.10.11	Name plate	Tag number, service engraved in stainless steel tag plate
1.11	<u>PRESSURE SWITCH</u>	
1.11.1	Type	(a) Piston for high pressure application.
		(b) Bellow / Diaphragm for low pressure application.
1.11.2	Sensing element material	AISI SS-316. All other wetted part SS316.
1.11.3	Case Material	Die-cast aluminium alloy, neoprene gasket.
1.11.4	Setter Scale	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points.

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SR. NO.	ITEM	DESCRIPTION
1.11.5	Over range	150 % of maximum pressure.
1.11.6	Adjustments	(a) Internal Set Point.
		(b) Differential adjustment.
1.11.7	End Connection	½" NPT (M) bottom connected.
1.11.8	Switch configuration	Two SPDT.
1.11.9	Switch Rating	240V, 5A AC / 220V, 0.5A DC.
1.11.10	Switch Type	Snap acting, hermetically sealed, shock & vibration proof.
1.11.11	Terminal Block	Suitable for full ring lugs.
1.11.12	Cable connection	½" NPT conduit connection.
1.11.13	Enclosure Class	IP-65.
1.11.14	Performance	(a) Repeat accuracy $\pm 1.0\%$.
		(b) Accuracy of Setting Indication of $\pm 1.5\%$.
1.11.15	Ambient temperature	0 – 50 Deg C.
1.11.16	Nameplate	Tag number, service engraved in SS tag plate.
1.11.17	Accessories	(a) Remote diaphragm seal with SS-316 capillary for viscous & corrosive application.
		(b) Siphons for steam and hot water services.
		(c) Retention ring and screws for surface mounting.

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SR. NO.	ITEM	DESCRIPTION
		(d) 1/2" NPT 2 Valve SS-316 barstock manifold.
		(e) 1/2" NPT cable gland.
1.12	<u>DIFFERENTIAL PRESSURE SWITCH</u>	
1.12.1	Type	Bellows/Diaphragm/Piston actuated.
1.12.2	Sensing element material	AISI SS-316. For all other wetted part SS 316.
1.12.3	Case Material	Die-cast aluminium alloy with neoprene gasket.
1.12.4	Setter Scale	Black graduation on white scale with 0-100% graduation and provided with red pointer for set point adjustment.
1.12.5	Over range	Static pressure on any one side, the other side being open to atmosphere.
1.12.6	Adjustments	(a) Internal set point adjustment.
		(b) Differential adjustment.
1.12.7	Process Connection	1/2" NPT (M) bottom / back connected.
1.12.8	Switch configuration	Two SPDT.
1.12.9	Switch rating	240V, 5A AC/220V, 0.5A DC.
1.12.10	Switch type	Snap acting type contacts, shock and vibration proof.
1.12.11	Terminal Blocks	Suitable for full ring lugs for cable

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SR. NO.	ITEM	DESCRIPTION
		connection.
1.12.12	Cable Connection	½" NPT conduit connection or compression gland.
1.12.13	Performance	(a) Repeat accuracy $\pm 1.0\%$.
		(b) Accuracy of set point Indication: $\pm 1.5\%$
1.12.14	Operating Ambient	0 - 50 °C (Maximum Continuous).
1.12.15	Enclosure	IP-65.
1.12.16	Accessories	(a) Snubbers for pulsating fluid application.
		(b) Syphons for steam and hot water services.
		(c) Retention ring and screws for surface mounting.
		(d) 1/2" NPT 3-Valve SS-316 manifold constructed from barstock.
		(e) 1/2" NPT Cable gland.
1.12.17	Nameplate	Tag number, service engraved in stainless steel tag plate.
1.12.18	Remote Seal type for special application	(a) Silicone oil/fluorolube filled remote diaphragm seal for dirty/viscous/corrosive fluid.
		(b) SS armoured capillary at least 3 meters each.

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SR. NO.	ITEM	DESCRIPTION
		(c) Adapter flanges with nuts, bolts and gaskets for instrument and process side.
1.13	<u>LEVEL SWITCH</u>	
1.13.1	Type	External cage float operated. Magnetically coupled.
1.13.2	Float Material	AISI-316 stainless steel or better.
1.13.3	Other wetted parts	AISI-316 stainless steel or better.
1.13.4	External Cage	Carbon steel/Stainless steel as per process requirements, welded type/ flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.
1.13.5	External cage mounting	Side-Side.
1.13.6	External cage connection	25 NB socket welded.
1.13.7	Switch housing	Epoxy coated die-cast aluminium alloy with neoprene gasket conforming to IP-65.
1.13.8	Type of switch configuration	2 SPDT (two nos.).
1.13.9	Contact rating	5A, 240V/AC, 0.25A, 220V DC.
1.13.10	Accessories	(a) Counter flange, nuts & bolts, suitable gasket etc.
		(b) Steel globe type drain valve.
		(c) ½"NPT cable gland.
		(d) Stainless steel nameplate with

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SR. NO.	ITEM	DESCRIPTION
		alpha-numeric engraved for service and tag.
1.13.11	Preferred feature	Switch operating point marked on cage.
1.13.12	Mounting	On standpipe.
1.14	<u>CONDUCTIVITY TYPE LEVEL SWITCH</u>	
1.14.1	Type	Conductivity discrimination.
1.14.2	Application	Drain pots viz. on CRH line.
1.14.3	Mounting	Flanged – on external cage.
1.14.4	Probe MOC	Stainless steel with high purity ceramic.
1.14.5	Probe rating	> Maximum design pressure of vessel.
1.14.6	Input	Four independent channel with selectable switching threshold for water conductivity.
1.14.7	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
1.14.8	Contact type & rating	2 SPDT or 1 DPDT @ 5A 30V DC.
1.14.9	Local Display	Coloured LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault.
1.14.10	Power supply	Dual 240V AC, 50 Hz, 1Ph.
1.14.11	Enclosure	IP-65, corrosion resistant & wall mounting type (Explosion proof for NEC Class-1, Division-1 area).

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SR. NO.	ITEM	DESCRIPTION
1.14.12	Accessories	(a) PTFE cable from probe to electronics.
		(b) Mounting accessories.
		(c) External cage.
		(d) Washer & gasket.
1.14.13	Test pressure	(e) Two times rated pressure.
1.14.14	Cable connection	(f) ½" NPT with cable gland.
1.15	<u>CONDUCTIVITY TYPE</u> <u>ELECTRONIC LEVEL</u> <u>INDICATOR</u>	
1.15.1	Type	Conductivity discrimination.
1.15.2	Application	HP heater level.
1.15.3	No. of Probes	10
1.15.4	Probe Mounting	Flanged – on standpipe.
1.15.5	Probe MOC	Stainless steel with high purity ceramic.
1.15.6	Probe rating	> Maximum design pressure of vessel.
1.15.7	Input	Independent channel with selectable switching threshold for water conductivity.
1.15.8	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
1.15.9	Contact type & rating	2 SPDT or 1 DPDT @ 5A 30V DC.

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SR. NO.	ITEM	DESCRIPTION
1.15.10	Current output	Isolated 4-20 mA DC.
1.15.11	Local Display	(a) Coloured (Red & Green) LEDs for level.
		(b) Flashing LEDs for fault.
1.15.12	Remote Display	Red, Green & flashing yellow LEDs for steam, Water & Fault indication respectively.
1.15.13	Power supply	Dual 240V AC, 50 Hz, 1Ph.
1.15.14	Enclosure	(a) IP-65, corrosion resistant & wall mounting type for local electronics.
		(b) IP-42 for remote indicator.
1.15.15	Accessories	(a) PTFE cable from probe to electronics.
		(b) Mounting accessories.
		(c) Standpipe.
		(d) Washer & gaskets.
		(e) Double isolation valves on each connection, double drain valves & double vent valves with mechanical lock.
		(f) ½" NPT cable gland.
1.15.16	Test pressure	Two times design pressure.
1.16	<u>ORIFICE PLATE</u>	

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SR. NO.	ITEM	DESCRIPTION
		drawing and Flow vs. DP curve.
1.17.7	Meter run pipe	Same as pipe material.
1.17.8	Accessories	Meter run pipe, nipples and root valves (Inspection port assembly for nozzles used in plant performance purpose).
1.18	<u>GAUGE GLASS</u>	
1.18.1	Type	Reflex.
1.18.2	Glass	Toughened borosilicate Resistant to mechanical and thermal shocks.
1.18.3	Body material	Carbon steel / stainless steel - As per process requirements (Flanged Connection).
1.18.4	Pressure rating	Twice the maximum working pressure.
1.18.5	Temperature rating	As required.
1.18.6	Bolts and nuts	Rust proof alloy steel.
1.18.7	Accessories	Suitable ball check valves of SS-304 /316 body, gaskets, companion flange etc.
1.19	<u>POWER CYLINDERS (PNEUMATIC)</u>	
1.19.1	Mounting Type	(a) Fixed position mounting. (End mounting)
		(b) Trunnion mounting.
1.19.2	Control Signal	4-20 mA DC to SMART positioner with Superimposed HART protocol for

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SR. NO.	ITEM	DESCRIPTION
1.25.16	Enclosure	Flame Proof.
1.25.17	Accessories	Calibration gas, mounting accessories and others as required to be provided
1.25.18	Application	Generator Gas Purity.
1.26	<u>RADAR TYPE LEVEL MEASUREMENT</u>	
1.26.1	Type	Radar based on Time Domain Reflectometry.
1.26.2	Antenna	Co axial / single rod type guided wave or Horn type as required for the application.
1.26.3	Communication	Two wire 4-20mA DC, HART protocol.
1.26.4	Environmental temperature	0 – 50 °C.
1.26.5	Enclosure	Explosion proof/IP 65 as per application.
1.26.6	Cable Entry	½" NPT.
1.26.7	Calibration	Self calibration with internal reference.
		Zero & Span calibration.
1.26.8	Programming	Handheld programmer & Local keypad.
1.26.9	Process Connection	Flanged /screwed.
1.26.10	Electronic Housing	Epoxy painted Die-Cast aluminium alloy.

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SR. NO.	ITEM	DESCRIPTION
1.26.11	Antenna / Flange assembly	316 SS or Hestalloxy. (as required)
1.26.12	Output Indicator	Digital Integral Display.
1.26.13	Accuracy	5 mm or 0.1% of probe length.
1.26.14	Accessories	(a) Programming tool kit.
		(b) Gasket.
1.27	<u>ULTRASONIC LEVEL TRANSMITTER</u>	
1.27.1	Principle of operation	Detection of reflected ultrasonic pulse, HART Protocol
1.27.2	Measuring ranges	Up to 30 meters (typical)
1.27.3	Signal processing	Microprocessor Controlled Signal Processing
1.27.4	Operating frequency	10 KHz to 50 KHz (typical)
1.27.5	Display	Large alpha-numeric back lit LCD/ LED
1.27.6	Calibration & Configuration	Accessible from front of panel
1.27.7	Diagnosis	On-line
1.27.8	Status	For power, Hi/Lo/V. Hi/V. Lo - level indication, fault etc.
1.27.9	Construction	Plug-on board
1.27.10	Power supply	240 V AC 50 Hz / 24V DC
1.27.11	Signal Output	4-20 mA DC - 600 Ohm load.

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SR. NO.	ITEM	DESCRIPTION
1.27.12	Hysteresis	Fully adjustable preferred
1.27.13	Output contacts	2 SPDT Potential free changeover contacts @ 240V, 5A AC/220V, 0.5A DC.
1.27.14	Accuracy & Repeatability	0.25% of span or better
1.27.15	Resolution	0.1% of span
1.27.16	Operating Temperature	Transmitter- 50 °C and Sensor – 80 °C
1.27.17	MOC Sensor	Body- PVC and Face – Polyurethane
1.27.18	Humidity	1% to 95% non condensing.
1.27.19	Enclosure	IP-65 Epoxy painted die cast aluminium or Polycarbonate housing.
1.27.20	Cable connection	3/4" ET
1.27.21	Mounting	2" for sensor and Transmitter on panel.
1.27.22	Accessories	Cable gland, prefab cable, mounting accessories.
1.28	<u>CAPACITANCE TYPE LEVEL SWITCH</u>	
1.28.1	Type	Capacitance type
1.28.2	Probe	(i) Rod or suspended electrode
		(ii) Rope type probes may be used only where required probe length is greater than 3 meters.
1.28.3	Probe Mounting	Stainless steel 1½" ANSI RF Flange / ¾" NPT (M)

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SR. NO.	ITEM	DESCRIPTION
1.28.4	Material of construction	316 SS
1.28.5	Insulation	PTFE Part/ Full as per service.
1.28.6	Enclosure	Powder/Epoxy coated Die cast aluminium with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
1.28.7	Ambient temperature	0-60 °C.
1.28.8	Mounting	On Tap
1.28.9	Supply voltage	240V AC, 50Hz /24V DC
1.28.10	Relay output	2 SPDT
1.28.11	Contact rating	240V, 5A AC/220V, 0.5A DC.
1.28.12	Response time	100 mSec or better
1.28.13	Cable connection	¾" ET
1.28.14	Accessories	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.
1.29	TEMPERATURE SWITCH	
1.29.1	Type	Mercury filled in.
1.29.2	Sensing Element Material	Bellow / Bourdon AISI SS 316.
1.29.3	Bulb Material	AISI SS 316.
1.29.4	Capillary	Stainless steel armoured.
1.29.5	Movement Material	AISI SS 304.
1.29.6	Case material	Epoxy coated steel plate or die cast aluminium alloy with neoprene gasket

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SR. NO.	ITEM	DESCRIPTION
		(b) Local indication for power.
1.38	<u>SIGHT GLASS</u>	
1.38.1	Type	Flap-type.
1.38.2	End connection	Screwed / Flanged.
1.38.3	Material	
(a)	Body	CS/SS as per process medium.
(b)	Indicator	Stainless steel.
1.38.4	Sight Glass	Toughened Borosilicate.
1.38.5	Gasket	Neoprene.
1.38.6	Bolts & Nuts	High tensile steel.
1.38.7	Hydraulic Test Pressure	1.5 times maximum working pressure.
1.38.8	Accessories	As required.
1.39	<u>LEVEL GAUGE (FLOAT & TAPE)</u>	
1.39.1	Type	Float and Tape
1.39.2	Float & Tape MOC	AISI 316
1.39.3	Pulley material	Aluminium
1.39.4	Guide wire	SS 316 Stainless steel
1.39.5	Accuracy	± 2 mm
1.39.6	Indication	On circular or vertical dial
1.39.7	Rating	Twice the design pressure

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

LOCAL CONTROL PANEL AND JB DETAILS

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SR. NO.	ITEM	DESCRIPTION
	(q) Accessories	Special cables, electronics, cabinets etc. as required to make the system complete, with bar/ chain.
	(r) Range	Application dependent.
	(s) Range increment	0.1% of this selected range.
	(t) Operating temperature	0-70 °C
	(u) Accuracy	± 0.5% FS range
2.0	<u>CONTROL PANELS/DESK MOUNTED INSTRUMENTS AND ELECTRICAL SYSTEM ACCESSORIES</u>	
2.1	<u>COUPLING RELAY</u>	
2.1.1	Type	Octal base plug-in type/ DIN rail Mounting.
2.1.2	Coil voltage	24 V D.C. in general / other as required.
2.1.3	Contact	2 NO & 2 NC (Minimum).
2.1.4	Contact rating	250 V/5A (A.C)/220V/2A (D.C).
2.1.5	Operating range	70 to 110% of rated voltage.
2.1.6	Insulation	2 kV for 1 minutes between terminal & earth.
2.1.7	Mechanical life	20 million operations.
2.1.8	Coil protection	Diode.
2.1.9	Indication	Coil on LED.

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SR. NO.	ITEM	DESCRIPTION
2.1.10	Enclosure	Transparent cover.
2.1.11	Connection	Screw terminals.
2.1.12	Mounting	Projection mounting inside panel / DIN rail mounting.
2.2	<u>DISTRIBUTION BOARDS</u>	
2.2.1	Type	Fixed, Modular.
2.2.2	Power distribution	Through MCCB.
2.2.3	Enclosure	Sheet Steel, IP54.
2.2.4	Mounting	Free standing (Can be attended from both front & back).
2.3	<u>RECEIVER RECORDER</u>	
2.3.1	Type	Microprocessor Based continuous video chart type. (Paper less)
2.3.2	Display type	320 × 240 pixels high resolution coloured LCD graphics.
2.3.3	Number of pen	2/4 as applicable.
2.3.4	Input	4-20mA DC/15 Volt/ RTD/ Thermocouple.
2.3.5	Display span rate	1, 5, 10, 20, 30 and 60 min / div. Selectable.
2.3.6	Digital indication	Measured values with engineering unit.
2.3.7	Trends	Coloured display on screen.

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SR. NO.	ITEM	DESCRIPTION
		thermocouple inputs.
2.5.16	Feature	(i) Alarm level indication by flashing Cursor.
		(ii) Green Digital display of parameter value in front panel with a 3.1/2 digit display.
2.6	<u>VALVE POSITION INDICATOR</u>	
2.6.1	Input	4-20 mA DC/1-5 Volts DC.
2.6.2	Indication	Pointer and Scale. Moving Coil Meter.
2.6.3	Readable Distance	3 meters (minimum)
2.6.4	Pointer Deflection	90 Deg Sector or linear.
2.6.5	Mounting	Flush Panel (Horizontal/vertical)
2.6.6	Accuracy	±1% or better.
2.6.7	Protection Class	IP 42.
2.6.8	Operating Ambient Temp.	0-50 °C.
2.6.9	Scale	0-100%.
2.6.10	Bezel Size	DIN Standard.
2.7	<u>DIGITAL INDICATOR</u>	
2.7.1	Type	Four and half digit LED seven-segment display with sign.
2.7.2	Face Dimension	72 x 144 mm / 48 x 96 mm. (as applicable)
2.7.3	Display Character	13.8 mm, Green. (LED)

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SR. NO.	ITEM	DESCRIPTION
2.7.4	Accuracy	0.1% of reading, ± 2 digit.
2.7.5	Input	4-20Ma DC/1-5 V DC/ RTD/ Thermocouple.
2.7.6	Mounting	Flush Panel.
2.7.7	Power Supply	240V $\pm 10\%$, 50 ± 2.5 Hz.
2.7.8	Output Contact	2 nos SPDT, contact rating 5A at 240V AC/ 0.25A at 220V DC.
2.7.9	Power/Signal Connection	Screwed.
	Large Display (150x300 mm) indicators shall be provided for MW, MVAR and frequency indications.	
2.8	TOTALIZER / COUNTER	
2.8.1	Type	Electronic.
2.8.2	Number of digits and digit size	Six, 9 mm high.
2.8.3	Input	4-20mA DC.
2.8.4	Reset	Manual.
2.8.5	Readable distance	3 meters. (minimum)
2.8.6	Mounting	Flush.
2.8.7	Performance	
(a)	Accuracy	$\pm 0.5\%$ of span.
2.8.8	Operating ambient temp.	0-50°C.
2.8.9	Accessories	Engraved phenolic nameplate affixed to front flange to identify tag number and measured variable.

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SR. NO.	ITEM	DESCRIPTION
2.8.10	Preferred Features	Power supply on/failure LED visible from front.
2.9	<u>PUSH BUTTON</u>	
2.9.1	Type	Shrouded square format.
2.9.2	Face Dimension	32 x 32 mm (maximum)
2.9.3	Contact Configuration	2 NO + 2 NC.
2.9.4	Contact Addition	Add-on block up to 4 each with 2 pairs of contacts.
2.9.5	Contact Material	Hard Silver Alloy.
2.9.6	Contact Rating	500V / 10 A.
2.9.7	Utilization Category	AC11 / DC11.
2.9.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.
2.9.9	Mechanical Life	1 million operation.
2.9.10	Construction	Aluminium shrouding with plastic lens.
2.9.11	Colours	Red, Green, Yellow, Black, etc.
2.9.12	Connection	Screw terminals.
2.9.13	Enclosure Class	IP-52.
2.9.14	Legend	Engraving.
2.10	<u>ILLUMINATED PUSH BUTTON</u>	
2.10.1	Type	Square format.
2.10.2	Face Dimension	32 x 32 mm. (maximum)

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SR. NO.	ITEM	DESCRIPTION
2.10.3	Contact Configuration	2 NO + 2 NC. (minimum)
2.10.4	Contact Addition	Add-on-Block up to 4 each with 2 pairs of contacts.
2.10.5	Contact Material	Hard Silver Alloy.
2.10.6	Contact Rating	500 V/ 10A.
2.10.7	Utilization Category	A C11 / DC11.
2.10.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.
2.10.9	Mechanical Life	1 Million Operation.
2.10.10	Lamp	LED with built-in resistors as required.
2.10.11	Lamp Rating :	
(a)	Voltage	240 V AC.
(b)	Watt	2 Watt (approx.)
2.10.12	Lamp and Lens Replacement	From front.
2.10.13	Construction	Transparent Plastic Lens.
2.10.14	Colour	Red, Green, Amber, Yellow etc.
2.10.15	Connection	Screw terminals.
2.10.16	Enclosure Class	IP-52.
2.10.17	Legend	Engraving.
2.11	<u>SELECTOR SWITCH</u>	
2.11.1	Type	2/3/4 position stay put type with rotary lever actuator.

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SR. NO.	ITEM	DESCRIPTION
2.11.2	Face Dimension	32 x 32 mm. (maximum)
2.11.3	Contact Configuration	4 pair of contacts.
2.11.4	Contact Addition	Add-on-Block up to 4 each with 2 pairs of contact.
2.11.5	Contact Material	Hard silver Alloy.
2.11.6	Contact Rating	500 V/10 A.
2.11.7	Utilization Category	AC11 / DC11.
2.11.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.
2.11.9	Mechanical Life	1 million operation.
2.11.10	Construction	Aluminium shrouding.
2.11.11	Connection	Screw terminals.
2.11.12	Enclosure Class	IP-52.
2.12	<u>INDICATING LAMP</u>	
2.12.1	Type	LED with built-in resistor.
2.12.2	Face Dimension	32 x 32 mm. (maximum)
2.12.3	Voltage	240 V AC.
2.12.4	Watt	2.5 Watt (approximate).
2.12.5	Lamp and Lens Replacement	From front.
2.12.6	Construction	Transparent Plastic lens.
2.12.7	Colour	Red, Green, Amber, Yellow etc.
2.12.8	Connection	Screw terminals.

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SR. NO.	ITEM	DESCRIPTION
2.12.9	Legend	Engraving.
2.13	<u>INDICATING METERS (A.C)</u>	
2.13.1	Type	Rectifier type.
2.13.2	Face Dimension	96 x 96 mm.
2.13.3	Scale	Radial arc of 240 Deg.
2.13.4	Accuracy	1.5% of full scale. ± 0.5 Hz for frequency meter.
2.13.5	Input	0-1/0-5A for current measurement, 0-240V, 50 ± 2.5 Hz for voltage/frequency measurement.
2.13.6	Zero Adjustment	Screw on meter face.
2.13.7	Enclosure	Shielded Case.
2.13.8	Mounting	Flush Panel.
2.13.9	End Scale Suppression	6 times the measuring range only for motor ammeters.
2.14	<u>INDICATING METERS (D.C)</u>	
2.14.1	Type	Taut band moving coil.
2.14.2	Face Dimension	96 x 96 mm.
2.14.3	Scale	Radial arc of 240 Deg.
2.14.4	Accuracy	1.5% of full scale.
2.14.5	Input	0-75 mA for current measurement. Direct reading for voltage measurement.

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SR. NO.	ITEM	DESCRIPTION
2.14.6	Zero Adjustment	Screw on meter face.
2.14.7	Enclosure	Shielded case.
2.14.8	Mounting	Flush Panel.
2.14.9	End Scale Suppression	2 times the measuring range only for motor ammeters.
	For electrical system's meter and for synchronization, Bidder shall refer to electrical volume of the specification.	
2.15	<u>AUXILIARY RELAY</u>	
2.15.1	Type	Electromagnetic.
2.15.2	Coil voltage	240 V A.C / 220V DC. For any other voltage bidder to make his own arrangement.
2.15.3	Contact Configuration	2 NO & 2 NC (Minimum), additional contacts as per requirement with provision for additional contact block expansion.
2.15.4	Contact rating	250V/5A. (A.C/D.C.)
2.15.5	Operating range	80 to 110% of rated voltage.
2.15.6	Insulation	2 kV for 1 minute between terminals & earth.
2.15.7	Mechanical life	20 million operations.
2.15.8	Coil protection	Diode/surge suppressor.
2.15.9	Connection	Screw terminals.
2.15.10	Mounting	Projection mounting inside panel.

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SR. NO.	ITEM	DESCRIPTION
2.16	<u>ELECTRICAL TRANSDUCER</u>	
	Transducers shall be provided for conversion of AC electrical quantities such as voltage, frequency, current and power. Transducer shall be suitable for 220V DC auxiliary supply. Transducers shall be of low burden type having 4 – 20 mA DC linear galvanically isolated output compatible with secondary indicating instrument. Transducer shall be dual channel type. Accuracy class of Transducers shall be as per IS14570:1998 or IEC688 :992.	
2.17	<u>SYNCHROSCOPE</u>	
	Synchroscope shall be designed to provide an illuminate and indication of phase and frequency difference between bus voltage and Generator voltage. It shall denote the actual frequency difference corresponding to the inverse of time taken for one rotation of the illuminated vector spot. The instrument shall be designed for industrial applications, which require precise, reliable and robust instruments for the display range and indication. Synchroscope shall be designed as per the DIN/IEC/BS standards.	
2.18	<u>ANNUNCIATION</u>	
2.18.1	PLC based system alarm annunciation system shall be solid state/microprocessor based and shall include all required logic sequence. Display part of the system shall have panel mounted facia LED array assemblies, sets of alarm accept, reset, mute and test push buttons and panel mounted audible devices.	
2.18.2	The system shall be immune to variations in the power supply and shall not generate spurious alarm when the system power is switched on (power-on-reset)	
2.18.3	Controller of the PLC/Microprocessor based control system shall be used for configuring the alarm	
2.18.4	10% wired spare channels & facia shall be provided in all cases	

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SR. NO.	ITEM	DESCRIPTION
2.18.5	ANNUNCIATOR LOGIC	
	(a)	The circuit components for individual windows shall be mounted on plug -in circuit cards.
	(b)	Input shall be provided with contact bounce filtering. The filter shall delay contact inputs for 15 milliseconds to protect against input device bounce and electrical noise on input lines.
	(c)	Critical alarms shall be hardwired to the input card of annunciator controller.
2.18.6	<u>OTHER TECHNICAL PARTICULARS</u>	
	(a)	Type of contact NO or NC configurable
	(b)	Contact interrogation voltage 24 V DC
	(c)	Window drivers. Electronically short circuit protected, current limiting with automatic recovery
	(d)	Facia dimension 75 mm (W) X 50 mm (H)
	(e)	LED per facia 8 nos./Window
	(f)	Flash rate Adjustable (slow, fast, intermittent)
	(g)	Inscription Type Etched on photo film (sandwiched)
	(h)	Inscription letter height 5 mm (min.)
	(i)	No. of row of inscription/facia 4 (max.)
	(j)	No. of letters/row 14 (max.)

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SR. NO.	ITEM	DESCRIPTION
	(k) Colour of letters	Black (for white windows)
	(l) Facia front cover	Hi-impact polystyrene
	(m) Facia rear plate	Translucent plastic
	(n) Colour of background	Milk white and red for critical / trip.
	(o) Fascia block plate	Cold rolled sheet steel epoxy painted.
	(p) Audible alarm	Cone type speaker
	(q) Tone generator	Electronic with adjustable tone, amplitude and frequency
	(r) Preferred sequence	(i) Ordinary Channel : ISA-S-18.1-1979-R
		(ii) First-up channel : ISA-S-16.1-1979- F3M3

NOTE:

1. Instruments which are open to atmosphere should be covered with proper canopy.

3.0 ~~CONTROL VALVES, ACTUATORS & ACCESSORIES~~

~~General Technical Guidelines for the Control Valves shall be as follows :~~

- ~~(a) Bidder shall exercise caution in selecting severe service control valves like BFP recirculation valves, HP & LP bypass valves, superheater & reheater attemperator valves, PRDS valves for Boiler & Turbine, Soot blower steam pressure control valve, control valves whose down stream are connected to vacuum such as HP/LP heater emergency level control, condenser make up water control valve, separator level control and CEP minimum flow control valve. For such critical applications, Bidder shall offer valves which are proven~~

4.0 CONTROL DESK / PANELS / RACKS

- (a) Convenient and logical approach to operational interfaces and aesthetics in the overall view of the panel /desk shall be considered.
- (b) For items susceptible to vibration, suitable anti-vibration padding shall be provided to prevent damage or malfunction.
- (c) All items inside the panels/cabinets shall be neatly arranged with easy access/maintenance approach.
- (d) Incoming power supply feeders shall be duplicated . Alarm shall be provided for failure of a power supply feed.
- (e) Desk/panel shall be provided with interior illumination, utility receptacles with plug and cooling fan.
- (f) Panel/Desk shall have gland plate at cable entry to panel. Thickness of gland plate shall not be less than 3 mm.
- (g) Wire shall be routed/laid through covered trough.
- (h) Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- (i) Nameplate
 - (i) Nameplate shall be provided for instrument or device mounted on the panel.
 - (ii) Nameplates for panels shall be provided both in front and rear.
- (j) All local control panels shall be housed in air condition environment.

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4.1 CONTROL DESK

- 4.1.1 Devices mounted on the desk shall be flush type. Devices shall be so mounted that their removal and replacement can be accomplished without interruption of services to others.
- 4.1.2 Desk shall be ergonomically designed to suit working on a 24 X 7 basis. Aesthetics, ergonomics and illumination shall be considered while positioning of the desk, large video screen and panels in control room.
- 4.1.3 Control desk shall be free standing floor mounting type of table-top design with compartments for locating the hardware. Desk shall be constructed from aluminum extrusion with high pressure laminate MDF board for work surface of approved colour. Aluminium structure shall be anodized or powder coated paint finish. Thickness of sheet shall not be less than 3 mm.
- 4.1.4 Monitors with retractable keyboard, emergency push buttons shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.
- 4.1.5 Desk shall be of modular, scalable and industrially ruggedized design and shall have Telephones and Intercom connections.
- 4.1.6 Desk shall have concealed cable trays for wire dressing.
- 4.1.7 Design shall include Earthing bolts.
- 4.1.8 Back installed items shall be suitably concealed from front view.

4.2 BACK UP PANEL

- 4.2.1 Construction shall be from sheet steel of thickness not less than 3 mm.
- 4.2.2 Electrical upright Panel construction & design shall be similar to back up panel. Control switches, meters, indicators, synchronizer, excitation control switch, annunciation window etc. along with associated mimic diagram, as recommended, shall be provided for manual synchronization of generator.

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4.2.3 Cabinets/Enclosure/Panels

- | | | | |
|-----|--------------------------|---|---|
| (a) | Material of construction | : | Cold rolled steel sheet. |
| (b) | Thickness of Sheet | : | (i) 2.0 mm for faces supporting instruments / terminals. |
| (c) | Construction | : | Welded throughout as per approved National Standards. |
| (d) | Panel height | : | 2300 mm. (approx) |
| (e) | (i) Corners | : | 7 mm inner radius. |
| | (ii) Dimensional | : | a. In height & length - 3 mm. |
| | (iii) Tolerances | : | b. In height between adjacent sections - 2 mm. |
| | | : | c. Total for a group - 6 mm. |
| (f) | Doors | : | Double, recessed, turned back edges. |
| | (i) Thickness of Sheet | : | 2 mm. |
| | (ii) Hinges | : | Stainless steel. |
| | (iii) Door latches | : | Three point type. |
| | (iv) Door gaskets | : | Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure. |
| | (v) Opening of the doors | : | Outward. |
| | (vi) Louvers | : | With removable wire mesh to ensure dust and vermin proof. |
| (g) | Color of interior | : | Brilliant white. |
| (h) | Colour external | : | RAL 7032. |

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- | | | | |
|-----|----------------------|---|--|
| (i) | Painting | : | Epoxy powder coated or better. |
| (j) | Gland plates | : | Removable 3 mm thick. (bottom) |
| (k) | Cable entry | : | Bottom. |
| (l) | Hardware | : | <ul style="list-style-type: none">(i) Anti vibration pad- 15 mm.(ii) Predrilled base channel ISMC - 10 or equivalent for all sides.(iii) Stainless steel buff- finished 2 mm thick kick plate for all sides.(iv) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws.(v) Rubber strips to ensure air tightness between kick plate and finished floor.(vi) Lifting hook / Eye bolt.(vii) Drawing pocket.(viii) Door switch, lamps, thermostat, heaters and fans. |
| (m) | Enclosure Protection | : | As per environment condition of the area of installation. Refer section-1 of this vol. |

4.3 LOCAL INSTRUMENT RACKS & ENCLOSURE

4.3.1 General Requirements

- (a) Devices located in the field shall be grouped and installed in the enclosure (Closed Rack) in outdoor areas such as Boiler area etc. and in Open Type Rack in covered areas such as TG Building.

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- (b) Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.,
- (c) No more than six instruments shall be grouped in a single rack/ enclosure.
- (d) Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.
- (e) Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air/gas piping.
- (f) Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.
- (g) Instrument piping and tubing shall be hydrostatically tested at one and one-half times the maximum system pressure except for low pressure and vacuum measurement for which the test pressure will be as per piping standard.
- (h) Service air connection shall be provided for continuous and intermittent purging of impulse pipe in dusty medium. Continuous purging shall be adopted for differential pressure measurement such as flue gas and coal air mixture application. Pressure measurement shall have only intermittent purging whenever required. In case of continuous purging, an air header shall be formed which shall receive service air through isolation valve and air filter regulator. Air shall be fed from the air header to both the impulse pipes near to take off points through isolation valves and flow regulators. Air header shall be constructed from stainless steel. Impulse pipe for such applications shall have a four-way valve. One port of the valve shall have an adaptor to connect flexible stainless steel braided nylon hose to the service air. Rating of the hose shall not be less than 10 Kg/sq.cm. Four way valve shall have two position operations. One position for service and other one for purging. Required pressure gauges shall be provided for monitoring of air pressure. Complete purging arrangement shall be integral to the enclosure and racks.

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- (i) Gate or ball type (full ported) instrument isolation valve and globe type blow down drain valve adequate for duty requirement and for withstanding continuous design pressure and temperature of main process medium shall be provided in the hook up plumbing. For process pressure equal or above 40 kg/ sq.cm single instrument isolation valve and double blowdown valves shall be used before connecting to blowdown header. Whereas for line pressure less than 40 kg/sq.cm, single instrument isolation valve and single blow down valves can be used before connecting to blow down header. Instrument manifolds shall be non integral and shall be installed close to the instrument.
- (j) Drawing No. PE-189-IN-SK-8004/P0 (Sheets 10) shall be referred for typical arrangement of Local instrument enclosure and rack.

4.3.2 Closed Instrument Rack

- (a) Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load-bearing posts shall be suitably supported by gusset plates or moment members.
- (b) Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black color finish.
- (c) 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any member, which would reduce access, shall be avoided.
- (d) Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.
- (e) Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box.

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- (f) Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.
- (g) All internal wirings between the instruments and junction box shall run through flexible conduits.
- (h) Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Header shall be of 2" NB ASTM A 106, Sch-80 Gr. C installed at a slope of 1:25 and extended beyond the rack for connection to plant drain header.
- (i) Each rack shall be provided with one receptacle, light fixtures each at instrument & Junction box compartments with wire guard.

4.3.3 Open Instrument Rack

- (a) Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or falling objects and shall be epoxy painted. Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable protective grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project. Canopy shall be of CRCA steel sheet of at least 3 mm thickness. Center posts or any member, which would reduce access, shall be avoided.
- (b) 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.
- (c) All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.
- (d) All racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Header

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shall be of 2" NB ASTM A 106, Sch-80 Gr. C installed at a slope of 1:25 and extended beyond the rack for connection to plant drain header.

4.3.4 Junction Box

Junction boxes of metallic construction.

- (a) Junction box shall be provided at a dry compartment at one side of the enclosure/rack with front opening type door. Junction box shall be of sheet steel construction with thickness not less than 2 mm. Earth stud shall be furnished at rack for safety grounding.
- (b) Terminals shall be screwless cageclamp type of reputed make and 20% spare terminals shall be furnished in the junction box.

~~5.0 DISTRIBUTED CONTROL SYSTEM (DCS)~~

~~5.1 SYSTEM FUNCTIONAL DESCRIPTION~~

~~5.1.1 Integrated functionally & geographically distributed and hierarchically structured real time control (both binary and modulating), Data acquisition, Man machine interface, Historization units and Management Information System (MIS) system synthesized from one general family of identical interchangeable multifunction hardware has been envisaged.~~

~~5.1.2 System shall be highly reliable with the availability of not less than 99.7% with adequate redundancy and fault tolerant configuration.~~

~~5.1.3 The system shall be unitized and connectivity with other plant control system & Plant wide network has been envisaged.~~

~~5.1.4 Remote input output stations as a data concentrator for acquisition and monitoring of non critical parameters like Boiler metal temperature and Generator winding temperature etc, are foreseen. RIO shall be industrially ruggedized and shall be provided with integral air conditioner considering the harsh environment.~~

~~5.1.5 For Power supply to DCS system refer Volume V, Section 10.~~

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		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

CABLE BOQ

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10.0 CONTROL & INSTRUMENTATION CABLE

10.1 Cables shall be flame retardant low smoke (FRLS) type. In hazardous areas cables of suitable R/L ratio shall be provided for intrinsic safety.

10.2 Durable marking shall be provided on the surface of the cable at intervals not exceeding 5 mtrs. Marking shall include Manufacturer's name, Year of manufacture, Voltage grade, Type of cables (Conductor size & no. of pairs/ triads/type of compensating /extension cable), Insulation material, FRLS etc. Sequential length marking shall also be provided at every meter interval on outer sheath of cable.

10.3 Standard seasoned wooden drum containing minimum 500 /1000 M $\pm$ 5% length. Drum shall be anti rodent, anti termite and smooth finish. Both end of cable shall be capped by means of non hygroscopic sealing material.

10.4 THERMOCOUPLE EXTENSION & COMPENSATING CABLE

- | | | | |
|-----|----------------------|---|---|
| (a) | Conductor | : | Solid conductor. |
| (b) | Conductor size | : | 16 AWG (1.31 Sq. mm) |
| (c) | Type | : | KX (Extension) (Chromel Alumel)
RX (Compensating) (Copper-Copper alloy) JX (Extension)
(Iron Constantan). |
| (d) | Conductor Insulation | : | HR PVC Type-C (IS-5831,1984) 0.6 mm thick. |
| (e) | Operating Voltage | : | 300V /500V RMS (Core to earth / core to core). |
| (f) | Twisting | : | Pair twisted with lay of 60 mm (max) |
| (g) | Twisting Direction | : | All pairs in the same direction. Lapped to form bunch with mylar tape. |

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- | | | | |
|-----|---------------------------------|---|--|
| (h) | Screen
(Pair & Overall) | : | Aluminium mylar tape with a thickness of 28 μ m (min.) for individual pair screen and 60 μ m (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyester tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire. |
| (i) | Drain wire | : | Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands/size:- 7/0.3mm) |
| (j) | Inner Sheath | : | Extruded FRLS PVC (anti rodent, anti termite & moisture resistant properties)
HR PVC Type ST2 of IS-5831,1984
Thickness as per IS-1554Part-I 1976. |
| (k) | Rip Cord | : | Non metallic under sheath. |
| (l) | Armouring | : | GI wire/strip as per IS 3975. |
| (m) | Outer Sheath | : | Extruded FRLS PVC (anti rodent, anti termite & moisture resistant properties)
HR PVC Type ST2 of IS-5831,1984
Thickness as per IS-1554Part-I 1976. |
| (n) | Filler | : | Non hygroscopic with FRLS property. |
| (o) | Temperature Range | : | Up to 85 °C. |
| (p) | Insulation at 20 ⁰ C | : | 100 MOhms/Km [Min]. |
| (q) | Capacitance at 800 Hz | : | 120 nf/km. |

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- | | | | |
|-----|-------------------|--------|--|
| (r) | Cross talk | : | 60 dB. |
| (s) | Attenuation | : | 1.2 dB/Km |
| (t) | Codes & Standards | : | IEC 332-1.
ANSI MC 96.1.
IS-8784-1987. |
| (u) | Tests | | |
| | | (i) | Oxygen Index: Min.29 at room temp. (ASTM-D-2863) |
| | | (ii) | Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I |
| | | (iii) | Temp Index : Min 250 DEG C at 21 Oxy. Ind. (ASTM-D-2863) |
| | | (iv) | Smoke Density Rating : Max.60% (ASTM-D-2843). |
| | | (v) | Flammability Test : as per IEC 332 Part-I/IEEE-383
Swedish Chimney Test - SS-424-1475 F3. |
| | | (vi) | High voltage test
Core to core- 1.5 kV for 1 min.
Core to screen-1.0 kV for 1 min. |
| | | (vii) | Insulation Resistance 100 M Ohm/Km Min. |
| | | (viii) | Rodent & Termite repulsion test (Presence of lead shall be confirmed) |

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
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MAHARASHTRA, INDIA.**

- (v) Conductor material & sheath color for thermocouple cable as per ANSI MC 96.1.

CABLE TYPE	OVERALL SHEATH COLOR	WIRE	SHEATH COLOR	CONDUCTOR MATERIAL
KX	Yellow	Positive	Yellow	Nickel / Chromium
		Negative	Red	Nickel / Aluminum
JX	Black	Positive	White	Iron
		Negative	Red	Constantan
RX	Green	Positive	Black	Copper
		Negative	Red	Copper Nickel Alloy

- (w) Durable printed or embossed numbering at regular interval of 50mm shall be provided for identification of pairs.

10.5 INSTRUMENTATION MULTIPAIRED SIGNAL CABLE

- (a) Conductor type : Stranded (7) annealed tinned copper.
- (b) Conductor size : 0.5/1.0/1.5 Sq.mm. (as required)
- (c) Conductor resistance : 39 Ω /Km/18 Ω /Km/12 Ω /Km.
- (d) Conductor Insulation : HR PVC Type-C (IS-5831,1984) 0.6 mm thick.
- (e) Operating Voltage : 300/500V RMS. (Core to earth/core to core)
- (f) Twisting : Twin twisted with lay of 60 mm.

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1X660MW BHUSAWAL TPS-UNIT:6
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- (g) Twisting Direction : All pairs in the same direction. Lapped to form bunch with mylar tape.
- (h) Screen (Pair & Overall) : Aluminium mylar tape with a thickness of 28 μm (min.) for individual pair screen and 60 μm (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyester tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire.
- (i) Analog signals- Individual pair & overall shield to be considered.
- (ii) Binary signals- overall shield to be considered.
- (i) Drain wire : Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm)
- (j) Inner Sheath : Extruded FRLS PVC (anti rodent, anti termite & moisture resistant properties)
- HR PVC Type ST2 of IS-5831,1984
- Thickness as per IS-1554, Part-I 1976
- (k) Rip Cord : Non metallic under sheath.
- (l) Armouring : GI wire/strip as per IS 3975
- (m) Outer Sheath : Extruded FRLS PVC (anti rodent, anti termite & moisture resistant properties).

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

HR PVC Type ST2 of IS-5831,1984.

Thickness as per IS-1554, Part-I 1976.

- | | | | |
|-----|------------------------|---|--|
| (n) | Filler | : | Non hygroscopic with FRLS property. |
| (o) | Temperature Range | : | 85 °C. |
| (p) | Insulation at 20 Deg.C | : | 100 MOhms/Km [Min] |
| (q) | Capacitance at 800 Hz | : | 120 nf/km |
| (r) | Cross talk | : | 60 dB. |
| (s) | Attenuation | : | 1.2 dB/Km. |
| (t) | Codes & Standards | : | (i) IPCEA-S-61-402.
(ii) BS 5308.
(iii) IEC 332-1.
(iv) ASTM-B-33.
(v) IS-8130-1984.
(vi) IS 1554 Part-1.
(vii) IS 10810. |
| (u) | Sheath color | : | Inner- Black and Outer- Gray. |
| (v) | Tests | : | (i) Oxygen Index: Min.29 at room temp. (ASTM-D-2863).
(ii) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I.
(iii) Temp Index: Min 250 ° C at 21Oxy. Ind. (ASTM-D-2863). |

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
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- (iv) Smoke Density Rating: Max.60% (ASTM-D-2843).
- (v) Flammability Test : as per IEC 332 Part-I.
- (vi) Swedish Chimney Test-SS-424-1475 F3.
- (vii) Insulation Resistance 100 M Ohm / Km Min.
- (viii) High voltage test
Core to core- 1.5 kV for 1 min.
Core to screen- 1.0 kV for 1 min.
- (ix) Rodent & Termite repulsion test (Presence of lead shall be confirmed).

(w) Colour of core for Instrumentation Cable (As per IS-9938)

PAIR	CORE	COLOR
1 st	1 st	Blue
1 st	2 nd	Red
2 nd	1 st	Gray
2 nd	2 nd	Yellow
3 rd	1 st	Green
3 rd	2 nd	Brown
4 th	1 st	White
4 th	2 nd	Black

TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

Above 4 Pairs, 4 Pairs making a unit shall have indelible printed colour coded bands like Pink for 1st unit, Orange for 2nd unit and Violet for 3rd unit and so on. In addition band marking, for example single band for 1st. unit, double band for 2nd. unit and so on, shall be provided on each conductor for identification of unit. Band marking on individual core shall be provided at regular intervals not exceeding 50 mm.

- 10.6 Cables near high temperature zone shall be capable of withstanding high temperature and terminated in junction box / panel in normal temperature zone. Teflon insulated and sheathed thermocouple extension cables and copper conductor cables shall be used in high temperature zone. Conductor and sheath shall be extruded FEP (Teflon) as per VDE 0207 Part 6 and ASTM D 2116. These cables shall be pair, multipair, triad, multitriad and twisted & shielded.

~~10.7 CONTROL & POWER CABLE~~

~~Bidder shall refer to Volume IVB of the electrical specification for detail.~~

~~11.0 ERECTION HARDWARE~~

~~This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.~~

~~11.1 ELECTRICAL ACCESSORIES~~

~~Electrical conduit and associated materials shall conform to the requirements of the articles which follow:~~

~~(a) Rigid Steel Conduit~~

- ~~(i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.~~
- ~~(ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.~~

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

PROCESS CONNECTION AND INSTRUMENT HOOK UP

9.0 PROCESS CONNECTION & INSTRUMENT HOOK UP

- 9.1 Instrument connection to the process system (piping, vessel etc.) shall be according to the process & piping specification upto and including the root valves. Root valves shall be installed as close as possible to the piping or vessel. Each instrument shall have its own independent connection to the process except for instruments located on standpipe. Each instrument shall be connected independently to the standpipe through isolation valve.
- 9.2 Isolation and blowdown drain valves adequate for duty and capable of withstanding continuous design condition of main process shall be provided. Instrument blow down valve near to the instrument shall be of gradual opening type. For process pressure equal or above 40 kg/ sq.cm double blowdown valves shall be used connecting to blowdown header. Instrument manifold/gauge valve shall be installed close to the instrument.
- 9.3 The nominal size of the takeoff connections on line shall not be less than NPS ½" for source conditions not in excess of either 900 psi or 425°C and NPS ¾" (for adequate physical strength) for design conditions exceed either of these limits. Where the size of the main is smaller than the limits given above, the takeoff connections shall not be less than the size of the main line.
- 9.4 Process connection for instruments lines and vessels shall be in accordance to standards such as ASME or other recognized international standards. Table below indicates the type of connection generally to be used.

SR. NO.	INSTRUMENTS	EQUIPMENT/PIPE SIDE	INSTRUMENT SIDE
(a)	Level Instruments		
	(i) Internal Displacer	4" – Flanged.	4" – Flanged.
	(ii) External Displacer	2" – Flanged.	2" – Flanged.
	(iii) Level gauge	¾" – Flanged.	¾" – Flanged.

**TECHNICAL SPECIFICATION FOR
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SR. NO.	INSTRUMENTS	EQUIPMENT/PIPE SIDE	INSTRUMENT SIDE
	(iv) DP Type	½" (min.) - welded 1" – welded for vessel like HP heaters, LP heaters, De-aerator etc. application.	½"- NPT.
	(v) External cage Level switch	1"- welded.	1"- welded.
(b)	Flow Instruments		
	(i) DP Type	½" - welded in general. 1" – welded for high pressure/ temperature main steam, feed water, PRDS etc. application.	½" – NPT.
(c)	Pressure Instruments		
	(i) Conventional	½" (min.)-welded 1"- welded for high pressure/ temperature main steam, feed water, PRDS etc. application.	½" – NPT.
	(ii) Diaphragm type-HFO application	3"- Flanged.	3"- Flanged.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	INSTRUMENTS	EQUIPMENT/PIPE SIDE	INSTRUMENT SIDE
(d)	Temperature Instruments		
	(i) Thermowell	Generally - M 33 X2 (M). 1½" Flanged- For air /FG path application.	½" NPT.
(e)	Analyzer		
	(i) Liquid analyzer	½" - 1" – welded.	½".

- 9.5 Size of impulse pipe for pressure measurement in air and flue gas duct path of boiler shall not be less than ¾" NB.
- 9.6 Separate stubs and take-off points with thermo well/root valves shall be provided for performance guarantee test.
- 9.7 Impulse pipes shall be clamped at suitable interval not exceeding 1.5 meter. Process pipe shall not be used for supporting the impulse pipe.
- 9.8 Fittings shall conform to ANSI B 16.11. Threads of piping component shall be of tapered construction.
- 9.9 Instrument blow down header shall in no case be lower than the material grade ASTM A 106 Gr. C.
- 9.10 Impulse pipe shall be laid at least with slope of gradient 1:10 to avoid any air pocket or water accumulation.
- 9.11 Expansion loop shall be provided at least at every 2.5 meter interval without affecting the gradient of slope in long run impulse pipe to avoid stress on the piping.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- 9.12 Siphon shall be provided in the impulse pipe or tube to protect the instruments where fluid temperature is 100 °C or more.
- 9.13 Orientation of tappings shall be as follows :
- (a) For liquid service within 45° at lower half of the pipe horizontal plane.
 - (b) For gas service within 90° at upper half of the pipe horizontal plane.
 - (c) For steam service within 45° at upper half of the pipe horizontal plane.
- As a rule tap orientation of high and low pressure side should be parallel and symmetrical.
- 9.14 Pressure & Differential pressure instruments in steam and liquid services shall be located below the taps and the piping shall be sloped to avoid formation of air pocket.
- 9.15 Pressure & Differential pressure instruments in air and flue gas service shall be located above the taps and the piping shall be sloped back to process to avoid formation of any liquid.
- 9.16 Impulse pipe including taps for furnace, flue gas and coal mill application shall be provided with air purge connection. Differential instruments for such application shall have continuous and as well as intermittent purging. Whereas, pressure measurement shall have only intermittent purging.
- 9.17 Material of impulse pipe for the instruments mounted on rack and enclosure shall be same as that of main process pipe except stainless steel tube of Gr. 316H or better shall be provided for connection in between impulse pipe (from tee connection on impulse pipe) and instrument manifold valve & instruments. Impulse pipe, tubes, fittings and accessories shall have the same design pressure and temperature applicable for the related main pipe.

10.0 POWER SUPPLY SYSTEMS

10.1 Instrumentation power supply system shall include all conditioning equipment required to accommodate normal variations in the electrical supply. All panels and cabinets shall accept redundant power feeds from two different sources.

10.2 Type of power supply systems envisaged are as follows:

- (a) 240V AC UPS.
- (b) 24V DC battery system.

The battery system shall be dual floating with each stream having its own float cum boost charger. Care shall be taken so that the control system is not damaged during boost charging and also that the cables are properly sized so that the voltage drop does not cause the terminal voltage at the consumer end to fall below the minimum recommended value.

1.0 ENVIRONMENTAL CONSIDERATIONS

1.1 I&C components should operate properly with no degradation in expected lifetime or in operation parameter in the normal power plant environment. C&I system shall be designed considering all the operating conditions which may be encountered during installation and operation.

11.2 TEMPERATURE

11.2.1 Where the environmental extreme exceeds the capabilities of the selected system, Bidder should take appropriate steps to control the environment.

11.3 HUMIDITY

I&C system shall be designed to withstand the humidity limits specified for the project. Condensation shall not be allowed to form in the cabinets nor should water be allowed to be admitted through conduit entering the cabinets from top or sides.

11.4 ATMOSPHERIC CONTAMINATION

Particulate contamination from fly ash and coal dust and gaseous contaminants such as SO₂ and other flue gas constituents in the coal fired plant are foreseen. This hazard shall be taken into design considerations.

11.5 VIBRATION

Design of the systems shall include features such as locking devices, anti vibration pads etc, to withstand vibration. In general, I&C equipment shall be installed away from the vibration zone.

11.6 LIGHTNING

Protection against lightning shall be considered by providing proper grounding, metal oxide arrestors, spark gap lightning arrestor, optical isolator and isolation transformer.

12.0 SECURITY

12.1 Door lock shall be provided in all Panels, Cabinets and Enclosures.

12.2 System mode key switch or password to prevent tampering of system program.

12.3 Redundant elements of the system shall not be exposed to the common hazards. For example routing of the redundant network cable through separate cable raceway, using separate cabinet/separate rack for redundant controller and redundant IO modules.

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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SR. NO.	DESCRIPTION	TYPE OF I/O	NO. OF I/O
	(xi) Current Transducer input	AI	1
(b)	DCS/PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE (Signal Exchange has been envisaged between DCS/PLC and PMCC/MCC)		
	(i) Start Command	DO	1
	(ii) Stop Command	DO	1
	(iii) ON Feedback	DI	1 COC
	(iv) OFF Feedback	DI	1 COC
	(v) Swgr/MCC Disturbance (Overload relay operated/ control supply fail/ Emergency LPBS stop)	DI	1
	(vi) Switchgear/MCC Available (switchgear/MCC in remote)	DI	1
(c)	DCS/PLC INTERFACE FOR BIDIRECTIONAL LT DRIVE- For Integral starters (Signal Exchange has been envisaged between Actuator and DCS/ PLC.)		
	(i) Open Command	DO	1
	(ii) Close Command	DO	1
	(iii) Integral starters Fault	DI	1
	(iv) Open limit switch feedback	DI	1 COC

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	DESCRIPTION	TYPE OF I/O	NO. OF I/O
	(v) Close limit switch feedback	DI	1 COC
	(vi) Position Transmitter (For inching type Drive)	AI	1
(d)	DCS/PLC INTERFACE FOR BIDIRECTIONAL LT DRIVE-For Non-Integral starters (Signal Exchange has been envisaged between Actuator and DCS/PLC.)		
	(i) Open Command	DO	1
	(ii) Close Command	DO	1
	(iii) Swgr/MCC Disturbance (Overload relay operated/ control supply fail/ Emergency LPBS stop)	DI	1
	(iv) Switchgear/MCC Available (switchgear/MCC in remote)	DI	1
	(v) Open limit switch feedback	DI	1 COC
	(vi) Close limit switch feedback	DI	1 COC
	(vii) Position Transmitter (For inching type Drive)	AI	1
(e)	DCS/PLC INTERFACE FOR SOLENOID DRIVE (Single coil)		
	(i) Energies or De-Energies	DO	1
	(ii) Open limit switch feedback	DI	1 COC
	(iii) Close limit switch feedback	DI	1 COC

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SR. NO.	DESCRIPTION	TYPE OF I/O	NO. OF I/O
(f)	DCS/PLC INTERFACE FOR SOLENOID DRIVE (Double coil)		
	(i) Energize	DO	1
	(ii) De-Energize	DO	1
	(iii) Open limit switch feedback	DI	1 COC
	(iv) Close limit switch feedback	DI	1 COC
(g)	DCS/PLC INTERFACE FOR PNEUMATIC DRIVE		
	(i) Command to I/P converter	AO	1
	(ii) Position Transmitter	AI	1
	(iii) Open limit switch feedback	DI	1 COC
	(iv) Close limit switch feedback	DI	1 COC
	(v) Command to Solenoid valve (Wherever applicable)	DO	1

Above I/Os used in OLCS or CLCS loops shall be redundant.

4.35

~~ELECTRICAL DISTRIBUTION AND MANAGEMENT SYSTEM~~

~~The entire unit and station electrical system within powerhouse area shall be monitored and operated from DCS and off site plant electrical system shall be monitored & operated from respective PLCs.~~

~~Plant Electrical Distribution system i.e. Unit Bus, Station Bus, Incoming & Outgoing feeders, transformer feeders, bus couplers etc. shall be operated and monitored from DCS. Trip and interlocking functions shall be hardwired at equipment level.~~

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

ISSUE	BY	CH	DATE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

FOR BID PURPOSE ONLY

DO NOT SCALE

DATE : 23-08-2011

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~

APPROVED

DIV INST.

DR P.N.Z.

CH D.J.P.

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NOTES:

1. PROVISION OF SINGLE OR DOUBLE ROOT VALVE AND DRAIN VALVE SHALL BE IN ACCORDANCE WITH THE PRESSURE/ TEMPERATURE REQUIREMENT. FOR LINE PRESSURE EQUAL TO OR GREATER THAN 40 KG/SQ. CM. 2 NOS ROOT VALVE AND 2 NOS DRAIN VALVE SHALL BE REQUIRED.
2. MATERIAL, SIZE AND RATING OF THE PROCESS HOOK UP ITEMS SHOWN IN THE DRAWING ARE INDICATIVE ONLY. ACTUAL REQUIREMENT SHALL BE AS PER PROCESS CONDITION AND SPECIFICATION OF CONTROL & INSTRUMENTATION.
3. DRAIN PIPE IN RACK AND ENCLOSURE SHALL BE 2" NB SCH 80.

ISSUE	BY	CH	DATE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

FOR BID PURPOSE ONLY

DO NOT SCALE

DATE : 23-08-2011

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~

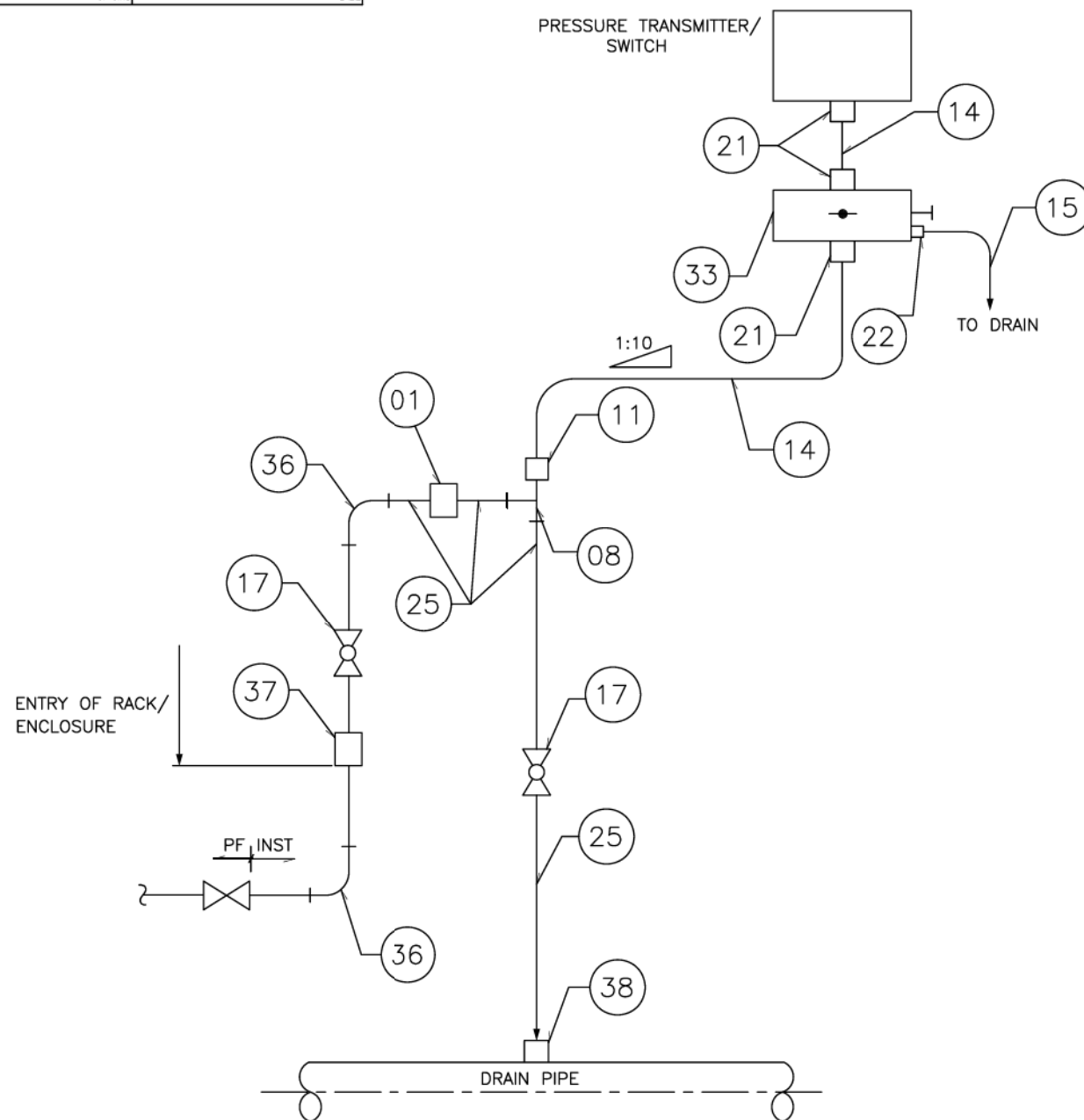
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DIV INST.

DR P.N.Z.

CH D.J.P.

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PRESSURE TRANSMITTER/PRESSURE SWITCH
MOUNTED ABOVE SOURCE POINT

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
08	1	EQUAL TEE (FEMALE) 1/2" SW 3000lbs, CS/AS
11	1	MALE CONNECTOR 1/2" PE x 1/2" OD 3000I lbs OF CS/AS
17	2	GLOBE VALVE 1/2" SW 800lbs OF CS/AS
14	3 MTRS.	TUBE 1/2" OD, 2.1mm THICK, SS 316
21	3	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 3000 lbs, SS 316
25	15 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
33	1	2 VALVES MANIFOLD 1/2" NPT(F), SS 316
01	1	FULL COUPLING 1/2" SW 3000lbs, CS/AS
15	0.15 MTRS.	TUBE 8mm OD, 1.0mm THK. SS 316
22	1	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 3000 lbs
36	2	90° ELBOW 1/2" SW 3000lbs, CS/AS
37	1	BULKHEAD UNION/COUPLING CL:3000 lbs, 1/2" NB-SW, AS PER ANSI B16.11, CS/AS
38	1	HALF COUPLING CL:3000 lbs/ 1/2" NB-SW, AS PER ANSI B16.11, CS/AS

SERVICE : CONDENSER PRESSURE, INSTRUMENT AIR ETC.

FOR BID PURPOSE ONLY

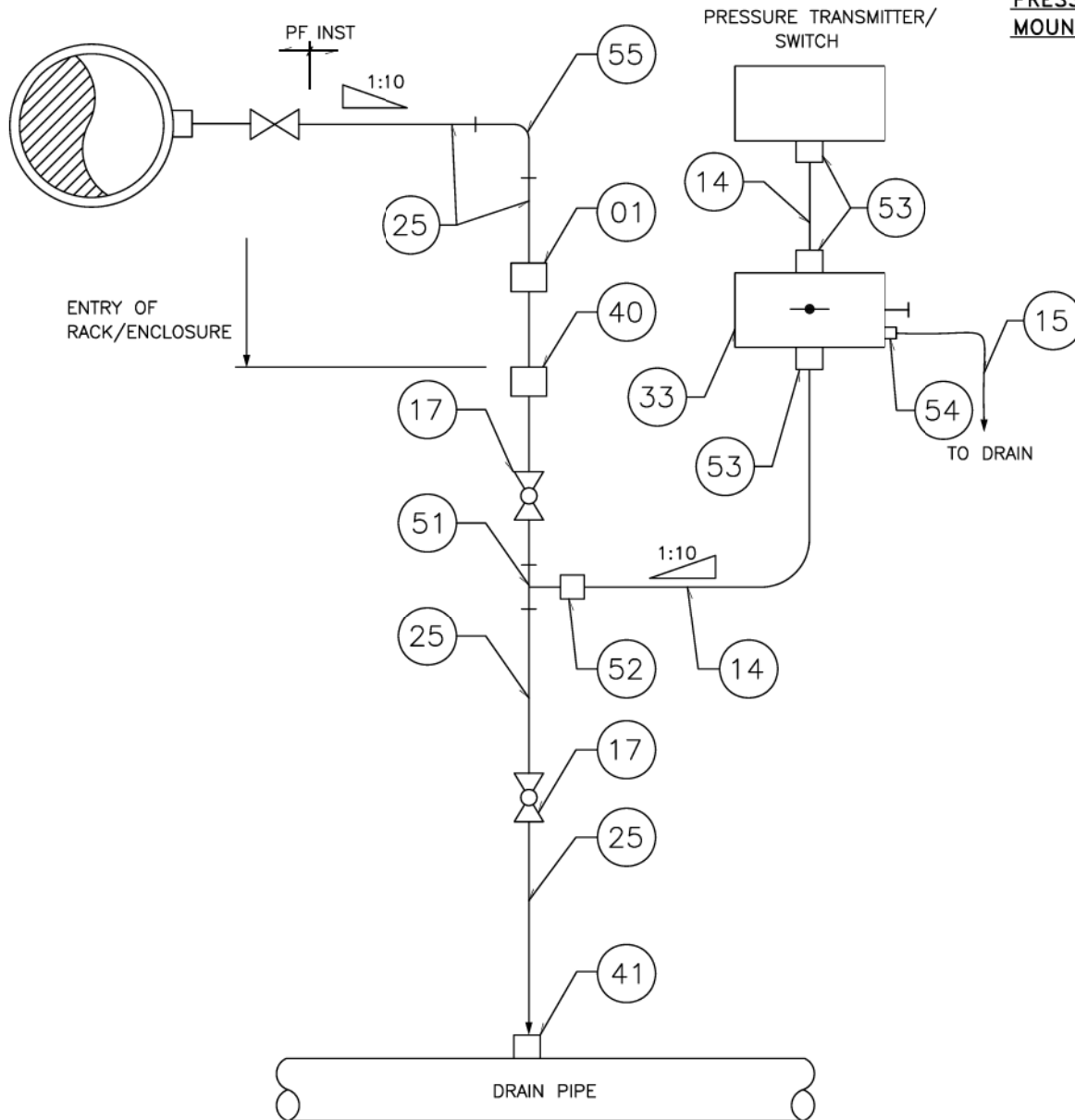
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ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED		
										DEPT	SIGNATURE	DATE
												*IF PRELIMINARY ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION, THE USER SHALL INITIALS AND DATE THE BOTTOM RIGHT HAND CORNER OF THE SHEET. CONSTRUCTION / FABRICATION INFORMATION CONTAINED WITHIN THIS SHEET ON INFORMATION CONTAINED WITHIN THIS SHEET IS NOT TO BE RELEASED FOR CONSTRUCTION / FABRICATION PURPOSES. THE USER MUST GET DESIGN OFFICE TO CLEAR AND USE IN THE BEFORE PROCEEDING WITH CONSTRUCTION / FABRICATION. INFORMATION CONTAINED WITHIN THIS SHEET IS NOT TO BE RELEASED FOR CONSTRUCTION / FABRICATION PURPOSES. THE USER MUST GET DESIGN OFFICE TO CLEAR AND USE IN THE BEFORE PROCEEDING WITH CONSTRUCTION / FABRICATION. I&C INFORMATION CONTAINED WITHIN THIS SHEET IS NOT TO BE RELEASED FOR CONSTRUCTION / FABRICATION PURPOSES. THE USER MUST GET DESIGN OFFICE TO CLEAR AND USE IN THE BEFORE PROCEEDING WITH CONSTRUCTION / FABRICATION. MECH INFORMATION CONTAINED WITHIN THIS SHEET IS NOT TO BE RELEASED FOR CONSTRUCTION / FABRICATION PURPOSES. THE USER MUST GET DESIGN OFFICE TO CLEAR AND USE IN THE BEFORE PROCEEDING WITH CONSTRUCTION / FABRICATION.

 MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**



**PRESSURE TRANSMITTER/PRESSURE SWITCH
MOUNTED BELOW SOURCE POINT**

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
51	1	EQUAL TEE (FEMALE) 1/2" SW 6000lbs, CS/AS
52	1	MALE CONNECTOR 1/2" PE x 1/2" OD 6000 lbs, CS/AS
17	2	GLOBE VALVES 1/2" SW 800lbs, CS/AS
14	3 MTRS.	TUBE 1/2" OD, 2.1mm THK, SS 316
53	3	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 6000 lbs, SS 316
25	15 MTRS.	IMPULSE PIPE 15 NB GR.B SCH 80, CS/AS
33	1	2 VALVES MANIFOLD 1/2" NPT(F), SS 316
01	1	FULL COUPLING 1/2" SW 6000lbs, CS/AS
15	0.15 MTRS.	TUBE 8mm OD, 1.0mm THK, SS 316
54	1	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 6000 lbs, SS 316
55	2	90° ELBOW 1/2" SW 6000lbs, CS/AS
40	1	BULKHEAD UNION/COUPLING CL:6000 lbs, 1/2"NB-SW, AS PER ANSI B16.11, CS/AS
41	1	HALF COUPLING CL:6000 lbs, 1/2" NB-SW, AS PER ANSI B16.11, CS/AS

SERVICE : CONDENSATE, FEED WATER ETC.

FOR BID PURPOSE ONLY

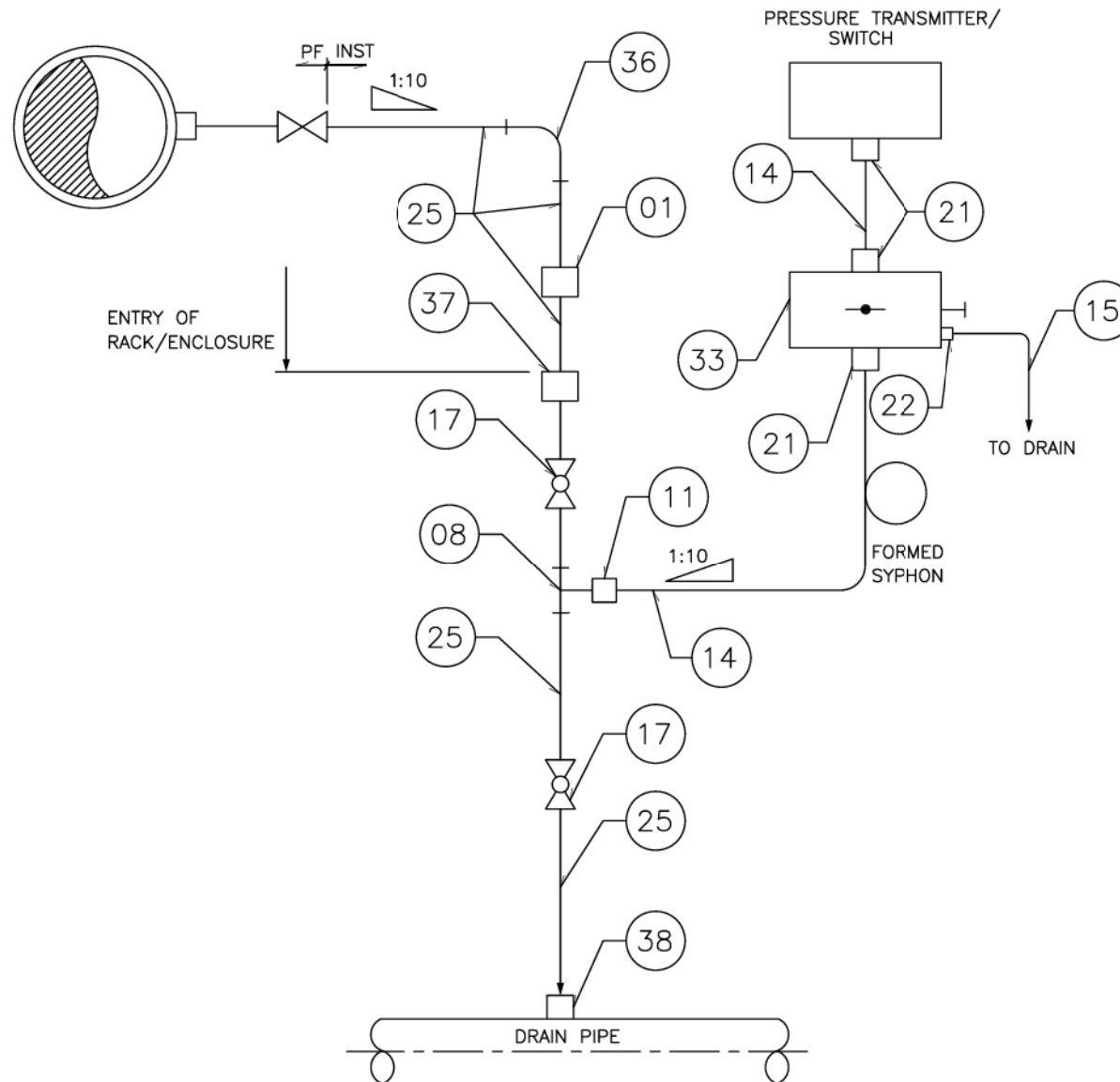
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ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE

MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM	

TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.
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PRESSURE TRANSMITTER/PRESSURE SWITCH MOUNTED BELOW SOURCE POINT (WITH SYPHON)



BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
08	1	EQUAL TEE (FEMALE) 1/2" SW 3000lbs, CS/AS
11	1	MALE CONNECTOR 1/2" PE x 1/2" OD 3000I lbs, CS/AS
17	2	GLOBE VALVES 1/2" SW 800lbs, CS/AS
14	3 MTRS.	TUBE 1/2" OD, 2.1mm THK.
21	3	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 3000 lbs, SS 316
25	15 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
33	1	2 VALVES MANIFOLD 1/2" NPT(F), SS 316
01	1	FULL COUPLING 1/2" SW 3000lbs, CS/AS
15	0.15 MTRS.	TUBE 8mm OD, 1.0 mm THK. SS 316
22	1	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 3000 lbs, SS 316
36	1	90° ELBOW 1/2" SW 3000lbs, CS/AS
37	1	BULKHEAD UNION/COUPLING CL:3000 lbs/ 1/2"NB-SW, AS PER ANSI B16.11, CS/AS
38	1	HALF COUPLING CL:3000 lbs/ 1/2" NB-SW, AS PER ANSI B16.11, CS/AS

SERVICE : LOW PRESSURE STEAM.

FOR BID PURPOSE ONLY

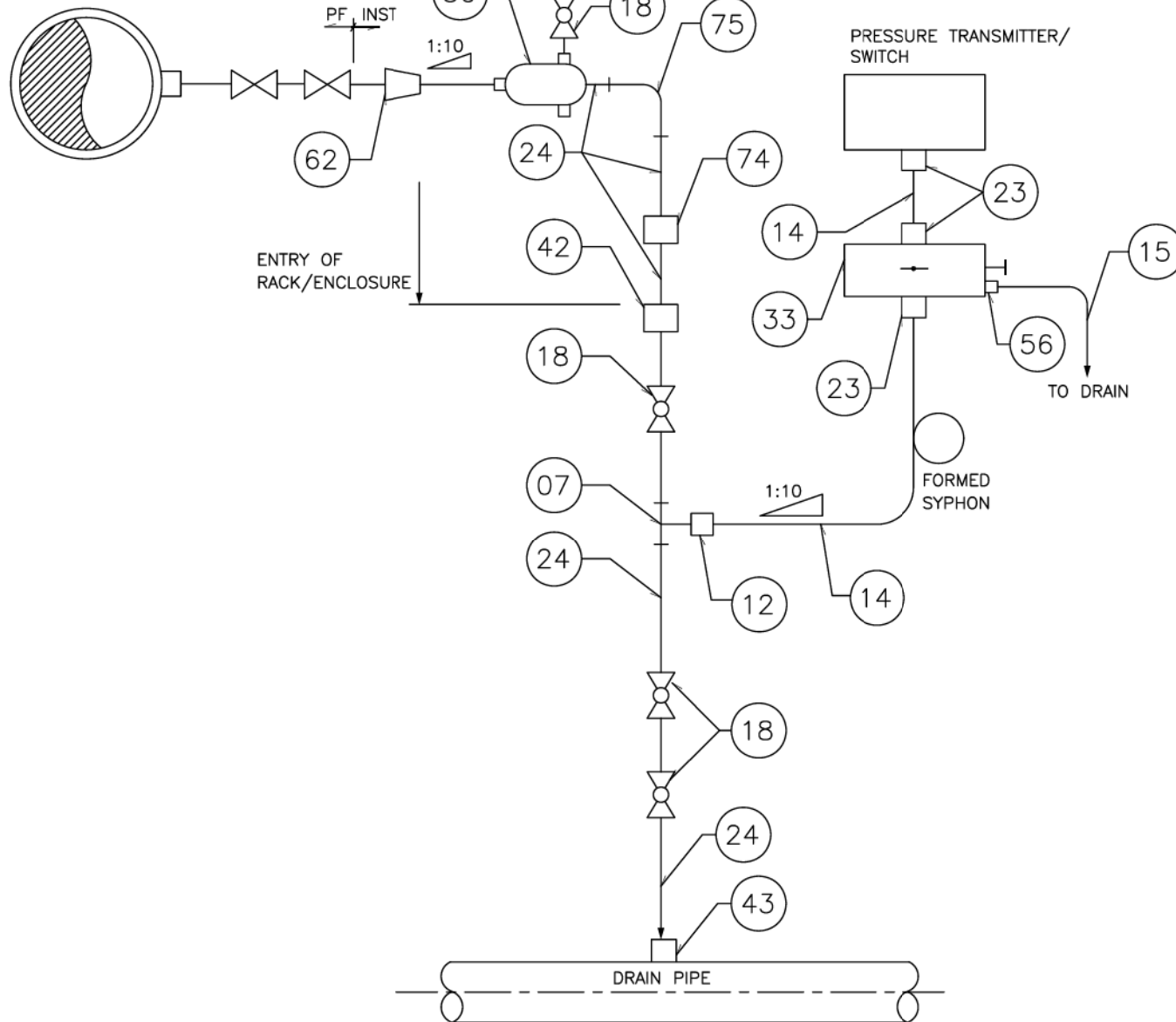
DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE

MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT
TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

**PRESSURE TRANSMITTER/ PRESSURE SWITCH
MOUNTED BELOW SOURCE POINT (WITH
CONDENSATE POT)**



BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
62	1	REDUCER 1"SW x 1/2" SW 9000lbs, CS/AS
07	1	EQUAL TEE (FEMALE)1/2" SW 9000 lbs, CS/AS
12	1	MALE CONNECTOR 1/2" PE x 1/2" OD 9000 lbs, CS/AS
18	4	GLOBE VALVES 1/2" SW 1500 lbs, CS/AS
14	3 MTRS.	TUBE 1/2" OD, 2.mm THK, SS 316
23	3	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 9000 lbS, SS 316
24	15 MTRS.	IMPULSE PIPE 15 NB SCH. 80, CS/AS
33	1	2 VALVES MANIFOLD 1/2" NPT(F), SS 316
74	1	FULL COUPLING 1/2" SW 9000lbs, CS/AS
15	0.15 MTRS.	TUBE 8mm OD, 1.0mm THK, SS 316
56	1	MALE CONNECTOR 1/4" NPT(M) x 8mm OD, 9000 lbs, SS 316
42	1	BULKHEAD UNION/COUPLING CL:9000 lbs- AS PER ANSI B16.11, 1/2" NB-SW, CS/AS
43	1	HALF COUPLING CL:9000 lbs, 1/2" NB-SW, AS PER ANSI B16.11, CS/AS
75	1	90° ELBOW 1/2" SW CL:9000 lbs, CS/AS
32	1	PLUG 1/2" NPT(F) 9000lbs, CS/AS
30	1	CONDENSATE POT 1/2" SW NPT(F) 9000lbs, CS/AS
66	1	15 NB SCH 80, SW x 1/2" NPT(M), SEAMLESS NIPPLE 6000 lbs, CS/AS

SERVICE : MEDIUM AND HIGH PRESSURE STEAM

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY	
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED	
										DEPT	SIGNATURE
											DATE
										CHEM	
										CIVIL	
										ELEC	
										I&C	
										MECH	

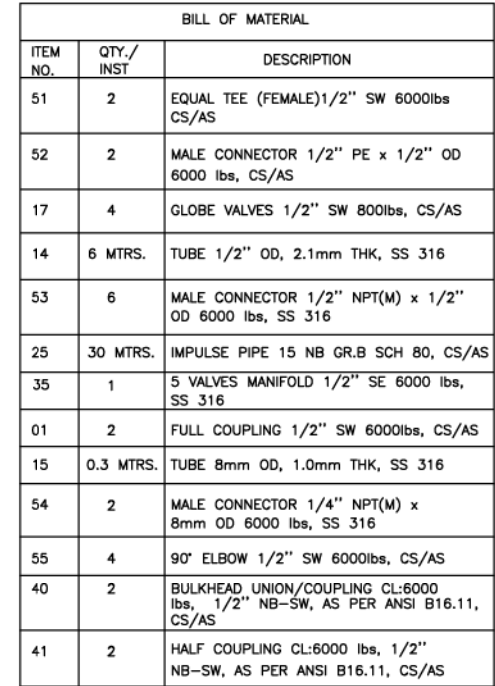
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MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

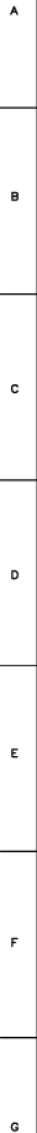


FOR BID PURPOSE ONLY

MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.

'P' (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION/FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY. A 'P' IS LOCATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK PERMITTED ON 'R' (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION/FABRICATION UNTIL THE NEXT GET IS ISSUED. TO CLARIFY, 'HOLD'S' IN TIME BEFORE PROCEEDING WITH CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLD'S'.
DRAWINGS SIGNED BY PROCON ENGINEER
AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.



A
B
C
D
E
F

FOR BID PURPOSE ONLY

 MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

H

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
51	2	EQUAL TEE (FEMALE)1/2" SW 6000lbs, CS/AS
52	2	MALE CONNECTOR 1/2" PE x 1/2" OD 6000 lbs, CS/AS
17	5	GLOBE VALVES 1/2" SW 600lbs, CS/AS
14	6 MTRS.	TUBE 1/2" OD, 2.1mm THICK, SS 316
53	6	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 6000 lbs, SS 316
25	30 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
35	1	5 VALVE MANIFOLD 1/2" NPTF, SS 316
01	2	FULL COUPLING 1/2"SW 6000lbs, CS/AS
30	1	CONDENSATE POT 1/2" SW 6000lbs, CS/AS
32	1	PLUG 1/2" NPT(F) 6000lbs, CS/AS
55	4	90° ELBOW 1/2" SW 6000lbs, CS/AS
15	0.3 MTRS.	TUBE 8mm OD, 1.0mm THICK, SS 316
54	2	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 6000 lbs, SS 316
40	2	BULKHEAD UNION/COUPLING CL 6000 lbs, AS PER ANSI B16.11,1/2" NB-SW CS/AS
41	2	HALF COUPLING CL 6000 lbs, 1/2" NB-SW, AS PER ANSI B16.11, CS/AS
66	1	15 NB SCH 80 SW x 1/2" NPT(M) SEAMLESS NIPPLE 6000 lbs, CS/AS

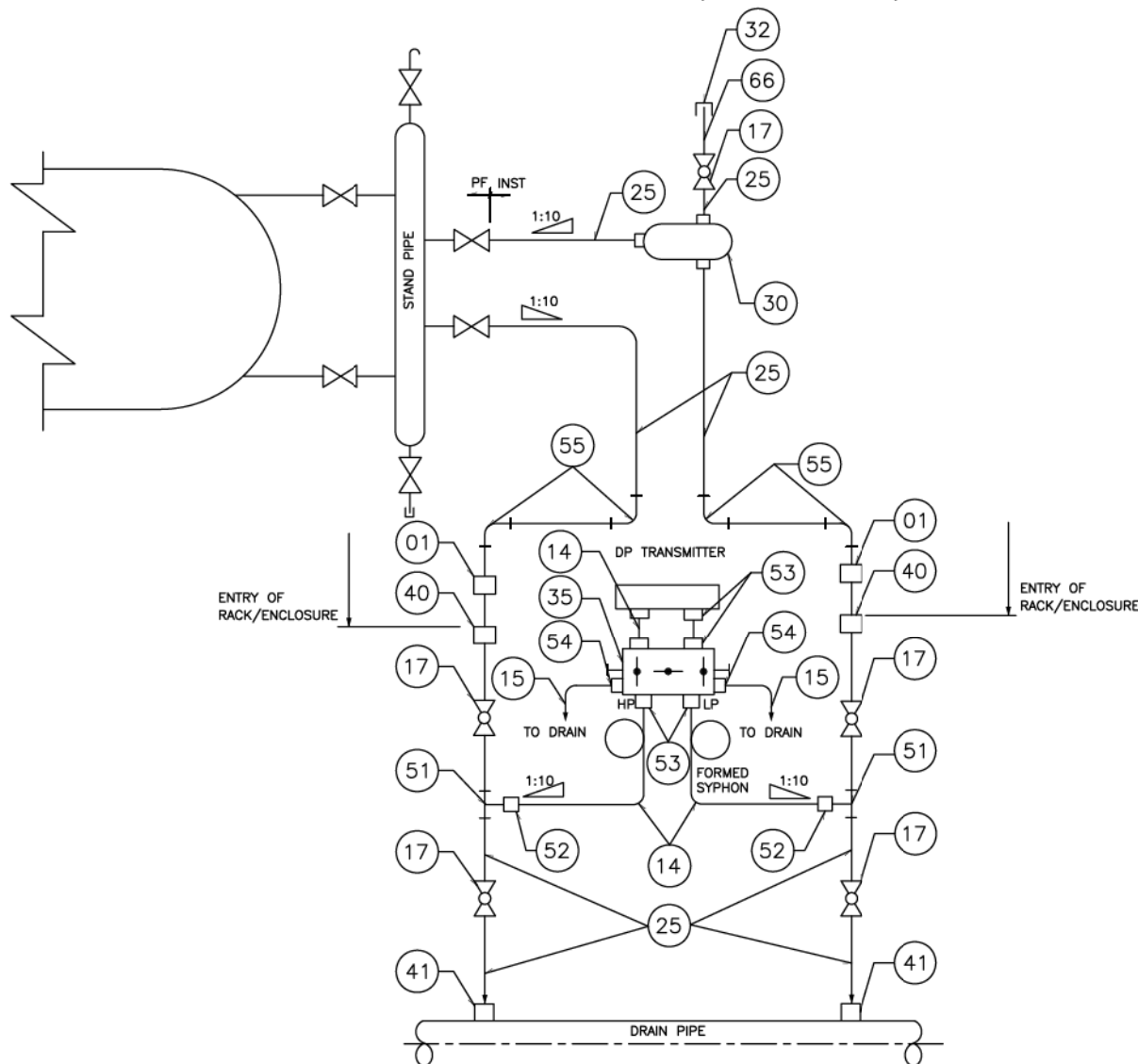
FOR BID PURPOSE ONLY

DO NOT SCALE

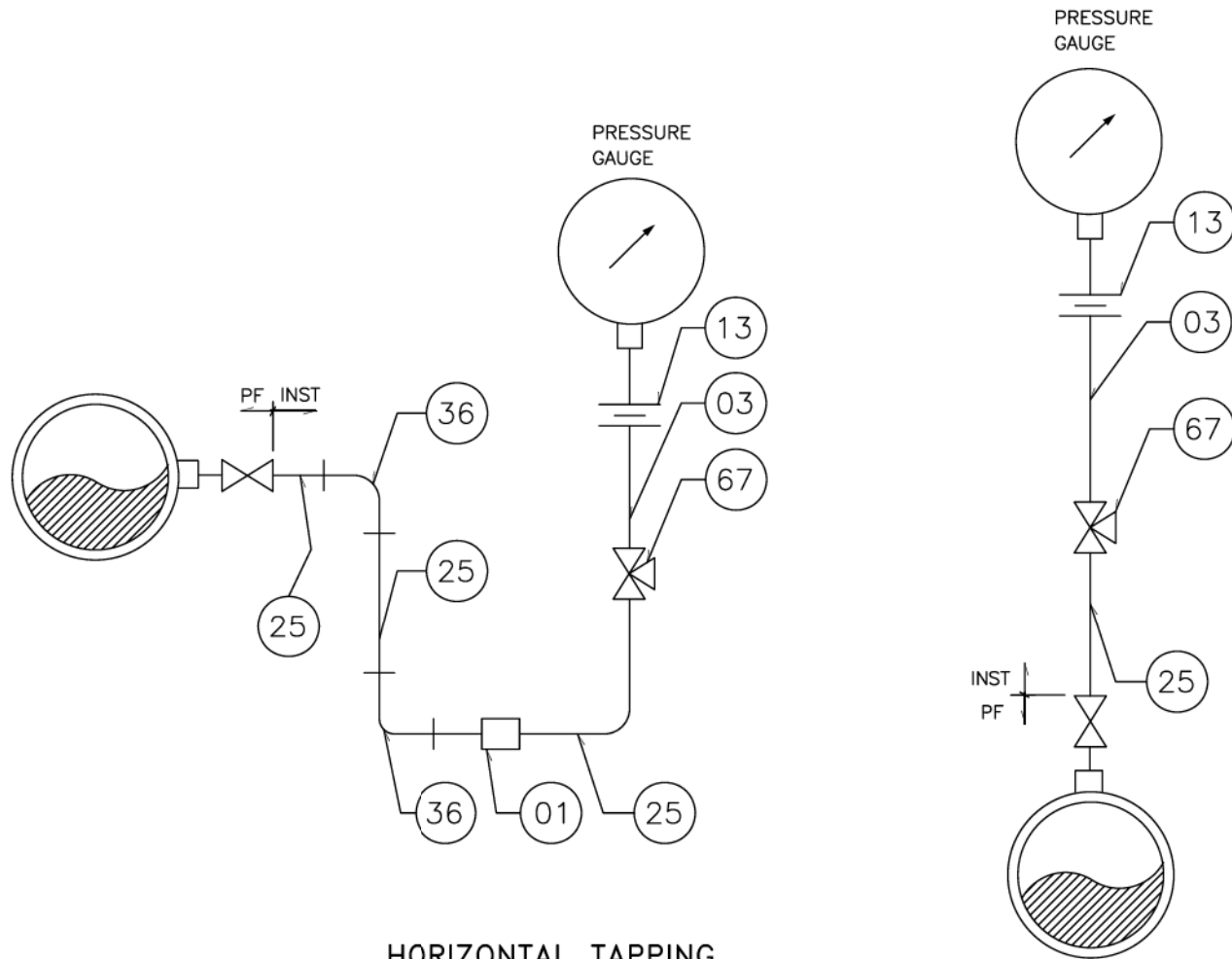
MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**



ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		"P" (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION/FABRICATION PURPOSES OR LIMITED RELEASED INFORMATION INDICATED IN THE SMALL BLOCK AT THE RIGHT HAND CORNER OF THE TITLE BLOCK. "R" (RELEASED) ISSUES OF INFORMATION CONTAINED WITHIN "HOLD" IS FIELD MUST GET DESIGN OFFICE TO CL "HOLD" IN TIME BEFORE PROCEEDING IN ANY CONSTRUCTION / FABRICATION WORK RELATED TO "HOLD". DRAWINGS SIGNED BY PROJEN ENGINEER AUTHORIZED REPRESENTATIVE ONLY CONSISTENTLY MAILED PERMANENTLY.	
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED			
										DEPT	SIGNATURE		DATE
											CHEM		
											CIVIL		
											ELEC		
I&C													
MECH													



HORIZONTAL TAPPING

VERTICAL TAPPING

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
25	15 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
01	1	FULL COUPLING 1/2" SW 3000lbs, CS/AS
36	2	90° ELBOW 1/2" SW 3000lbs, CS/AS
03	1	1/2" NPT(M) x 1/2" PE, 4" LONG NIPPLE, CS/AS
13	1	NUT & TAIL FITTING WITH CU WASHER 1/2" NPT(F) x 1/2" PE
67	1	3 WAY GAUGE COCK 1/2" SW 3000lbs, CS/AS

SERVICE : WATER, CONDENSATE ETC.

FOR BID PURPOSE ONLY

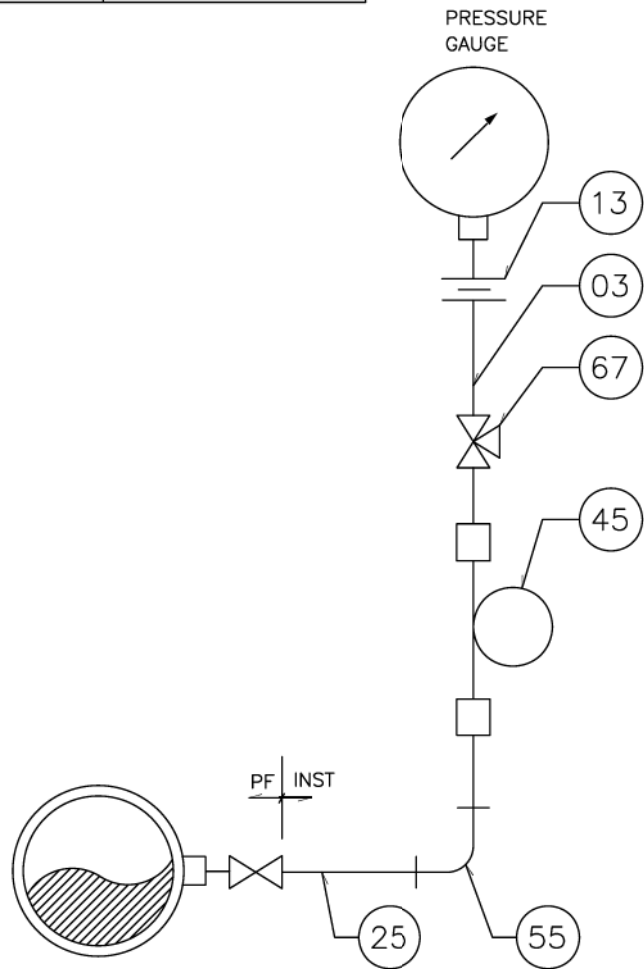
DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY			1" (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION, BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 1" (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN "HOLD" IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR "HOLD" IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO "HOLD".
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE	

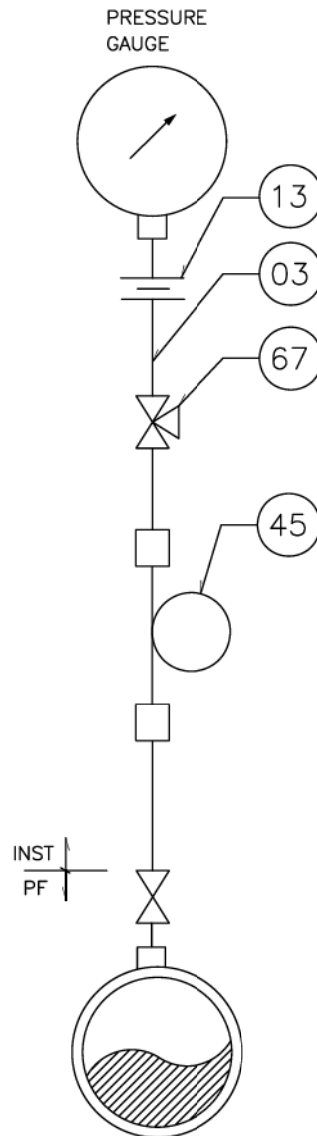
MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.



HORIZONTAL TAPPING



VERTICAL TAPPING

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
25	15 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
55	1	90° ELBOW 1/2" SW 6000lbs, CS/AS
03	1	1/2" NPT(M) x 1/2" PE 4" LONG NIPPLE, CS/AS
13	1	NUT & TAIL FITTING WITH SS WASHER 1/2" NPT(F) x 1/2" PE
45	1	SYPHON 1/2" OD SCH. 80, CS/AS
67	1	3 WAY GAUGE COCK 1/2" SW 3000lbs, CS/AS

SERVICE : STEAM, FEED WATER.

FOR BID PURPOSE ONLY

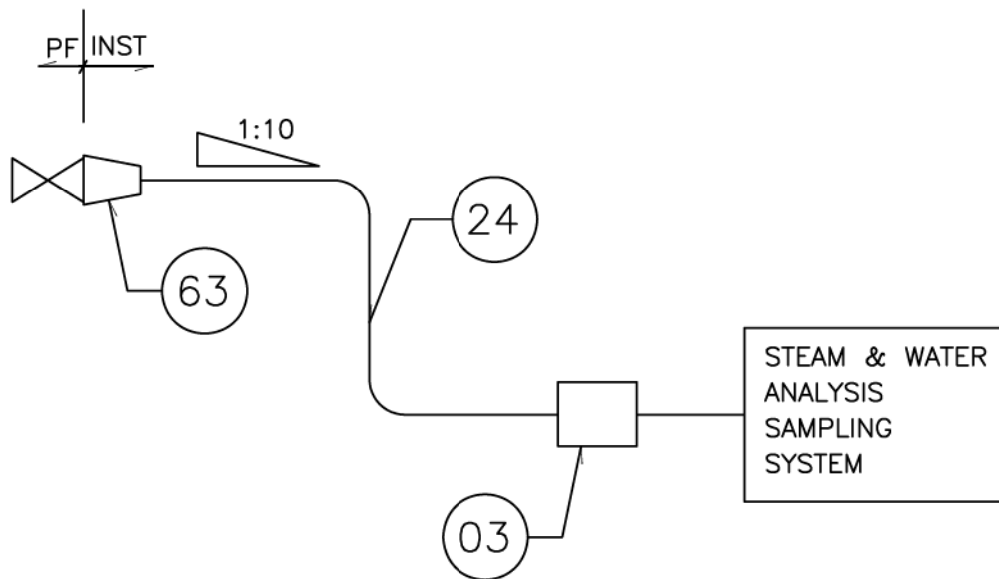
DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY			1" (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION. BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON "HOLD" ISSUES ONLY. INFORMATION CONTAINED WITHIN "HOLD" IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR "HOLD" IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK. DRAWINGS SIGNED BY PROCON ENGINEERS' AUTHORIZED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE	

MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	TYPICAL INSTRUMENT INSTALLATION DIAGRAM

TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.

FOR SWAS



BILL OF MATERIAL

ITEM NO.	QTY./ INST	DESCRIPTION
03	1	FULL COUPLING 1/2" SW 6000lbs, CS/AS
63	1	REDUCER 1" SW x 1/2" SW 6000lbs, CS/AS
24	A/R	IMPULSE PIPE 15 NB SCH 80, CS/AS

LEGEND:

A/R – AS PER REQUIREMENT

FOR BID PURPOSE ONLY

DO NOT SCALE

DATE : 23-08-2011

ISSUE BY CH DATE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~

APPROVED

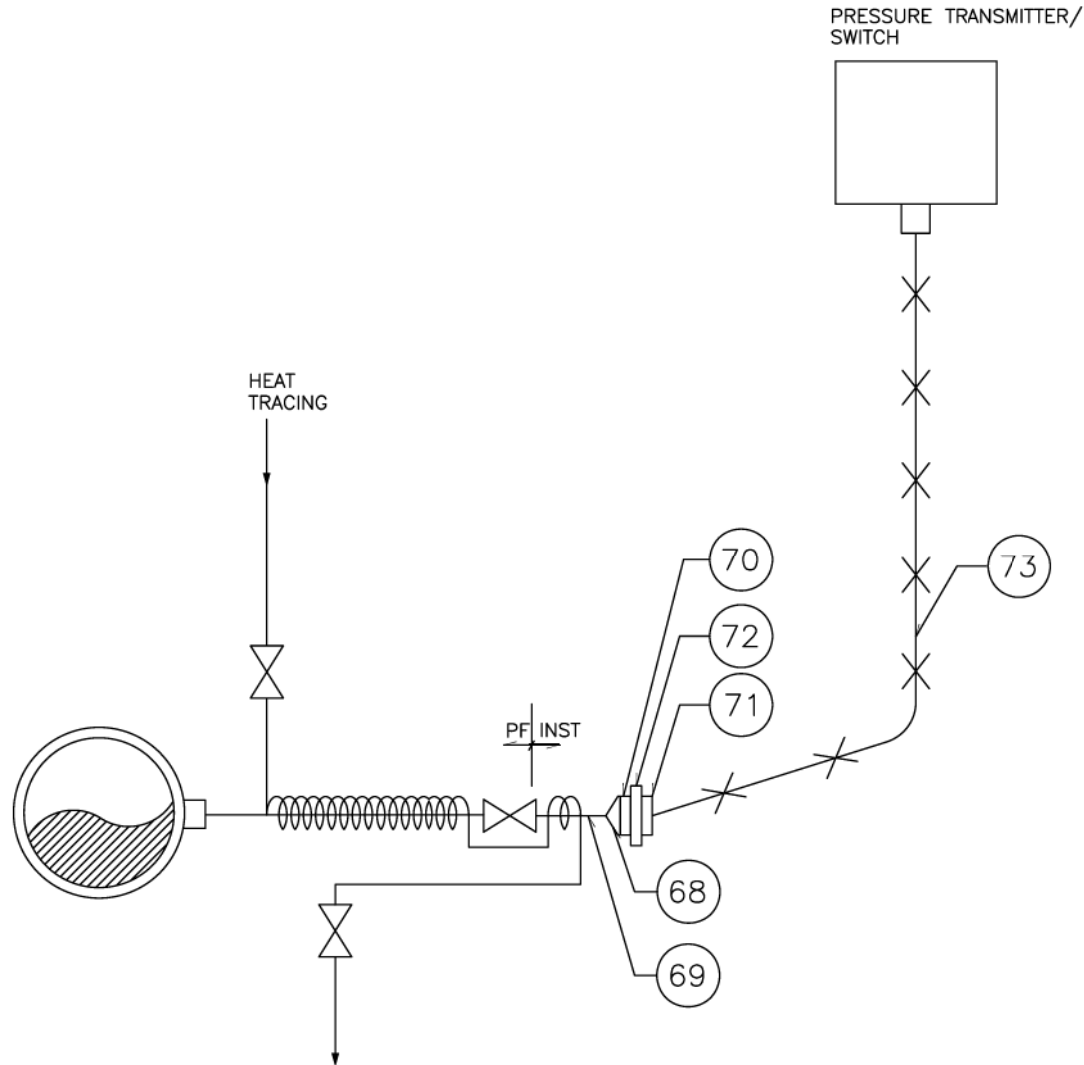
DIV INST.

DR P.N.Z.

CH D.J.P.

PO

PRESSURE TRANSMITTER/ PRESSURE SWITCH IN HFO SERVICE



BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
73	A/R	INSTRUMENT CAPALLARY TUBE
72	1	SEAL DIAPHRAGM
69	1	1" NPS SCH-80 CS/AS NIPPLE
71	1	2" 300 lbs ANSI FLANGE SUPPLIED ALONG WITH INSTRUMENT
70	1	2" 300 lbs, ANSI FLANGE WELD NECK.
68	1	1" x 2" CS/AS EXPANDER, SW

LEGEND:

A/R – AS PER REQUIREMENT.

NOTE:

1. QUANTITY IN COLUMNS TO BE DOUBLED FOR DP MEASUREMENT.

FOR BID PURPOSE ONLY

DO NOT SCALE

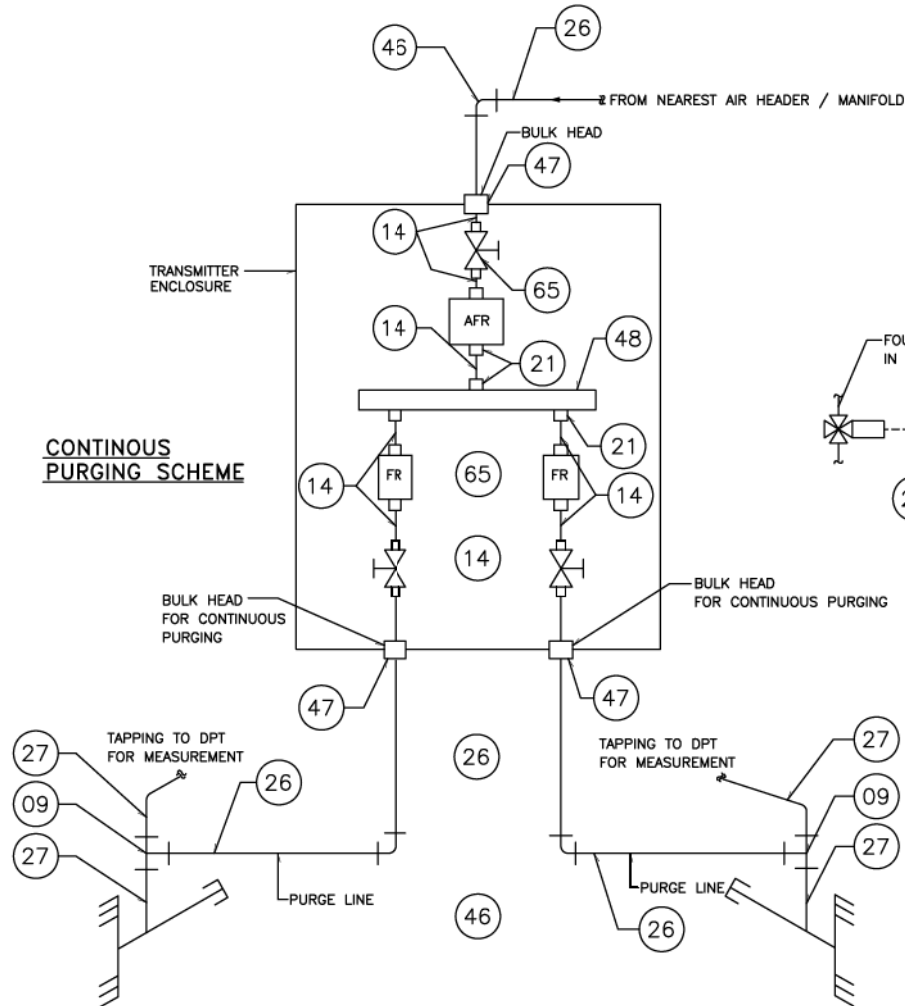
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			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED	SIGNATURE	DATE
										DEPT		
										CHEM		
										CIVIL		
										ELEC		
										I&C		
										MECH		

MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	TYPICAL INSTRUMENT INSTALLATION DIAGRAM

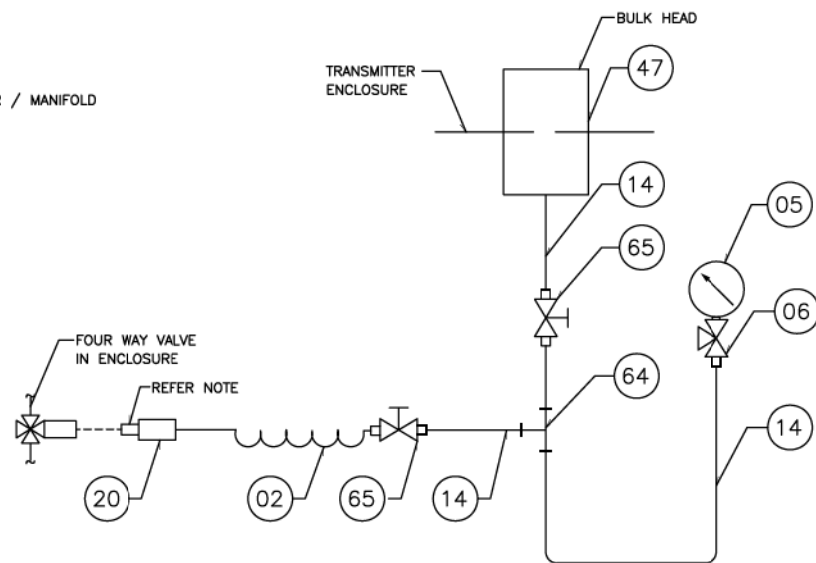
**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

TYPICAL AIR PURGING SCHEMES

CONTINUOUS PURGING SCHEME



INTERMITTENT PURGING SCHEME



B.O.M. ON SHT. NO. 16 OF 20

LEGEND:

FR - FLOW REGULATOR

NOTE:

QUICK DISCONNECTING FITTING IS CONNECTED TO FOUR WAY VALVE WHERE INTERMITTENT PURGING IS CALLED IN SCHEME. WAY VALVE WHERE INTERMITTENT PURGING IS CALLED IN SCHEME.

FOR BID PURPOSE ONLY

DO NOT SCALE

MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		"P" (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION/FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON "K" (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN "HOLD" IS NOT RELEASED FOR CONSTRUCTION/FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR "HOLD" IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO "HOLD". DRAWINGS SIGNED BY PROCON ENGINEERS AUTHORIZED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED		
										SIGNATURE	DATE	

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
27	15MTRS.	IMPULSE PIPE 3/4" NB, CS/AS.
26	A/R	GI PIPE, 1/2" NB.
09	2	FORGED UNEQUAL TEE AS PER ANSI B16:11 SIZE: 2 x3/4" NB SW x 1/2" NPTF,CL 3000.
46	3	GALVANISED ELBOW CL 3000 SIZE: 1/2" NPTF.
20	1	QUICK DISCONNECTING FITTING MALE/END CONN. TO SUIT 1/2" OD CONN.
02	A/R	NYLON NOSE TO SUIT 1/2" END CONN. PR. TESTING 10 Kg/cm ² g.
14	A/R	SEAMLESS TUBE 1/2" OD, 2.1mm THICK, SS 316.
47	3	BULK HEAD COUPLING TO SUIT 1/2" OD TUBE & 1/2" NB PIPE, SS 316.
65	5	BALL VALVE 1/2" NPT(F), SS 316.
21	18	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 3000lbs, SS 316.
48	1	INSTRUMENT AIR HEADER 1" NB PIPE, SS 316.
64	1	EQUAL TEE, SS 316, TO SUIT 1/2" OD TUBE.
05	1	PR. GAUGE, 4" DIAL SIZE, RANGE 0–10 Kg/cm ² g CONNECTION 1/2" NPTM
06	1	3 WAY GAUGE COCK 1/2"NPTF x 1/2" OD.

FOR BID PURPOSE ONLY

DO NOT SCALE

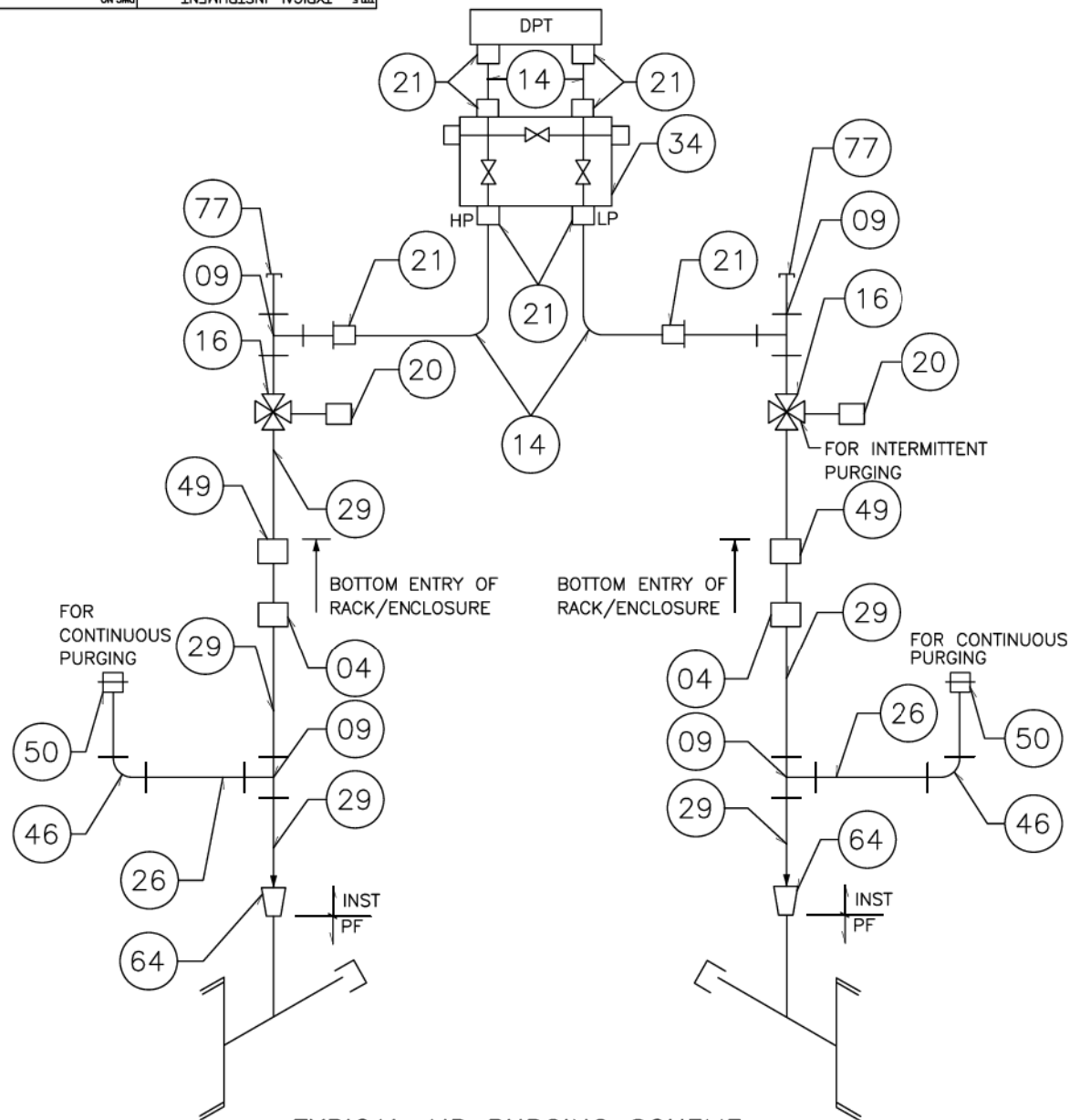
DATE : 23-08-2011

ISSUE	BY	CH	DATE

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~	APPROVED
D. DIV INST.	
DR P.N.Z.	
CH D.J.P.	
	PO



TYPICAL AIR PURGING SCHEME

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
64	2	REDUCER 1" BSPF x 3/4" NB-SW CL 3000, CS/AS
04	2	FORGED COUPLING 3/4" SW CL 3000 AS PER ANSI B16.11
09	4	FORGED UNEQUAL TEE AS PER ANSI B16.11 SIZE : 2 x 3/4" NB-SW x 1/2" NPTF, CL 3000
77	2	NIPPLE & CAP 3/4" NB-SCH 80,CAP-3/4" NPTF
14	6 MTRS.	SEAMLESS TUBE 1/2" OD, x 2.1mm THK., SS 316
16	2	FOUR WAY VALVE SIZE: (2 x 3/4" NB-SW)x(2 x 1/2"NPTF) CL:800
20	2	QUICK DISCONNECTING FITTING SIZE: 1/2"NPTM
21	8	MALE CONNECTOR 1/2" NPT(M) x TO SUIT 1/2" OD TUBE, SS 316
29	30 MTRS.	SEAMLESS PIPE/3/4" NB SCH 80
26	A/R	PIPE AS PER IS-1239 SIZE: 1/2" NB-HEAVY GRADE
34	1	3 VALVE MANIFOLD 1/2" NPT(F), SS 316
46	2	GALVANISED ELBOW CL 3000 SIZE : 1/2" NPTF
49	2	BULK HEAD COUPLING CL 3000 SIZE : 3/4" NB SW, CL 3000, AS PER ANSI B16.11
50	2	BULK HEAD COUPLING CL 3000 SIZE : 1/2" NPTF, AS PER ANSI B16.11

SERVICE : FLUE GAS, FURNACE ETC.

FOR BID PURPOSE ONLY

DO NOT SCALE

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			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE	



MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

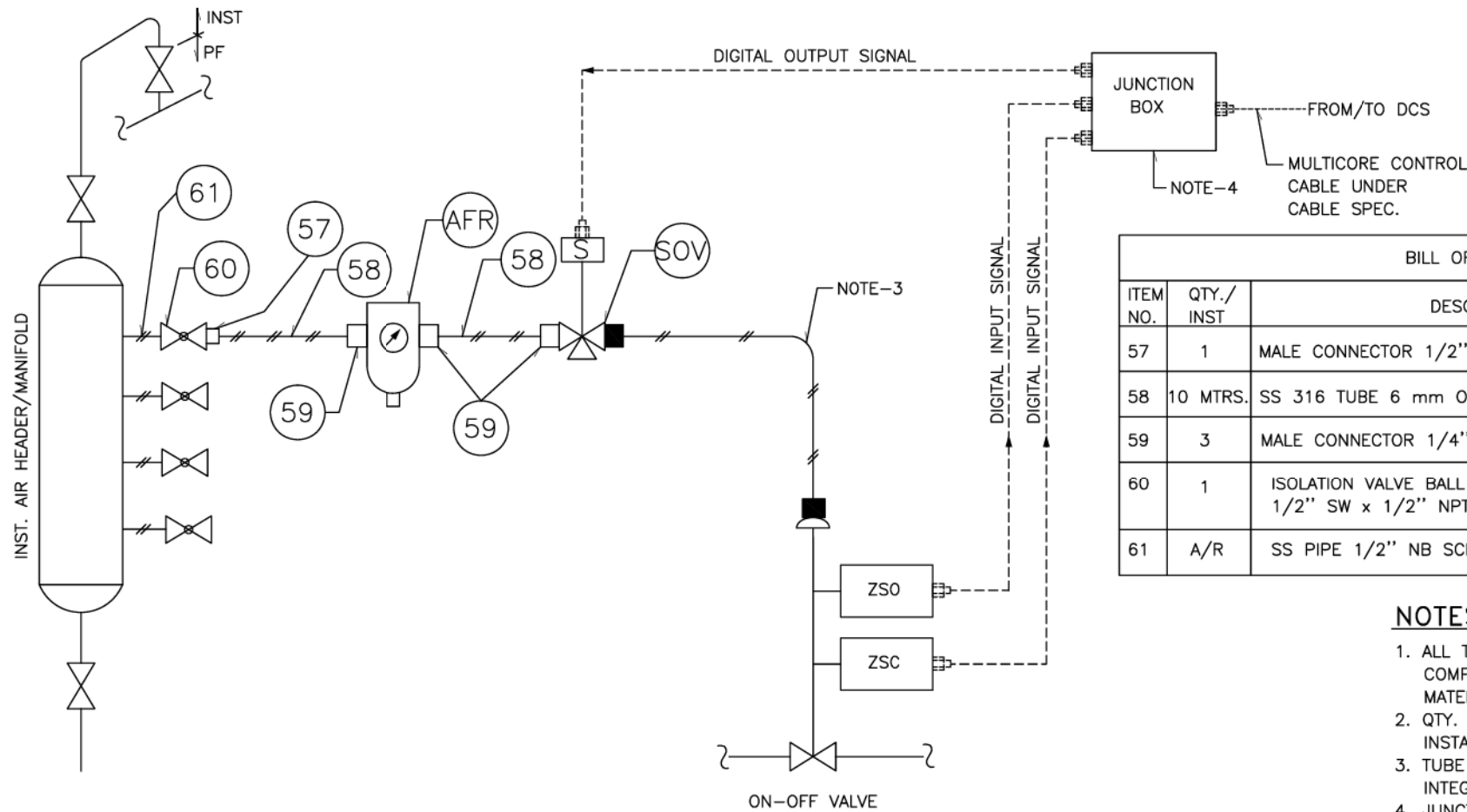
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SERVICE : FLUE GAS, PRIMARY AIR, SECONDARY AIR ETC.

1. AIR PURGING ARRANGEMENT SHALL BE INCLUDED.

DO NOT SCALE

ISSUE	REVISIONS					BY	CLEARED				APPD	DATE	FOR RO ISSUE ONLY			MAHAGENCO MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT TYPICAL INSTRUMENT INSTALLATION DIAGRAM	TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	
							CHEM	CIVIL	ELEC	I&C			MECH	CLEARED				
	DEPT	SIGNATURE	DATE															
	CHEM																	
	CIVIL																	
	ELEC																	
	I&C																	
MECH																		



BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
57	1	MALE CONNECTOR 1/2"NPT(M) x 6mm OD COMPRN.
58	10 MTRS.	SS 316 TUBE 6 mm OD x 1.0mm THK.
59	3	MALE CONNECTOR 1/4"NPT(M) x 6mm OD COMPRN.
60	1	ISOLATION VALVE BALL TYPE 600 lbs 1/2" SW x 1/2" NPT(F), SS 316.
61	A/R	SS PIPE 1/2" NB SCH 40S.

NOTES:

- ALL TUBE FITTINGS ARE OF DOUBLE COMPRESSION TYPE AND OF SS 316 MATERIAL.
- QTY. SHOWN ARE TYPICAL FOR ONE INSTALLATION ONLY.
- TUBE & FITTINGS MARKED ARE ■ INTEGRAL TO THE VALVE.
- JUNCTION BOX WILL BE INTEGRAL TO ACTUATOR.
- ISOLATION VALVE SHALL BE INSTALLED CLOSE TO THE VALVE ASSEMBLY.

FOR BID PURPOSE ONLY

LEGEND:

A/R - AS PER REQUIREMENT
SOV - SOLENOID VALVE
AFR - AIR FILTER REGULATOR

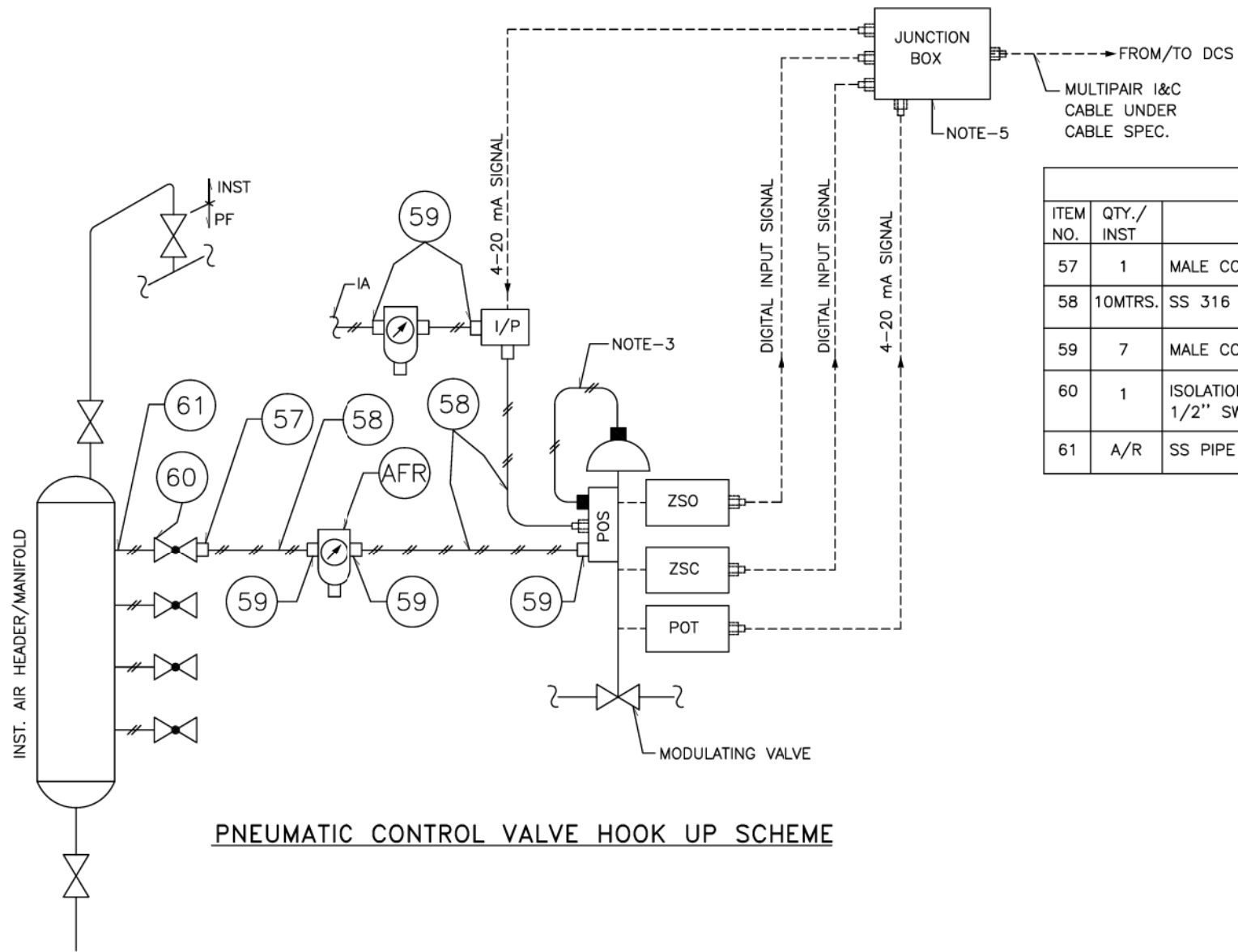
PNEUMATIC SOV HOOK UP SCHEME

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY			1" (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION. BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 1" (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN "HOLD" IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR "HOLD" IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK. DRAWINGS SIGNED BY PROCON ENGINEERS' AUTHORIZED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE	

MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	TYPICAL INSTRUMENT INSTALLATION DIAGRAM

TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.

DO NOT SCALE



PNEUMATIC CONTROL VALVE HOOK UP SCHEME

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
57	1	MALE CONNECTOR 1/2" NPT(M) x 6mm OD COMPRN.
58	10MTRS.	SS 316 TUBE 6mm OD x 1mm THK.
59	7	MALE CONNECTOR 1/4"NPT(M) x 6mm OD COMPRN.
60	1	ISOLATION VALVE BALL TYPE 600 lbs 1/2" SW x 1/2" NPT(F), SS 316.
61	A/R	SS PIPE 1/2" NB SCH 40S.

LEGEND:

A/R - AS PER REQUIREMENT
 POT - POSITIONER TRANSMITTER
 AFR - AIR FILTER REGULATOR
 IA - INSTRUMENT AIR

NOTES:

- ALL TUBE FITTINGS ARE OF DOUBLE COMPRESSION TYPE AND OF SS 316 MATERIAL.
- QTY. SHOWN ARE TYPICAL FOR ONE INSTALLATION ONLY.
- TUBE & FITTINGS MARKED ARE INTEGRAL TO THE VALVE.
- LIMIT SWITCHES WILL BE CONNECTED WHEREVER APPLICABLE.
- JUNCTION BOX WILL BE INTEGRAL TO ACTUATOR.
- ISOLATION VALVE SHALL BE INSTALLED CLOSE TO THE VALVE ASSEMBLY.

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY	
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED	
										DEPT	SIGNATURE
										CHEM	
										CIVIL	
										ELEC	
										I&C	
										MECH	

MAHARASHTRA STATE POWER GENERATION CO.LTD.
 BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT
 TYPICAL INSTRUMENT
 INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
 CW TREATMENT PLANT
 1X660MW BHUSAWAL TPS-UNIT:6
 MAHARASHTRA, INDIA.**

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

ERRECTION HARDWARE

**TECHNICAL SPECIFICATION FOR
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MAHARASHTRA, INDIA.**

~~Above 4 Pairs, 4 Pairs making a unit shall have indelible printed colour coded bands like Pink for 1st unit, Orange for 2nd unit and Violet for 3rd unit and so on. In addition band marking, for example single band for 1st. unit, double band for 2nd. unit and so on, shall be provided on each conductor for identification of unit. Band marking on individual core shall be provided at regular intervals not exceeding 50 mm.~~

~~10.6 Cables near high temperature zone shall be capable of withstanding high temperature and terminated in junction box / panel in normal temperature zone. Teflon insulated and sheathed thermocouple extension cables and copper conductor cables shall be used in high temperature zone. Conductor and sheath shall be extruded FEP (Teflon) as per VDE 0207 Part 6 and ASTM D 2116. These cables shall be pair, multipair, triad, multitriad and twisted & shielded.~~

~~10.7 CONTROL & POWER CABLE~~

~~Bidder shall refer to Volume IVB of the electrical specification for detail.~~

11.0 ERECTION HARDWARE

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

11.1 ELECTRICAL ACCESSORIES

Electrical conduit and associated materials shall conform to the requirements of the articles which follow:

(a) Rigid Steel Conduit

- (i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
- (ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.

**TECHNICAL SPECIFICATION FOR
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MAHARASHTRA, INDIA.**

- (iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with ANSI C 80.1 and UL6. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.
- (iv) All conduit fittings shall conform to the requirements of ANSI C 80.4 and UL-514 where these standards apply.
- (b) Flexible Conduit
 - (i) Flexible conduit shall be of three-layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.
 - (ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.
- (c) Special Fittings
 - (i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.
 - (ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

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11.1.1 Electrical Junction Box

- | | | | |
|-----|-----------------------|---|--|
| (a) | Type of Enclosure | : | Dust tight & weatherproof conforming to IP 65. |
| (b) | Material | : | 3 mm sheet steel |
| (c) | Type of Cover | : | Solid unhinged with retention chain. |
| (d) | Paint | : | External - RAL 7032, Internal – Brilliant White. |
| (e) | Mounting | : | Surface |
| (f) | Cable Entry | : | 3 mm (min) Gland plate |
| (g) | Gasket | : | Neoprene |
| (h) | Grounding | : | Brass earth lug with green screw head
External-2 nos , Internal-1no.M6. |
| (i) | Number of Drain Holes | : | Two at bottom capped. |
| (j) | Identification | : | Label for JB and Tags for cable. |
| (k) | Accessories | : | (i) Rail mounted cage clamp type
screwless terminals with markers. |
| | | : | (ii) Cable gland |
| | | : | (iii) Ferrules |
| | | : | (iv) Canopy at top |

11.1.2 Cable Gland

- | | | | |
|-----|--------------|---|--------------------|
| (a) | Type | : | Double compression |
| (b) | Entry Thread | : | NPT |

**TECHNICAL SPECIFICATION FOR
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- (c) Material : Brass
- (d) Finish : Cadmium Plated
- (e) Protection : IP 54 or better
- (f) Accessories : Neoprene gasket, locknuts, reducers etc.

11.1.3 Cable Tray

- (a) Material : Mild steel, slotted
- (b) Thickness : not less than 2.0 mm
- (c) Finish : Hot dip galvanized
- (d) Perforation : As per MFR standard
- (e) Cover : Suitable for tray

11.2 PROCESS HOOK UP ACCESSORIES & SPECIFICATION

Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner's approval.

11.2.1 Seamless Stainless Steel Pipe

- (a) Reference : ASTM A-312 TP 316
- (b) Material Grade : TP 316
- (c) Type : Seamless /Plain end
- (d) Size : ½" NB
- (e) Schedule : 40
- (f) Standard Length : 5 meter

**TECHNICAL SPECIFICATION FOR
DM PLANT
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11.2.2 Stainless Steel Pipe Fittings

- | | | | |
|-----|------------------|---|--|
| (a) | Reference | : | ASTM A-182 F 316 / ANSI B16.11 |
| (b) | Type | : | Forged |
| (c) | Rating | : | 3000 lbs / 6000 lbs / 9000 lbs |
| (d) | Size | : | ½" NB |
| (e) | End connection | : | Generally socket weld |
| (f) | Type of Fittings | : | Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. |

11.2.3 Seamless Stainless Steel Tube

- | | | | |
|-----|----------------|---|--|
| (a) | Reference | : | ASTM A-213 TP 316 |
| (b) | Material Grade | : | TP 316 |
| (c) | Size | : | ½" OD X 2.1 MM Thick |
| (d) | Type | : | Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube. |
| (e) | Properties | : | The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80. |
| (f) | Test Pressure | : | 400 Kg/Sq. cm (minimum) |
| (g) | Tolerance | : | ± 0.13 mm for outside diameter |

**TECHNICAL SPECIFICATION FOR
DM PLANT
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$\pm 15\%$ for wall thickness.

- (h) Standard Length : 5 meter
- (i) Test : Flare, Hardness, Ball and Bubble Test.

11.2.4 Stainless Steel Tube Fittings

- (a) Reference : ASTM-A-182
- (b) Type : Double ferrule double compression.
- (c) Material : 316 Stainless steel forged.
- (d) Ferrule : 316 Stainless Steel.
- (e) Type of Fittings : Male/female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation.
- (f) Size : To suit SS tubing and NPT end connection.

11.2.5 C.S. Pipe

- (a) C.S. Pipe : ASTM-A 106 Gr. C
- (b) Material : Cold drawn seamless black C.S
- (c) Type : Seamless/Plain ends.
- (d) Size : $\frac{1}{2}$ " NB
- (e) Schedule : 80, 160, XXS as required.
- (f) Standard Length : 6 meter

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11.2.6 C.S. Pipe Fittings

- | | | |
|----------------------|---|--|
| (a) Reference | : | ASTM-A 105/ANSI B16.11 |
| (b) Type | : | Forged |
| (c) Rating | : | 3000 lbs/6000 lbs/9000 lbs |
| (d) Size | : | ½" NB |
| (e) End connection | : | Generally socket weld. |
| (f) Type of Fittings | : | Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. |

11.2.7 A.S. Pipe

- | | | |
|---------------------|---|------------------------------------|
| (a) Reference | : | ASTM-A 335 P22 AS PER ANSI B 36.10 |
| (b) Material | : | Cold drawn seamless A.S |
| (c) Type | : | Seamless / Plain ends |
| (d) Size | : | ½" NB |
| (e) Schedule | : | XXS |
| (f) Standard Length | : | 5 meter |

11.2.8 A.S. Pipe Fittings

- | | | |
|---------------|---|------------------------------------|
| (a) Reference | : | ASTM-A 182 F22 AS PER ANSI B 16.11 |
| (b) Type | : | Forged |
| (c) Rating | : | 9000 lbs |
| (d) Size | : | ½" NB |

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- | | | | |
|---------|-----------------------------|---|--|
| | (e) End connection | : | Generally socket weld |
| | (f) Type of Fittings | : | Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. |
| 11.2.9 | Carbon Steel Globe Valve | | |
| | (a) Reference | : | ASTM A-105 |
| | (b) Type | : | Globe |
| | (c) Construction | : | Forged Body Cadmium Plated. |
| | (d) End Connection | : | ½" Socket Weld |
| | (e) Rating | : | CL. 800 / CL. 2500 |
| | (f) Material | : | Body - Carbon steel
Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited |
| | (g) Packing | : | Teflon / Grafoil as required |
| | (h) Yoke | : | ASTM A105 |
| | (i) Handwheel | : | Carbon steel |
| | (j) Design standard | : | As per ANSI B 16.34 |
| 11.2.10 | Stainless Steel Globe Valve | | |
| | (a) Reference | : | ASTM A-182 F316 |
| | (b) Type | : | Globe |
| | (c) Construction | : | Forged Body |
| | (d) End Connection | : | Socket Weld |
| | (e) Proof Pressure | : | 400 Kg/Cm2 |
| | (f) Material | : | Body - Stainless steel |

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Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited

- (g) Packing : Teflon as required
- (h) Yoke : ASTM A182 F316
- (i) Handwheel : Carbon steel
- (j) Design standard : As per ANSI B 16.34

11.2.11 Alloy Steel Globe Valve

- (a) Reference : ASTM A-182 F22
- (b) Type : Globe
- (c) Construction : Forged Body
- (d) End Connection : ½" Socket Weld
- (e) Rating : CL. 2500
- (f) Material : Body - Alloy steel
Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited

- (g) Packing : Grafoil as required
- (h) Yoke : ASTM A182 F22
- (i) Handwheel : Carbon steel
- (j) Design standard : As per ANSI B 16.34

11.2.12 Condensate Pot

- (a) Reference : ASTM A182 F22 / ASTM A105
- (b) Material : Alloy steel/carbon steel as per applicatio

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- (c) Construction : Drilled from bar stock
- (d) End connection : 3 nos. ½" socket weld end
- (e) Accessories : Vent valves

11.2.13 Instrument Valve Manifold

- (f) Type : (i) Two valve manifold
: (ii) Five valve manifold
- (g) Mounting : Remote 2" Pipe Mounting
- (h) Construction : Single block (bar stock)
- (i) Material : Forged body and bonnet AISI 316 stainless steel.
- (j) Ports : 1/2 " NPT (F)
- (k) Rating : 420 Kg/Sq. cm at ambient
- (l) Operating Temperature : (-) 30 to (+) 170 Deg C
- (m) Packing : PTFE Wafer
- (n) Seat & Stem : AISI 316 SS
- (o) Plug : AISI 316 SS free to turn on stem/17-4 PH.
- (p) Handle Bar : AISI 316 SS
- (q) Connection : Straight
- (r) Accessories : (i) Plugs for all ports.
: (ii) Mounting Bracket , bolts , nuts.

**TECHNICAL SPECIFICATION FOR
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1X660MW BHUSAWAL TPS-UNIT:6
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11.3 PNEUMATIC HOOK UP ACCESSORIES

11.3.1 Air Header :

(a)	Technical Particulars	:	For Panel	For Field
(b)	Material of Construction	:	Stainless steel	Stainless steel
(c)	Inlet Connection	:	2" NPT (M)	1" NPT (M)
(d)	Header Take-off	:	Stainless steel	Stainless steel
(e)	Take off connection	:	1 / 2" NPT (M)	1/ 2" NPT (M)
(f)	Tube Take-off	:	Tube adapter on valve	Tube adapter on valve
(g)	Drain	:	SS drain valve at lowest point	SS drain valves at lowest poin

11.3.2 Seamless Stainless Steel Tube

(a)	Reference	ASTM A-269 TP 316
(b)	Material Grade	TP 316
(c)	Size	¼" OD X 0.049" wall thickness.
(d)	Type	Cold drawn annealed, pickled, passivated, de-scaled, ,hydraulically cleaned seamless tube.
(e)	Properties	The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
(f)	Test Pressure	400 Kg/Sq. cm

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MAHARASHTRA, INDIA.**

- | | | |
|-----|-----------------|---|
| (g) | Tolerance | ± 0.13 mm for outside diameter
± 15 % for wall thickness |
| (h) | Standard Length | 5 meter |
| (i) | Test | Flare, Hardness, Ball and Bubble Test |

12.0 SPECIAL TOOLS & TACKLE AND TEST EQUIPMENT FOR DCS/PLC AND OTHER SYSTEMS

- 12.1 Bidder shall supply a complete set of new, unused and reliable type of special tools and tackle and test equipment which are necessary or convenient for erection, commissioning, maintenance and overhaul of the plant and equipment provided under this specification.
- 12.2 The tools & tackle and Test Equipment shall be shipped in separate container, clearly marked with names of the equipment for which they are intended.
- 12.3 Bidder shall furnish list of tools & tackle and test equipment proposed to be supplied along with the bid.

	TITLE: TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-156-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 00	DATE:

P&ID FOR CW/ACW SYSTEM

Pipe Sizes for carbon Steel Pipes

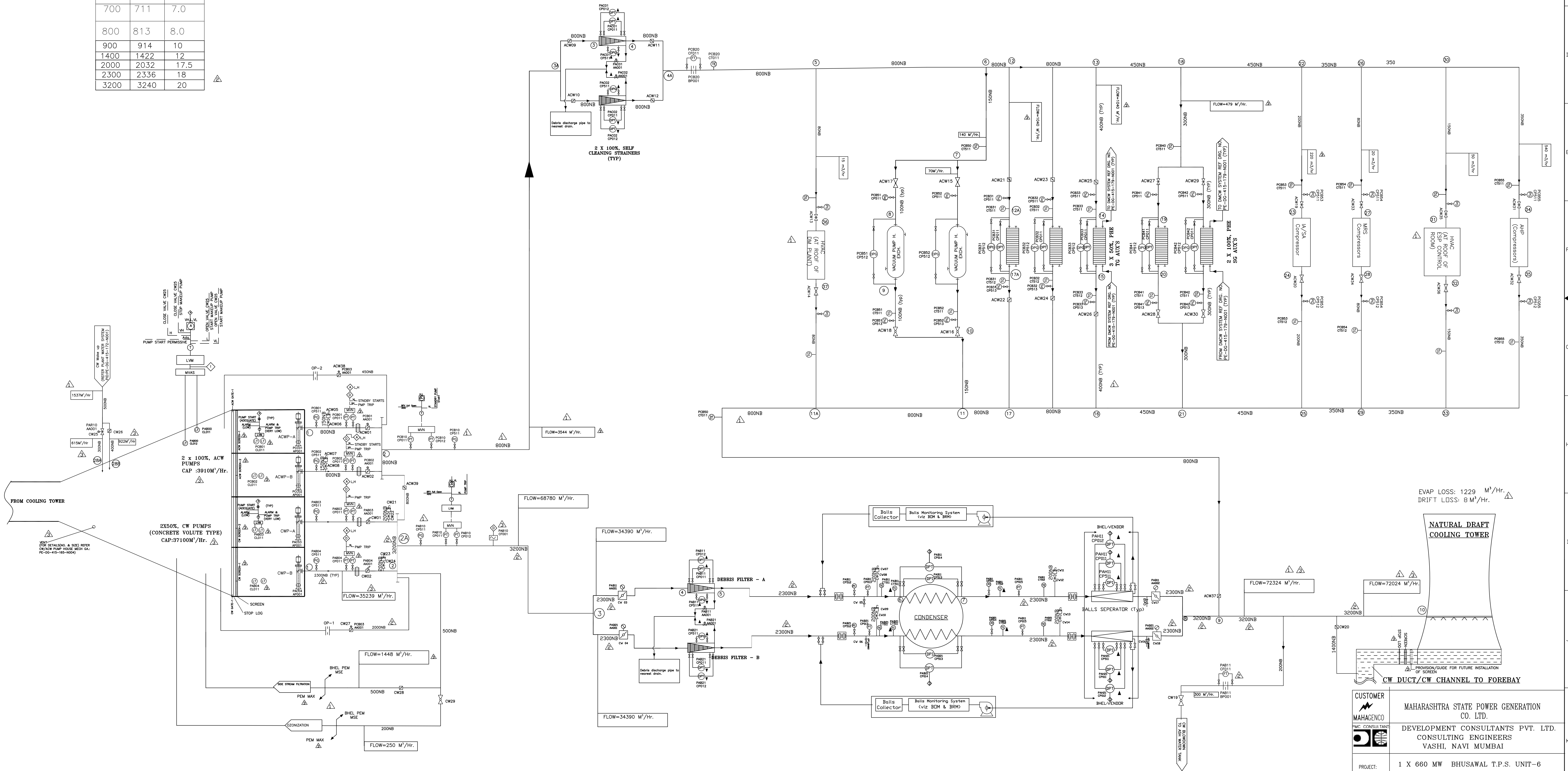
NB	OD (mm)	THICK. (mm)
100	115.0	5.4
150	166.5	5.4
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0
400	406.4	6.0
450	457.0	6.0
500	508.0	6.0
600	610.0	6.0
700	711	7.0
800	813	8.0
900	914	10
1400	1422	12
2000	2032	17.5
2300	2336	18
3200	3240	20

LEGEND	
	MOTOR OPERATED GATE VALVE
	MOTOR OPERATED BUTTERFLY VALVE
	MANUAL BUTTERFLY VALVE
	NON RETURN VALVE
	GLOBE VALVE
	AIR RELEASE VALVE
	PRESSURE GAUGE
	PRESSURE SWITCH
	PRESSURE TRANSMITTER
	DIFFERENTIAL PRESS. GAUGE
	DIFFERENTIAL PRESS. SWITCH
	DIFFERENTIAL PRESS. TRANSMITTER
	LEVEL TRANSMITTER
	BYPASS/ ONLINE ROTAMETER
	TEMPERATURE ELEMENT
	TEMPERATURE GAUGE
	DCS
	ALARM
	ORIFICE PLATE
	R.E. JOINT (STD.)
	VERTICAL PUMP
	ULTRASONIC FLOW TRANSMITTER
	LVM - LIMIT VALUE MONITOR
	MVAS- MEAN VALUE AUTO SELECTION
	INDICATION
	TYP - TYPICAL
	ELECTRO-HYDRAULIC ACTUATOR OPERATED BFV

S.NO.	EQUIPMENT	NOS. WORK. + STANDBY	CW REQD. PER COOLER CUB.M/Hr.	CW REQD. PER UNIT CUB.M/Hr.	PRESS. DROP MWC	TEMP. RISE °C	REMARKS
1	CONDENSER	1 + 0	68780	68780	3.27	9.96	
2	VACUUM PUMPS	1 + 1	70	140	3.5	2.0	
3	PHE'S (TG AUX)	2 + 1	1040	2080	8	8.5	
4	PHE'S (SG AUX)	1 + 1	479	479	8	5.9	
5	AHP COMPRESSOR	-	-	540	10	5.5	
6	IA/SA COMPRESSOR	-	-	220	10	10	
7	MRS	-	-	20	10	10	

NOTES:

- DESIGN PRESSURE : 5.0 Kg/cm² (g) FOR C.W.SYSTEM.
DESIGN PRESSURE : 7.5 Kg/cm² (g) FOR A.C.W.SYSTEM.
DESIGN CW INLET TEMP. TO CONDENSER & VACUUM PUMP HEAT EXCH. = 32 °C
DESIGN CW INLET TEMP. TO PHE'S = 36 °C
DESIGN MECHANICAL TEMPERATURE : 60 °C
- MATERIALS OF CONSTRUCTION:
 - PIPING UPTO AND INCLUDING 150NB SHALL BE CARBON STEEL, ERW, IS-1239 (HEAVY GRADE)
 - PIPING > 150NB SHALL BE CARBON STEEL (IS-2062), ROLLED AND WELDED, CONFORMING TO IS-3559
 - ALL PRESSURE TAPPINGS & ROOT VALVES TO BE OF 15 NB.
 - CW SYSTEM : 150 NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED AS REQD. AS PER LAYOUT.A.C.W SYSTEM : 50 NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE. 25 NB DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES UPTO 350 NB AS PER LAYOUT REQUIREMENTS.
- INSTRUMENTS MARKED - * THIS SHALL BE SUPPLIED ALONGWITH THE EQUIPMENTS.
- ADDITIONAL AIR RELEASE VALVES (200 NB) SHALL BE PROVIDED, IF REQUIRED AS PER SURGE STUDIES.
- PAINTING/PROTECTION - PIPES:
 - EXTERNAL SURFACE - OVERGROUND PIPING
 - A) SURFACE CLEANING BY WIRE BRUSH SURFACE PREPARATION AS PER S.A.S.2.
 - B) APPLICATION OF ONE COAT OF RED LEAD PRIMER FOLLOWED BY ADEQUATE NO. (2 to 3) OF FINISH COATS OF SYNTHETIC ENAMEL PAINT TO ACHIEVE TOTAL DRY FILM THICKNESS OF 150-200 MICRONS.
 - C) UNDERGROUND PROTECTION SHALL BE AS "ONE COAT" OF COAL TAR PRIMER (MIN. 2 MM) OF APPROVED QUALITY FOLLOWED BY A FINAL COATING OF EPOXY RESIN & COAL TAR BLEND (MIN 1 MM) AND THEN TWO LAYERS, EACH 2MM THICK OF COAL TAR TAPE AS OUTER WRAP".
 - D) CW PIPE BURIED PORTION COMING UNDER RAIL OR ROAD SHALL BE CONCRETE ENCASED.
- REFERENCE DRAWINGS/DOC:
 - DCW SYSTEM P&ID: PE-50-415-179-N001
 - DCW SYSTEM DESIGN PHILOSOPHY & SYSTEM WRITEUP: PE-DC-415-179-N002
 - SA OF NDCI: PE-VI-415-116-N001
- PORTABLE SUMP PUMP MAY BE USED FOR EMPTYING CW PIPE.



03	REVISED INLINE WITH RESOLUTION OF ERM DATED 24-25/4/19	NK	NR	AJ	10/5/19	
02	REVISED INLINE WITH CUSTOMER COMMENTS	NK	NR	AJ	23/01/19	
01	REVISED INLINE WITH CUSTOMER COMMENTS	NK	NR	AJ	16/07/18	
REV.	REASONS FOR REVISION	DRAWN	CHECKED	APPROVED	DATE	
TITLE						DEPT. SCALE
DRAWING NO.						PE-DG-415-165-N001
SHEET						1 OF 1 REV. 3

CUSTOMER	MAHARASHTRA STATE POWER GENERATION CO. LTD.
	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI, NAVI MUMBAI
PROJECT:	1 X 660 MW BHUSAWAL T.P.S. UNIT-6
	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NODA

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DEPT.	CDN	NAME	SIGN
CDN	NAME	CDN	NAME
APPD	NAME	APPD	NAME



TITLE:

TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

BHEL DOCUMENTS NO.: PE-TS-415-156-A001

VOLUME **III**

REV. NO. 00

LIST OF SCHEDULES


TITLE:

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SPEC NO: PE-TS-415-156-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

SL. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (week)	SIZE
CW TREATMENT				
1	PE-V0-415-156-A001	P&I DIAGRAM OF CW TREATMENT PLANT	4	A1
2	PE-V0-415-156-A002	EQUIPMENT LAYOUT OF CW TREATMENT PLANT	4	A1
3	PE-V0-415-156-A003	PROCESS SIZING CALCULATION	4	A4
4	PE-V0-415-156-A004	TECHNICAL DATA SHEET FOR METERING PUMPS OF CW TREATMENT PLANT	10	A4
5	PE-V0-415-156-A005	INSTRUMENT SCHEDULE OF CW TREATMENT PLANT	10	A4
6	PE-V0-415-156-A006	CABLE SCHEDULE FOR CW TREATMENT PLANT	12	A4
7	PE-V0-415-156-A007	ERECTION PROCEDURE OF CW TREATMENT PLANT	14	A4
8	PE-V0-415-156-A008	CABLE TRAY / TRENCH LAYOUT & CONDUIT ROUTING DRG. ALONG WITH EARTHING LAYOUT FOR CW TREATMENT PLANT	12	A1
9	PE-V0-415-156-A009	PIPING LAYOUT FOR CW TREATMENT PLANT	10	A1
10	PE-V0-415-156-A010	GA & WIRING DIAGRAM FOR CONTROL PANEL OF CW TREATMENT PLANT	12	A4
11	PE-V0-415-156-A011	GA DRAWING OF ALL TANKS/ VESSELS OF CW TREATMENT PLANT	8	A3
12	PE-V0-415-156-A012	VALVE SCHEDULE OF CW TREATMENT PLANT	10	A4
13	PE-V0-415-156-A013	O&M MANUAL OF CW TREATMENT PLANT	24	A4
14	PE-V0-415-156-A014	Electrical load data OF CW TREATMENT PLANT	8	A4
15	PE-V0-415-156-A015	PG test procedure for CWTP	20	A4
16	PE-V0-415-156-A016	DATA SHEET OF HORIZONTAL CENTRIFUGAL PUMPS OF CW TREATMENT PLANT	10	A4
17	PE-V0-415-156-A017	Cable schedule OF CW TREATMENT PLANT	12	A4
18	PE-V0-415-156-A018	Manufacturing quality plan for dosing pumps with motor OF CW TREATMENT PLANT	10	A4
19	PE-V0-415-156-A019	QAP FOR TANKS/ VESSELS OF CW TREATMENT PLANT	8	A4
20	PE-V0-415-156-A020	DATA SHEET OF MOTOR OF CW TREATMENT PLANT	10	A4
21	PE-V0-415-156-A021	DATA SHEET FOR INSTRUMENTS OF CW TREATMENT PLANT	10	A4
22	PE-V0-415-156-A022	Manufacturing quality plan for horizontal centrifugal pumps with motor OF CW TREATMENT PLANT	10	A4
23	PE-V0-415-156-A023	DATA SHEET AND GA FOR LOCAL CONTROL PANEL	16	A4

1. Any additional drawings-documents required during detailed engineering stage shall be provided by bidder without any commercial, technical and delivery implication to BHEL and customer.

2. Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure IV of this specification. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link

(<http://124.124.36.198/wrenchwebaccess/login.aspx>)”

• DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

• For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

3. Re-submission of drawing/document shall be done within 10 days by supplier.



TITLE:

TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

SPEC NO: PE-TS-415-156-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL
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DEVIATION SHEET (COST OF WITHDRAWL)									
 PROJECT:-1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA PACKAGE:- CW TREATMENT PLANT									
TENDER ENQUIRY REFERENCE:-									
NAME OF BIDDER:-									
SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME				DESIGNATIONS		SIGN & DATE			
NOTES:									
1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.									
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.									
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.									
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.									
6. Bidder shall furnish price copy of above format along with price bid.									
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.									
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.									
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.									
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.									
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.									
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.									
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									



TITLE:

**TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

SPEC NO: PE-TS-415-156-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

COMPLIANCE CUM CONFIRMATION SCHEDULE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.



TITLE:

TECHNICAL SPECIFICATION FOR
CW TREATMENT PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

BHEL DOCUMENTS NO.: PE-TS-415-156-A001

VOLUME III

REV. NO. 00

SUGGESTIVE PRICE FORMAT FOR CW TREATMENT PLANT FOR 1X660MW BHUSAWAL TPS-UNIT:6.

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	HSN/SAC CODE	UNIT	TOTAL PRICE FOR "FOR" SITE
(1)	(2)		(3)	(4)
1.0	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for SUPPLY PART, SERVICES PART & MANDATORY SPARES comprising of design (i.e. Preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals) , engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, Chemicals, spares for erection ,startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, minor civil works, erection & commissioning, trial run at site, complete Operation and Maintenance including O&M spares (as applicable) of CW treatment programme and carrying out performance guarantee /Functional / Demonstration tests at site (As applicable), training of customer/ client O&M staff & final handing over to end customer in flawless condition for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification No PE-TS-415-156-A001, amendment & agreements till placement of order.		SET	
2.0	BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE			
2.1	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e. Preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals) , engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, Chemicals, along with spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification No PE-TS-415-156-A001, amendment & agreements till placement of order.	84798999	SET	
2.2	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for the SERVICES PART comprising of unloading, handling, transportation & storage at site, in site transportation, assembly, minor civil works, erection & commissioning, final painting at site, trial run at site and carrying out performance guarantee /Functional / Demonstration tests at site (As applicable), training of customer/ client O&M staff & final handing over to end customer in flawless condition for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification No PE-TS-415-156-A001, amendment & agreements till placement of order.	998732	SET	
2.3	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for complete Operation and Maintenance including Operation and Maintenance spares (as required) of CW treatment system for the total scope defined as per BHEL NIT & tender technical specification No PE-TS-415-156-A001,, amendment & agreements till placement of order for Six (6) months .	998732	SET	
2.4	Total lumpsum firm price inclusive of all prevailing taxes, duties and other levies for Mandatory spares comprising of manufacture, fabrication, assembly, inspection / testing (as applicable) at vendor's & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification No PE-TS-415-156-A001, amendment & agreements till placement of order.	84798999	LOT	
Note: 1.) PG to consider and suitably incorporate taxes, duties and other commercial aspects. 2.) Bidder to quote the Prices in 'figures' along with corresponding 'words'. 3.) Payment against sl no 2.3 above shall be based on pro rata basis as per actual service availed.				



TITLE
* SCHEDULE OF DECLARATIONS

BHEL DOCUMENTS NO.: PE-TS-415-156-A001

VOL III

SHEET..... OF.....

* Bidder shall include this schedule both in technical and Price offers

DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification (except indicated in the deviation sheet (cost of withdrawal).

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Biders Company Name

Authorised representative's
Signature

Name

Bider's Name The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL