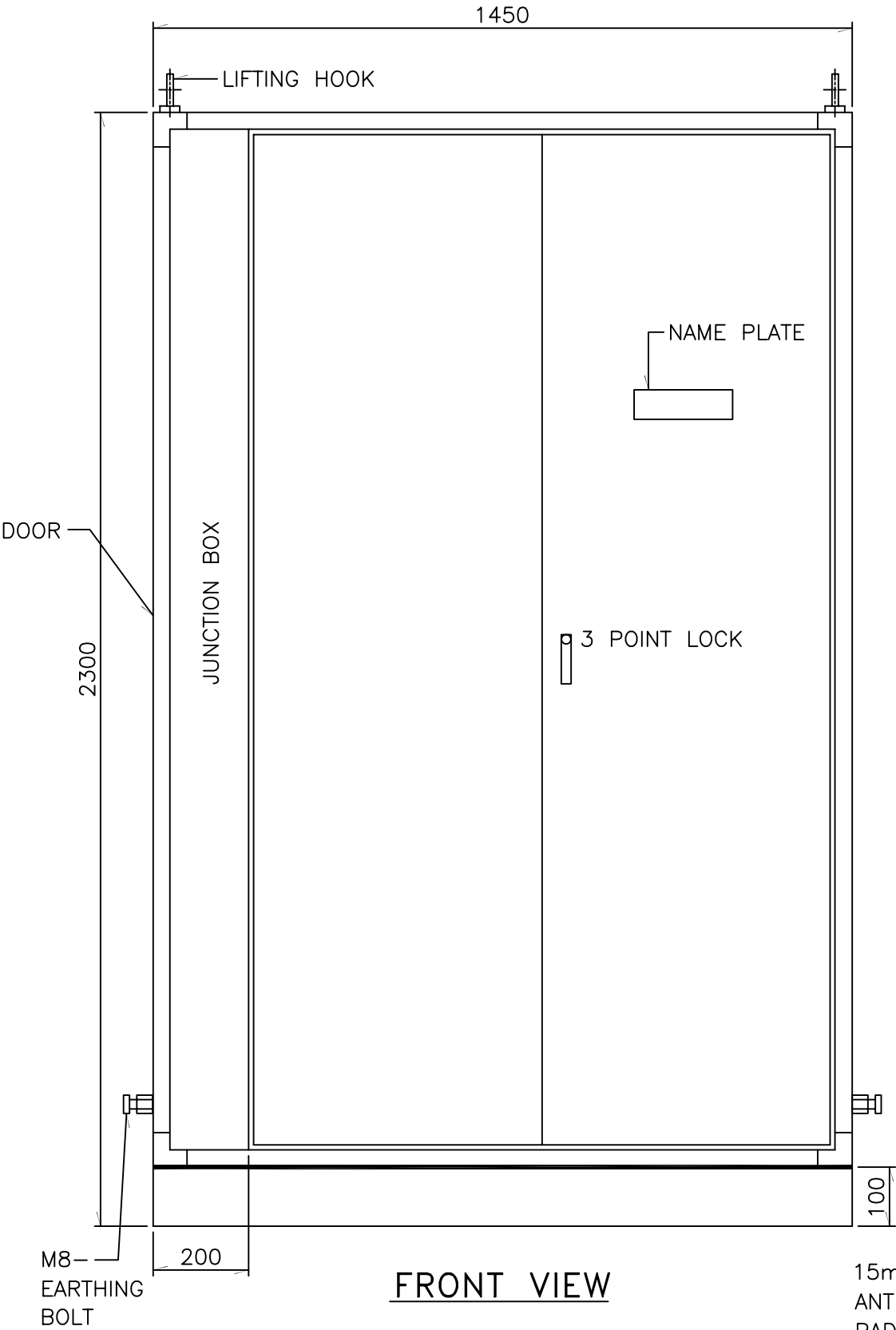
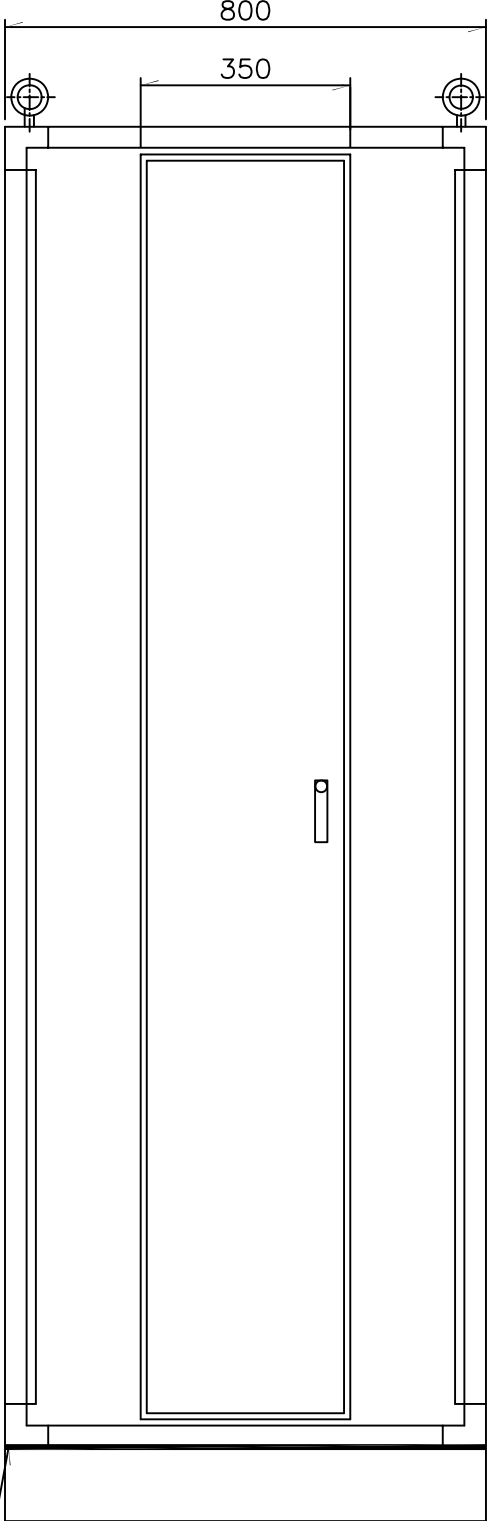


LOCAL INSTRUMENT ENCLOSURE



FRONT VIEW



LH SIDE VIEW

NOTES:

1. DIMENSIONS SHOWN ARE TENTATIVE AND SHALL BE FINALIZED AT DETAILING.
2. ALL SHEETS SHALL BE 3mm THICK CRCA SHEET.
3. ALL DOORS SHALL BE FLUSH/CONCEALED TYPE.
4. COLOR:

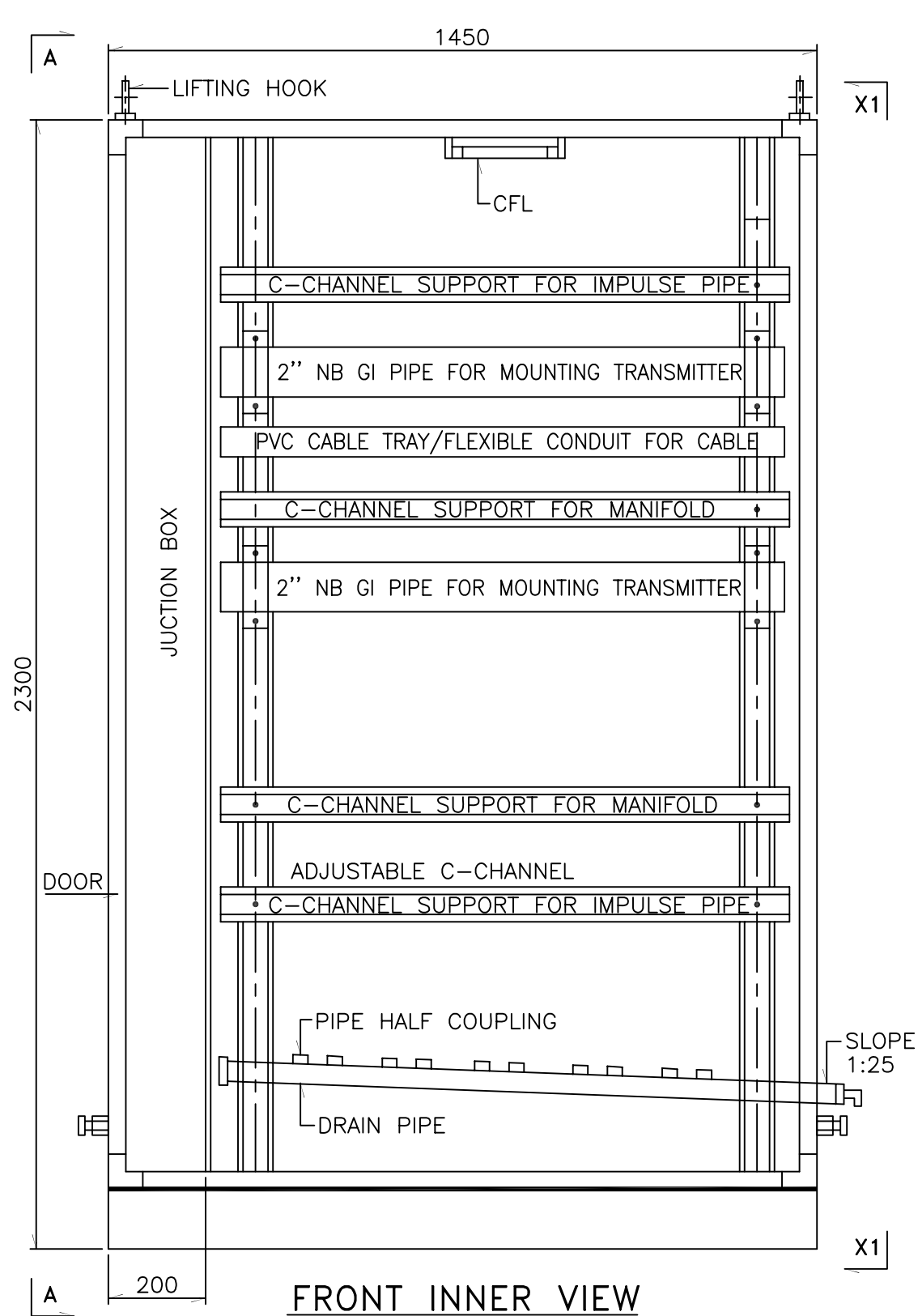
EXTERIOR : RAL 7032.

INTERIOR : BRILLIANT WHITE OVER ALL THICKNESS WILL BE > 100 MICRONS.
5. BASE FRAME WILL BE MADE OUT OF ISMC 100 AND COLOR WILL BE BLACK PAINT FINISH.
6. BULKHEAD PLATE FOR TOP AND BOTTOM SHALL BE 1150 x 650 x 6.
7. CABLE GLAND PLATE OF THICKNESS 3mm CRCA SHEET SHALL BE PROVIDED BOTTOM OF JUCTION BOX.
8. ENCLOSURE PROTECTION CLASS SHALL IP-65.
9. TERMINALS INSIDE JUCTION BOX SHALL BE SCREWLESS CAGE CLAMP TYPE.
10. DOORS SHALL BE PROVIDED WITH CONCEALED HINGES, THREE POINT LOCKING FOR FRONT, REAR AND SIDE DOOR HINGES SHALL BE OF STAINLESS STEEL.
11. XLPE GASKET SHALL BE PROVIDED BETWEEN BULKHEAD PLATE & ENCLOSURE.
12. EARTH BUSBAR 25 x 6 TINNED COPPER.
13. DRAIN PIPE SLOPE SHALL BE 1:25 APPROX.
14. COMMOMN LOCK/KEY SHALL BE PROVIDED FOR ALL LIE'S & JB'S.
15. FOUNDATION BOLTS SHALL BE PROVIDED.
16. TAG PLATES SHALL BE PROVIDED FOR EACH INSTRUMENTS.
17. INSTRUMENT TAG VIS-A-VIS SERVICE AND TERMINAL DETAILS SHALL BE PRINTED ON PHENOLIC BOARD MOUNTED ON BACK SIDE OF JUNCTION BOX DOOR.
18. 20% TERMINALS SHALL BE PROVIDED AS SPARE.
19. NAME PLATE OF PANEL SHALL BE FIXED ON FRONT DOOR.
20. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

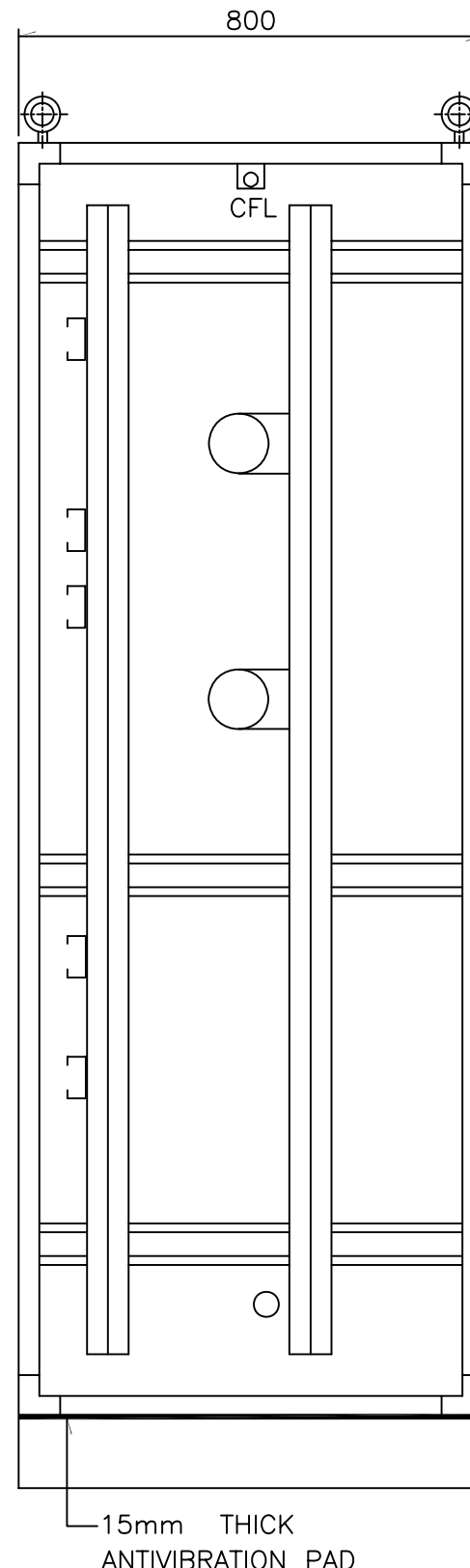
FOR BID PURPOSE ONLY

DO NOT SCALE

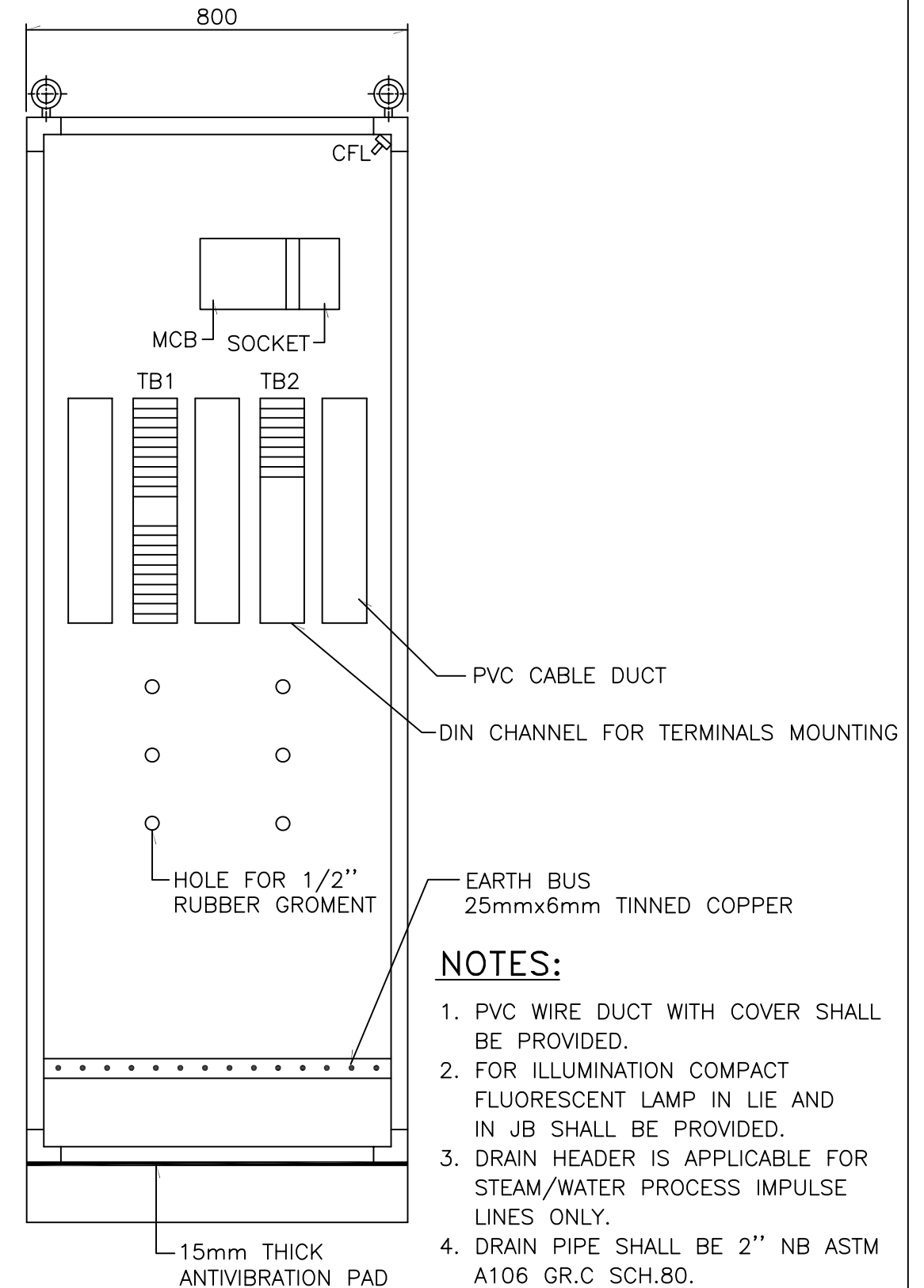
ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR R0 ISSUE ONLY			 MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT G.A. DRAWING FOR LOCAL INSTRUMENT ENCLOSURE	TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED				
										DEPT	SIGNATURE	DATE		
									CHEM					
									CIVIL					
									ELEC					
									I&C					
									MECH					



FRONT INNER VIEW



SIDE VIEW FROM X1-X1



SIDE VIEW FROM A-A

NOTES:

1. PVC WIRE DUCT WITH COVER SHALL BE PROVIDED.
2. FOR ILLUMINATION COMPACT FLUORESCENT LAMP IN LIE AND IN JB SHALL BE PROVIDED.
3. DRAIN HEADER IS APPLICABLE FOR STEAM/WATER PROCESS IMPULSE LINES ONLY.
4. DRAIN PIPE SHALL BE 2" NB ASTM A106 GR.C SCH.80.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR R0 ISSUE ONLY	
			CHEM	CIVIL	ELEC	I&C	MECH			CHEM	MECH

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 'R' (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'.

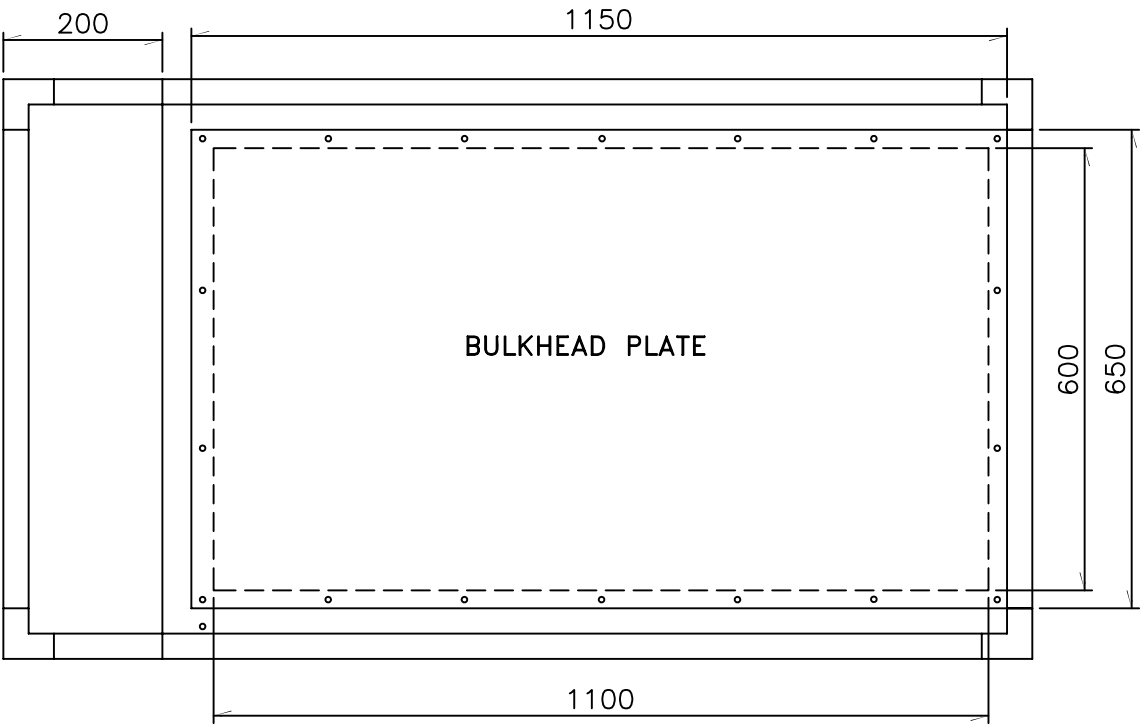
DRAWINGS SIGNED BY PROCON ENGINEERS' AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.



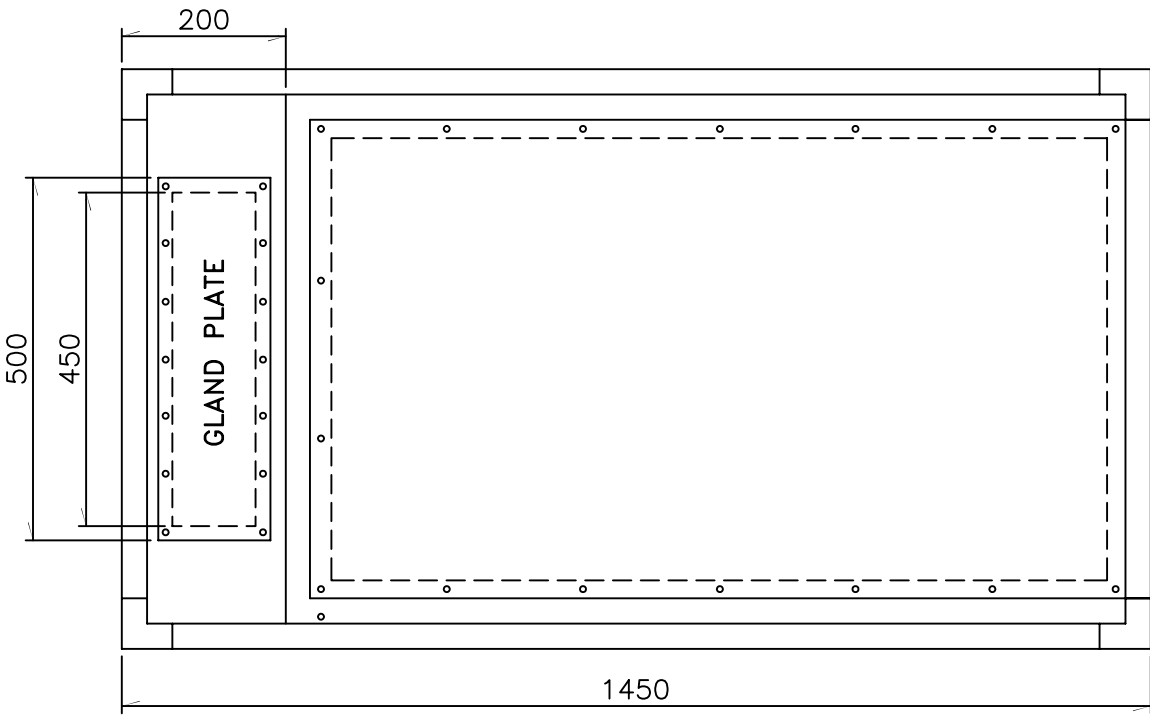
MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

INNER G.A. DRAWING FOR
LOCAL INSTRUMENT ENCLOSURE

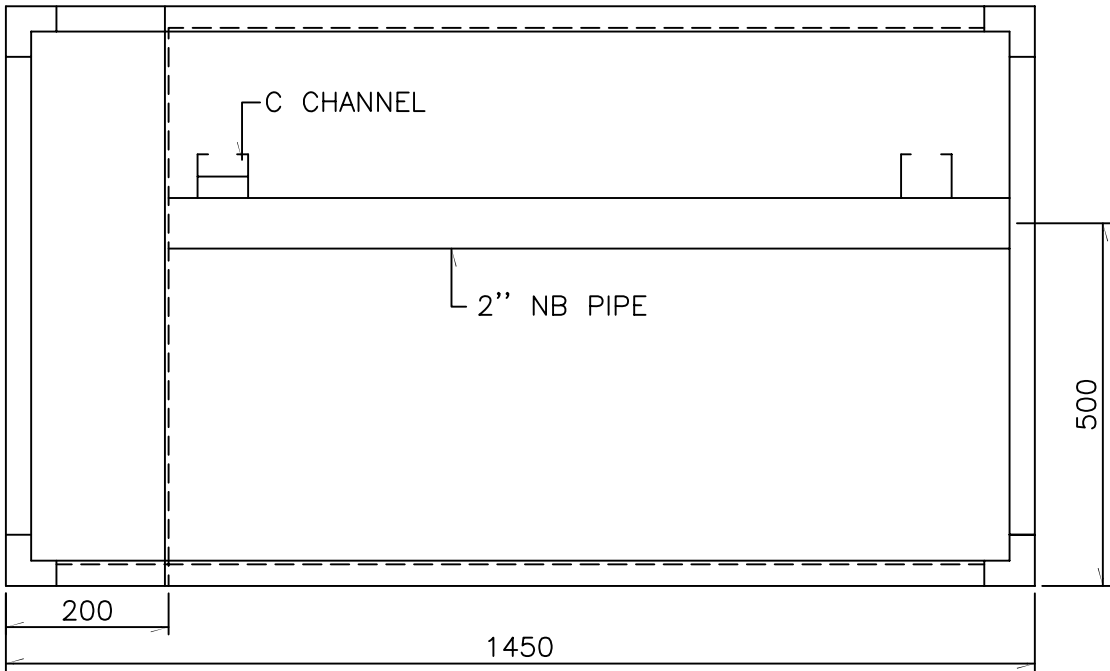
TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.



TOP VIEW



BOTTOM VIEW



TOP VIEW WITHOUT BULKHEAD PLATE

NOTES:

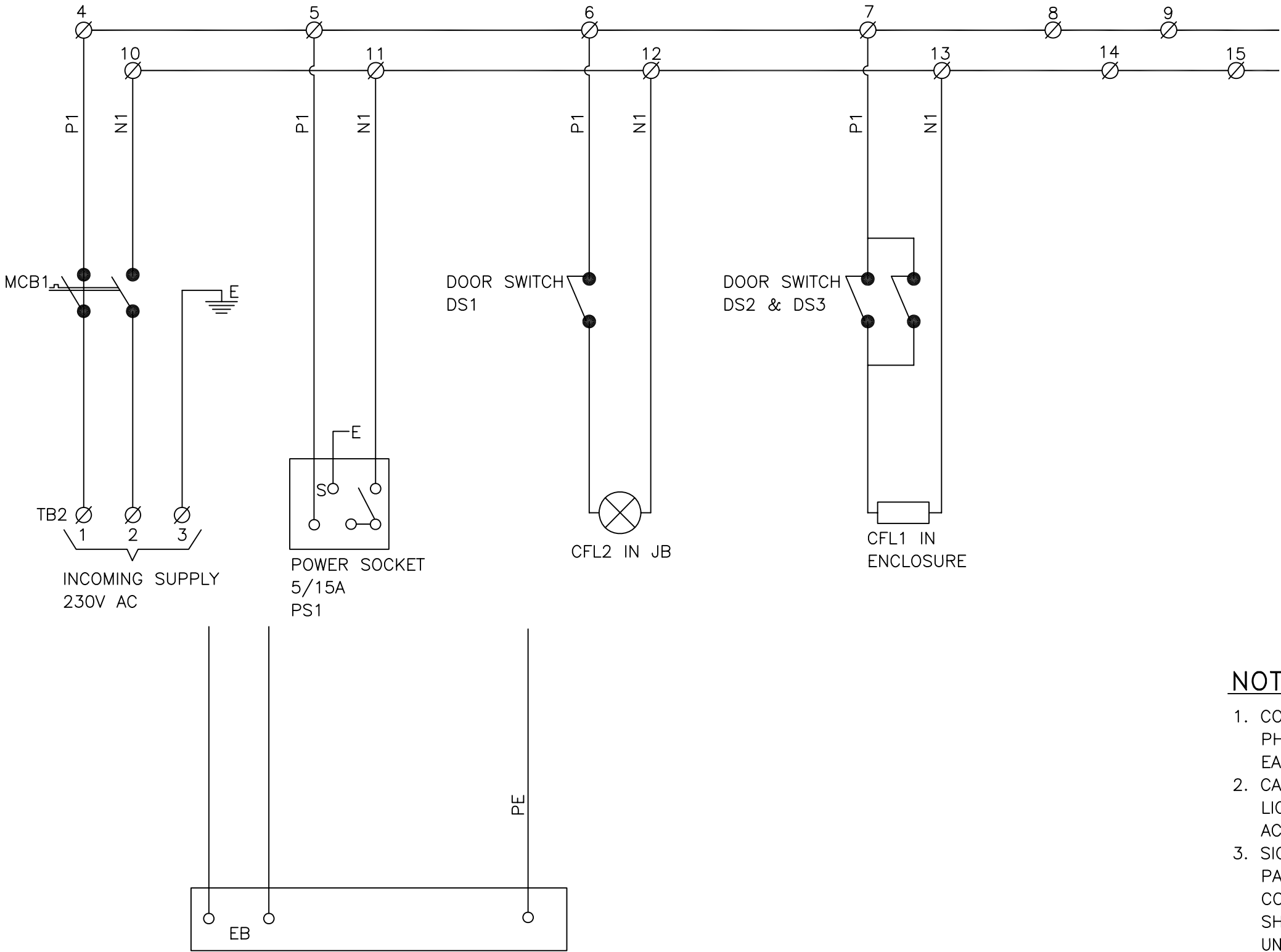
1. BULK HEAD PLATE DIMENSION ARE 1150 x 650 x 6.
2. IMPULSE PIPE ENTRY: BOTTOM ENTRY FOR AIR/FLUE GAS APPLICATIONS.
3. IMPULSE ENTRY: TOP ENTRY FOR STEAM/WATER APPLICATIONS.
4. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR R0 ISSUE ONLY			MAHAGENCO MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT BULKHEAD DETAILS FOR LOCAL INSTRUMENT ENCLOSURE	TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED				
										DEPT	SIGNATURE	DATE		
									CHEM					
									CIVIL					
									ELEC					
									I&C					
									MECH					

POWER WIRING CIRCUIT



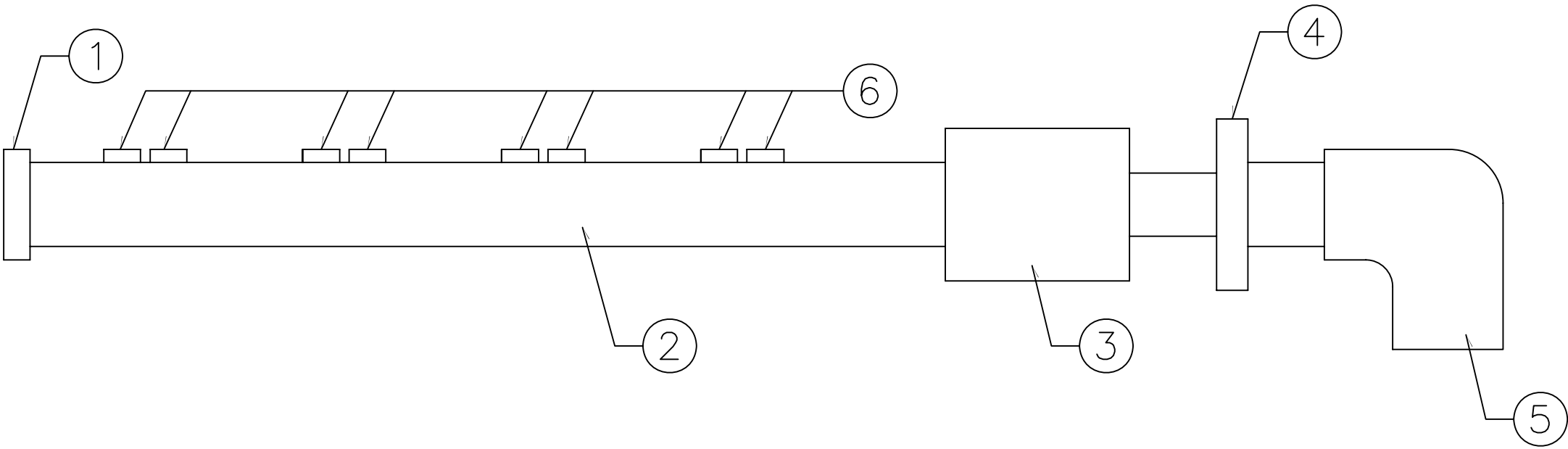
NOTES:

1. COLOR CODING FOR POWER SUPPLY: PHASE-RED, NEUTRAL-BLACK AND EARTH-GREEN.
2. CABLE ROUTING FROM TB TO PANEL LIGHT WILL BE 1.5 sq.mm 1100V AC GRADE.
3. SIGNAL WIRING WILL BE DONE BY 4 PAIR x 0.5 sq.mm ANNEALED TINNED COPPER, PAIR TWISTED OVERALL & SHIELDED, VOLTAGE GRADE 1100V, UNARMoured FRLS PVC SHIELDED CABLE.

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR R0 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 'R' (RELEASED) ISSUES ONLY. INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR 'HOLDS' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLDS'. DRAWINGS SIGNED BY PROCON ENGINEERS' AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED			
										DEPT	SIGNATURE	DATE	 MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT ELECTRICAL WIRING AND TERMINATION DRAWING FOR LOCAL INSTRUMENT ENCLOSURE
										CHEM			
										CIVIL			
										ELEC			
										I&C			
										MECH			
TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.													
CH. D.J.P. PE-189-IN-SK-8004 (SH. 9 OF 10) PO													



BILL OF MATERIAL		
SL. NO.	DESCRIPTION	QTY.
1	2" S.W. CAP, CS	1
2	2" NB, ASTM A-106, SCH 80/GR. C	1
3	2" SW x 1" NPT(F) COUPLING, CS	1
4	1" NPT(M) x 1" BSP(M) HEX. NIPPLE WITH FITTING, CS	1
5	1" BSP(F) ELBOW, CS (BOTH ENDS THREADED)	1
6	HALF COUPLING; SIZE; 1/2" NB SW	AS REQD.

FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR R0 ISSUE ONLY			 MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED				
										DEPT	SIGNATURE	DATE		
										CHEM				
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										ELEC				
										I&C				
										MECH				

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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.~~

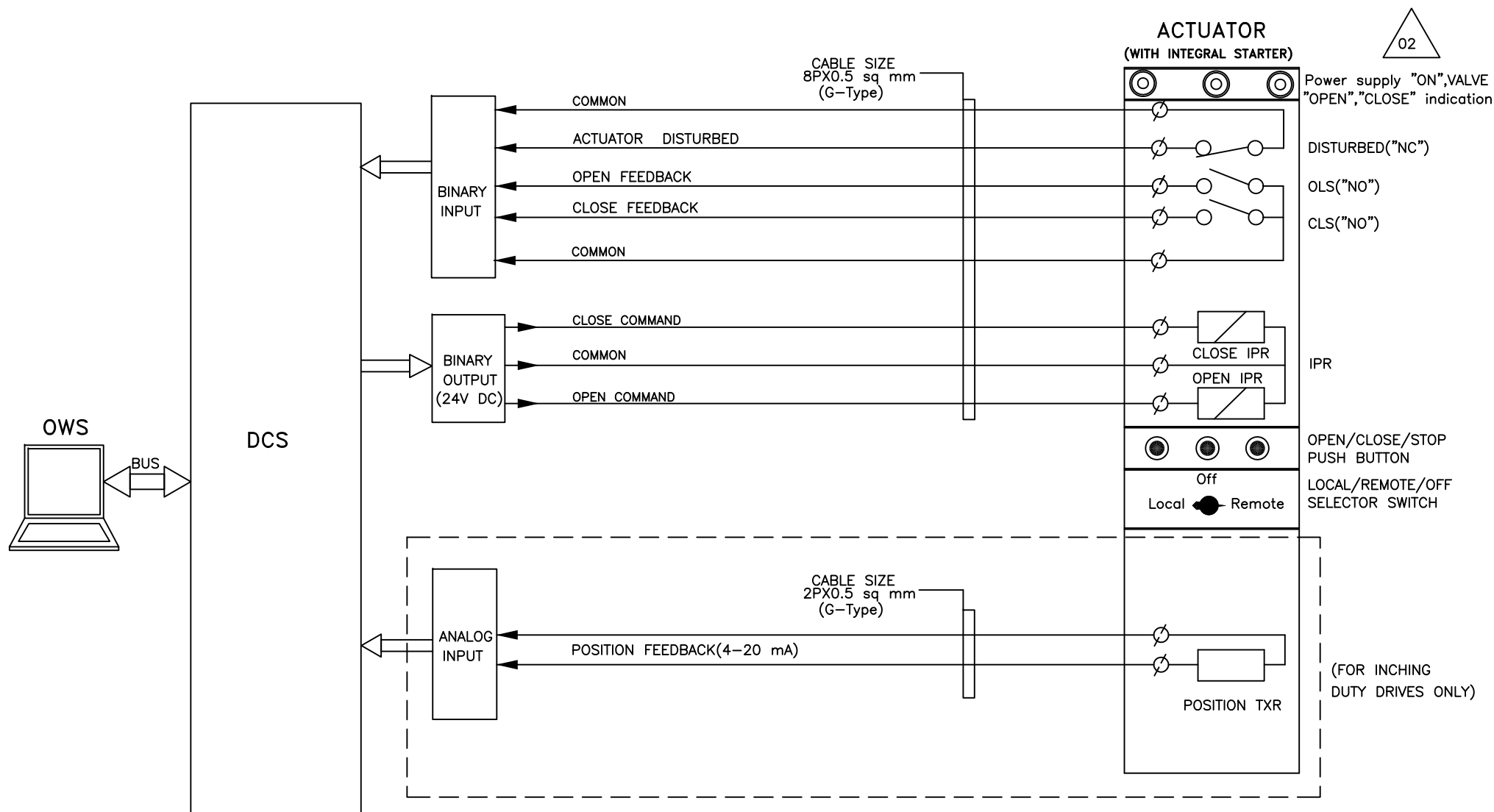
~~5.1.5 For Power supply to DCS system refer Volume V , Section 10.~~

CONSULTANT : PROCON ENGINEERS

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

DRIVE CONTROL PHILSOPHY

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)

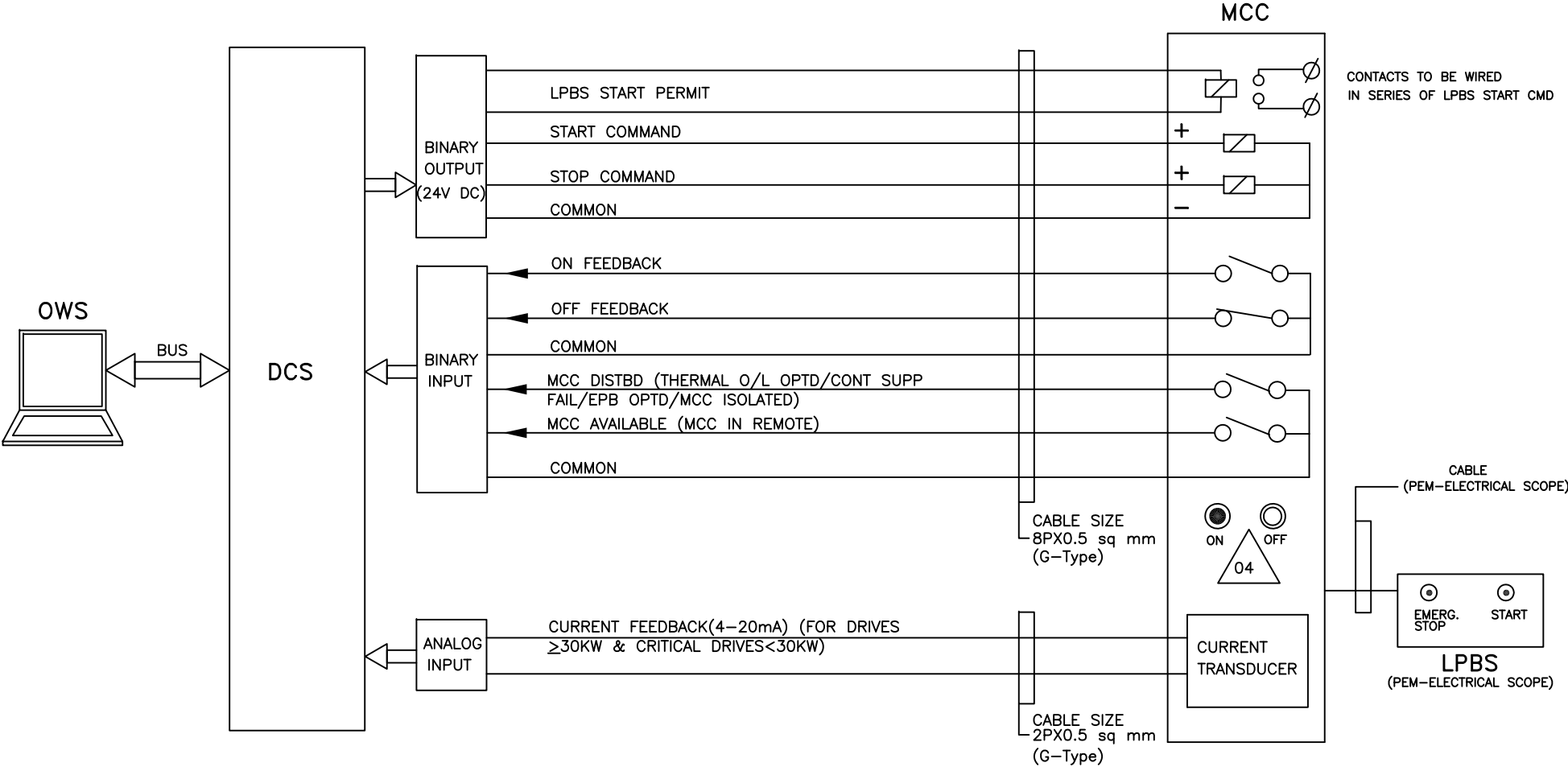


NOTE:

1. DISTURBED= Loss of Power supply (1 Phase/3 Phase),
Loss of control supply, Motor thermostate trip,
Thermal over load relay trip, Valve jammed,
Torque open/close cut off, Local/Off/Remote Sel. switch
in local or off mode etc.

	PROJECT:	1x660 MW BHUSAWAL STPP		DRG.NO.	PE-DM-415-145-1002
	TITLE	DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE		DATE	01.10.2018
				REV.NO.	04
				SHT	8

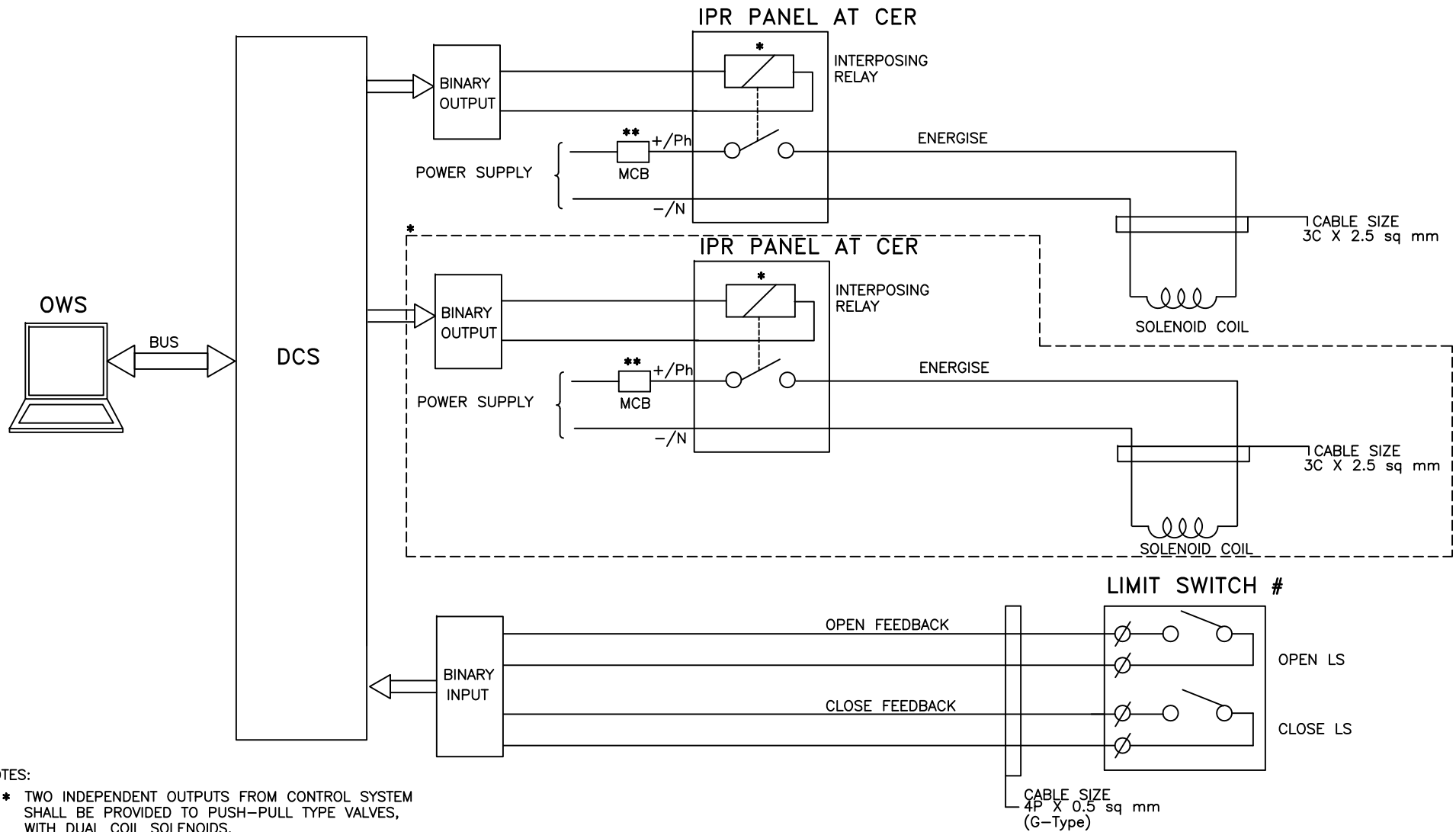
DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE(CONTACTOR OPERATED)



NOTE: INTERPOSING RELAYS(IPRs) TO BE SUPPLIED ALONG WITH MCC.

	PROJECT:	1x660 MW BHUSAWAL STPP		DRG.NO.	PE-DM-415-145-1002
	TITLE	DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE		DATE	01.10.2018
				REV.NO.	04
				SHT	9

DCS INTERFACE FOR SOLENOID DRIVE (24V DC / 240V AC UPS)



NOTES:

* TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.

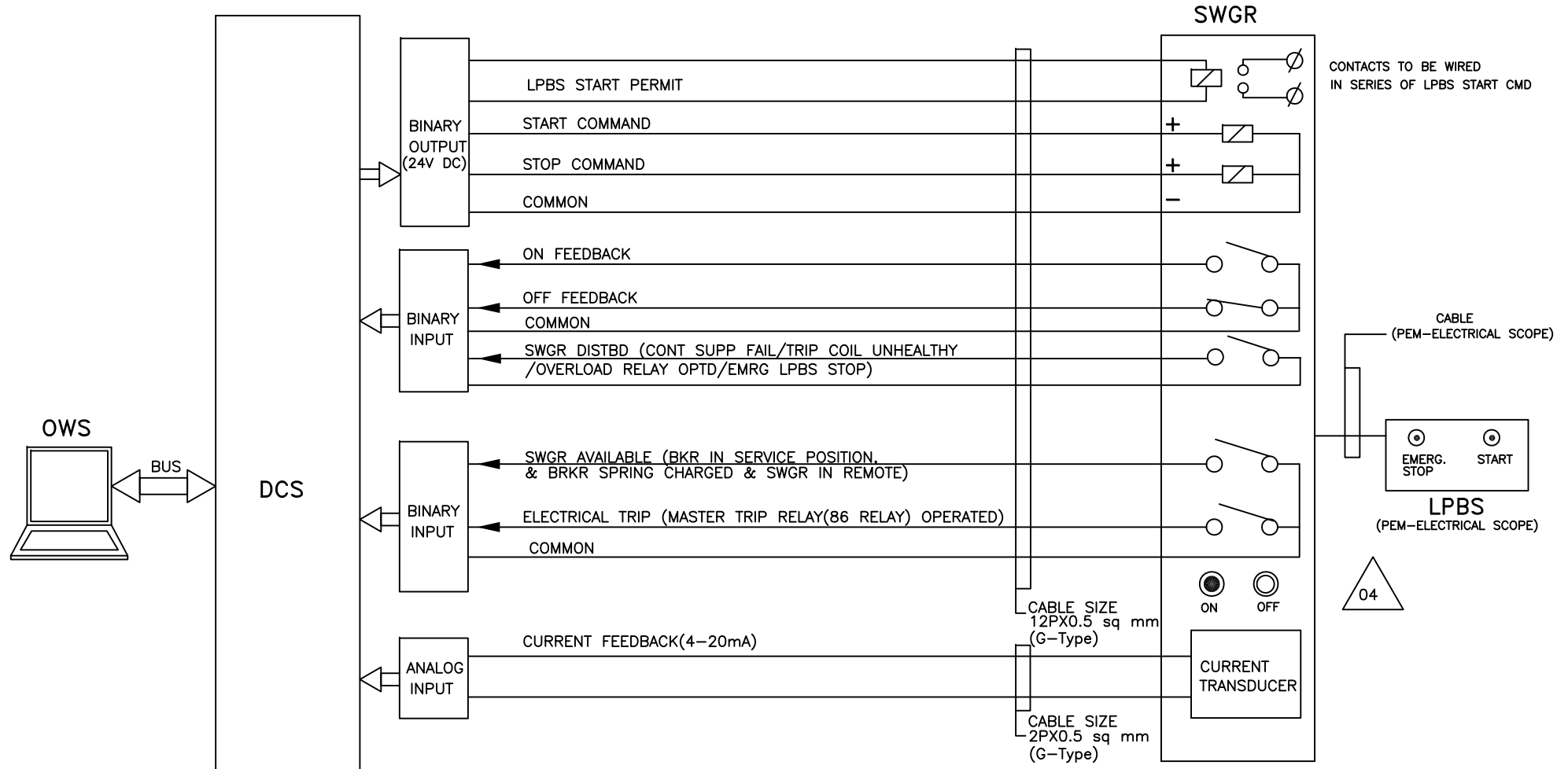
** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.



PROJECT:	1x660 MW BHUSAWAL STPP	DRG.NO.	PE-DM-415-145-1002
TITLE	DDCMIS INTERFACE FOR SOLENOID DRIVE	DATE	01.10.2018
		REV.NO.	04
		SHT	10 OF 12

DCS INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



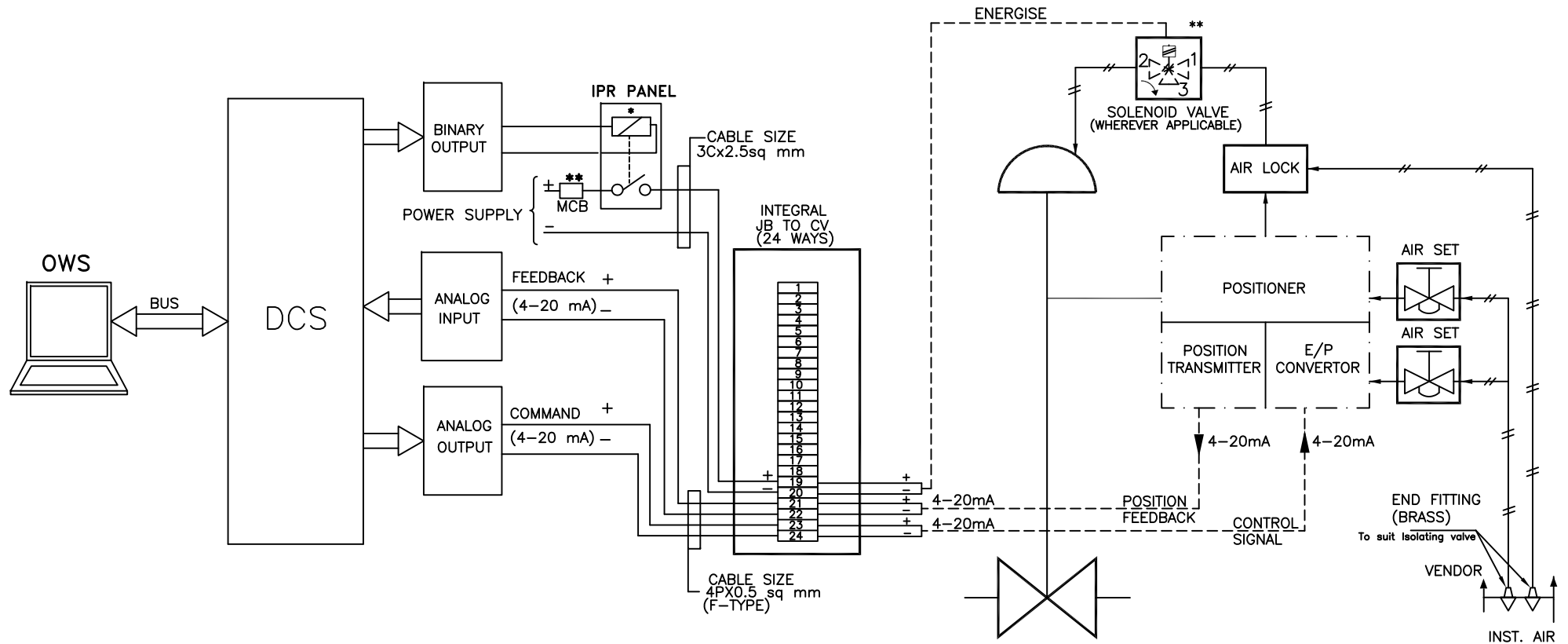
NOTE:– INTERPOSING RELAYS(IPRs) TO BE SUPPLIED ALONG WITH SWITCHGEAR.
BEARING AND WINDING TEMPERATURES FOR HT DRIVES SHALL BE HOOKED TO DCS.

04



PROJECT:	1x660 MW BHUSAWAL STPP	DRG.NO.	PE-DM-415-145-1002
TITLE	DDCMIS INTERFACE FOR UNIDIRECTIONAL HT DRIVE	DATE	01.10.2018
		REV.NO.	04
		SHT	11

DCS INTERFACE FOR ANALOG DRIVE



NOTES:

** APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.



PROJECT:	1x660 MW BHUSAWAL STPP	DRG.NO.	PE-DM-415-145-1002
TITLE	TYPICAL HOOK-UP DIAGRAM ANALOG DRIVE	DATE	01.10.2018
		REV.NO.	04
		SHT	12 OF 12 Page 410 of 485

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

ACTUATOR DETAILS

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

1.0 SCOPE

- 1.1 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates.
- 1.2 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification.

2.0 STANDARDS

- 2.1 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.
- 2.2 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed:
- (a) IS-9334
- (b) IS-325

3.0 SERVICE CONDITIONS

- 3.1 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.

4.0 RATING

- 4.1 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.
- 4.2 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

5.0 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.1 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.2 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).
- 5.3 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.4 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.5 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.0 SPECIFIC REQUIREMENT

6.1 CONSTRUCTION

- 6.1.1 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring. Actuator shall be integral type. Integral starter shall have facility to hook-up with Plant DCS for positioning of limit and torque switches.
- 6.1.2 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.
- 6.1.3 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.1.4 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

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

6.2 MOTOR

- 6.2.1 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service.
- 6.2.2 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.2.3 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.2.4 Earthing terminals shall be provided on either side of the motor.

6.3 LIMIT SWITCHES

Each actuator shall be provided with following limit switches:

- 6.3.1 Two (2) torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.3.2 Four (4) end-of-travel limit switches, two for each direction of travel.
- 6.3.3 Two (2) position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.
- 6.3.4 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.

6.4 HAND WHEEL

Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.

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

6.5 POSITION INDICATOR/TRANSMITTER

The actuator shall have:

6.5.1 One (1) built-in local position indicator for 0-100% travel

6.5.2 One (1) position transmitter, potentiometer type, for remote indicator.

6.6 SPACE HEATER

A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.

6.7 WIRING

All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 Sq.mm copper. All wiring shall be identified at both ends with ferrules.

6.8 TERMINAL BOX

The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.

7.0 TEST

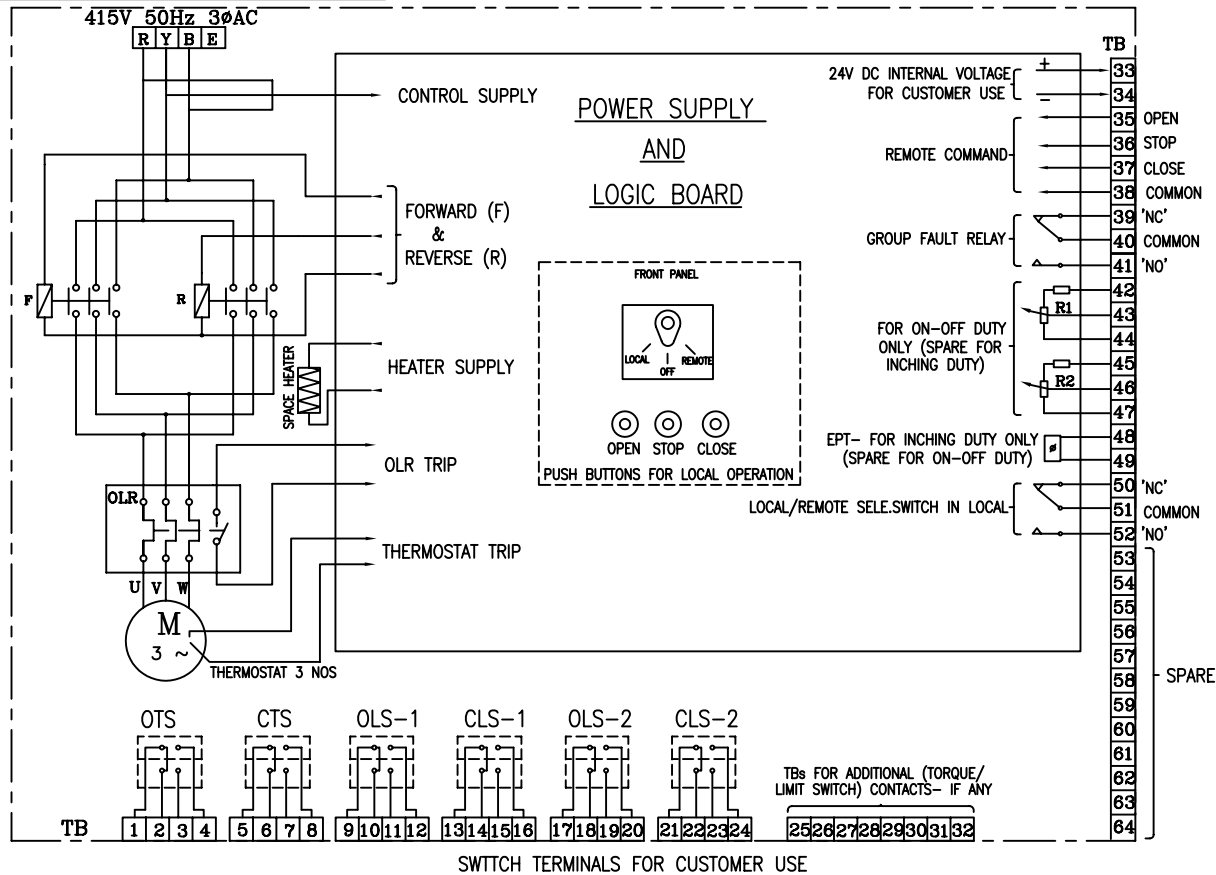
7.1 The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

7.2 TEST WITNESS:

Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

3-V-MISC-24227

DRAWING NO.



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL				
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL				
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL				
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL				
OLS-1	9-10					
	11-12					
CLS-1	13-14					
	15-16					
OLS-2	17-18					
	19-20					
CLS-2	21-22					
	23-24					
SWITCH	TERMINAL NO.	FULL OPEN	a	INTERMEDIATE	b	FULL CLOSE
		VALVE POSITION				
 INDICATES CONTACT CLOSED						
 INDICATES CONTACT OPEN						
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC						

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

NOTE:-

- ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
- CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
- OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
- OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
- CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
- EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
- FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
- M - MOTOR 3φ 415V 50 Hz AC SUPPLY

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)			
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		DRN	N.P.ESWAR	SIGN	N.P.
365-121		CHD	D.DINAKARAN	DATE	07.10.04
DEPT VL		APPD	K.ARUNACHALAM	NO. OF VAR.	07.10.04
CODE	SCALE	WEIGHT (KG).	REFERENCE INFORMATION		
TITLE	CARD CODE	DRAWING NO.			REV
WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER	U 01	3-V-MISC-24227			0
Page 416 of 485					

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

CONTROL AND INSTRUMENT CABEL DETAILS

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

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. |

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

- | | | | |
|-----|---------------------------------|---|--|
| (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
DM 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 | | <div style="margin-left: 20px;">(i) Oxygen Index: Min.29 at room temp. (ASTM-D-2863)</div> <div style="margin-left: 20px;">(ii) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I</div> <div style="margin-left: 20px;">(iii) Temp Index : Min 250 DEG C at 21 Oxy. Ind. (ASTM-D-2863)</div> <div style="margin-left: 20px;">(iv) Smoke Density Rating : Max.60% (ASTM-D-2843).</div> <div style="margin-left: 20px;">(v) Flammability Test : as per IEC 332 Part-I/IEEE-383
Swedish Chimney Test - SS-424-1475 F3.</div> <div style="margin-left: 20px;">(vi) High voltage test
Core to core- 1.5 kV for 1 min.
Core to screen-1.0 kV for 1 min.</div> <div style="margin-left: 20px;">(vii) Insulation Resistance 100 M Ohm/Km Min.</div> <div style="margin-left: 20px;">(viii) Rodent & Termite repulsion test (Presence of lead shall be confirmed)</div> |

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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.

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

- | | | | |
|-----|-------------------------|------|--|
| (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
DM 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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- (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
DM PLANT
1X660MW BHUSAVAL 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 DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

PROCESS CONNECTION AND INSTRUMENT HOOK UP DETAILS

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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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
DM 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
DM 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.

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

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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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
DM PLANT
1X660MW BHUSAVAL 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
DM PLANT
1X660MW BHUSAVAL 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
DM 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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

FOR BID PURPOSE ONLY

DO NOT SCALE

DATE : 23-08-2011

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~

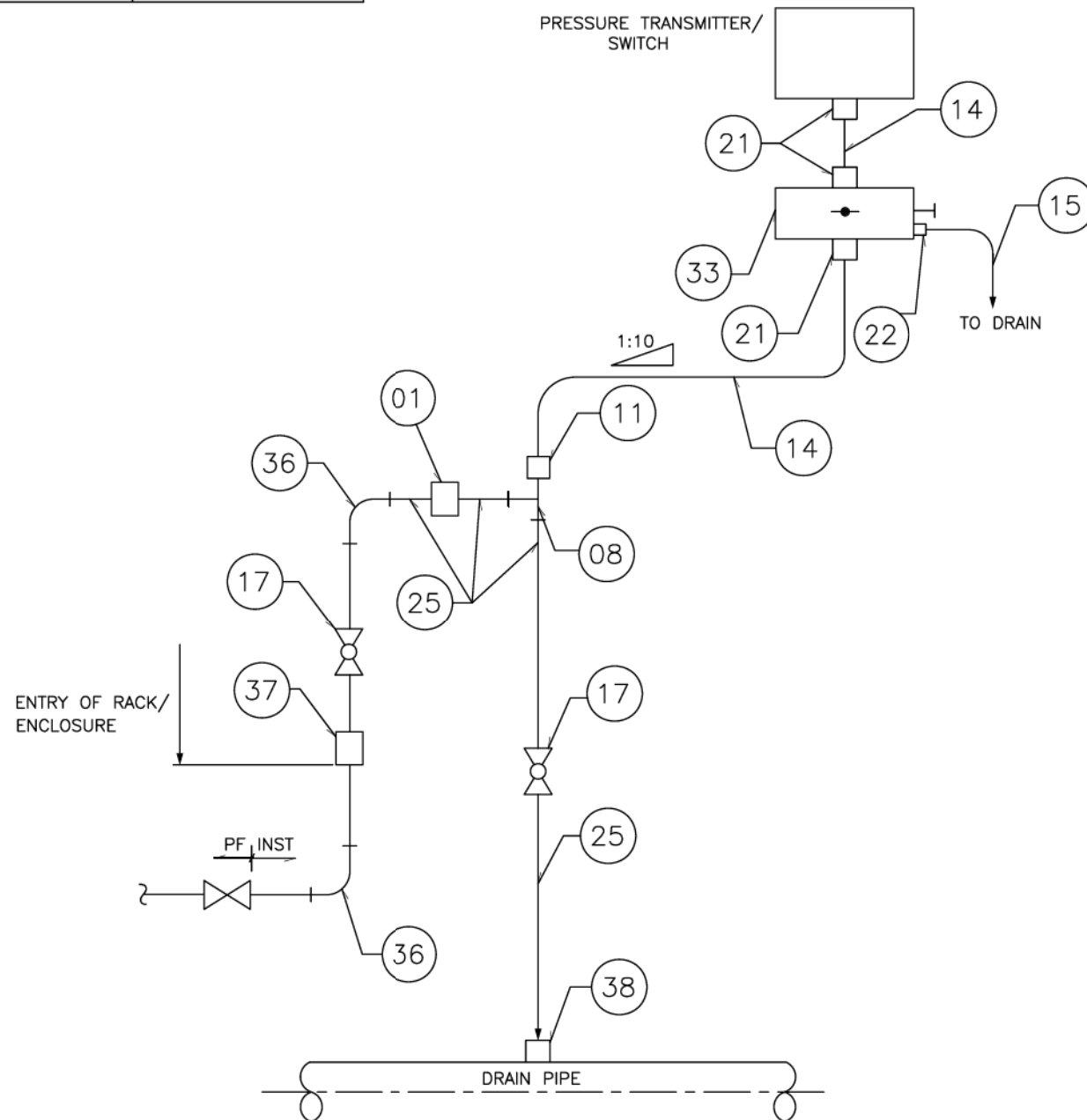
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DIV INST.

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.

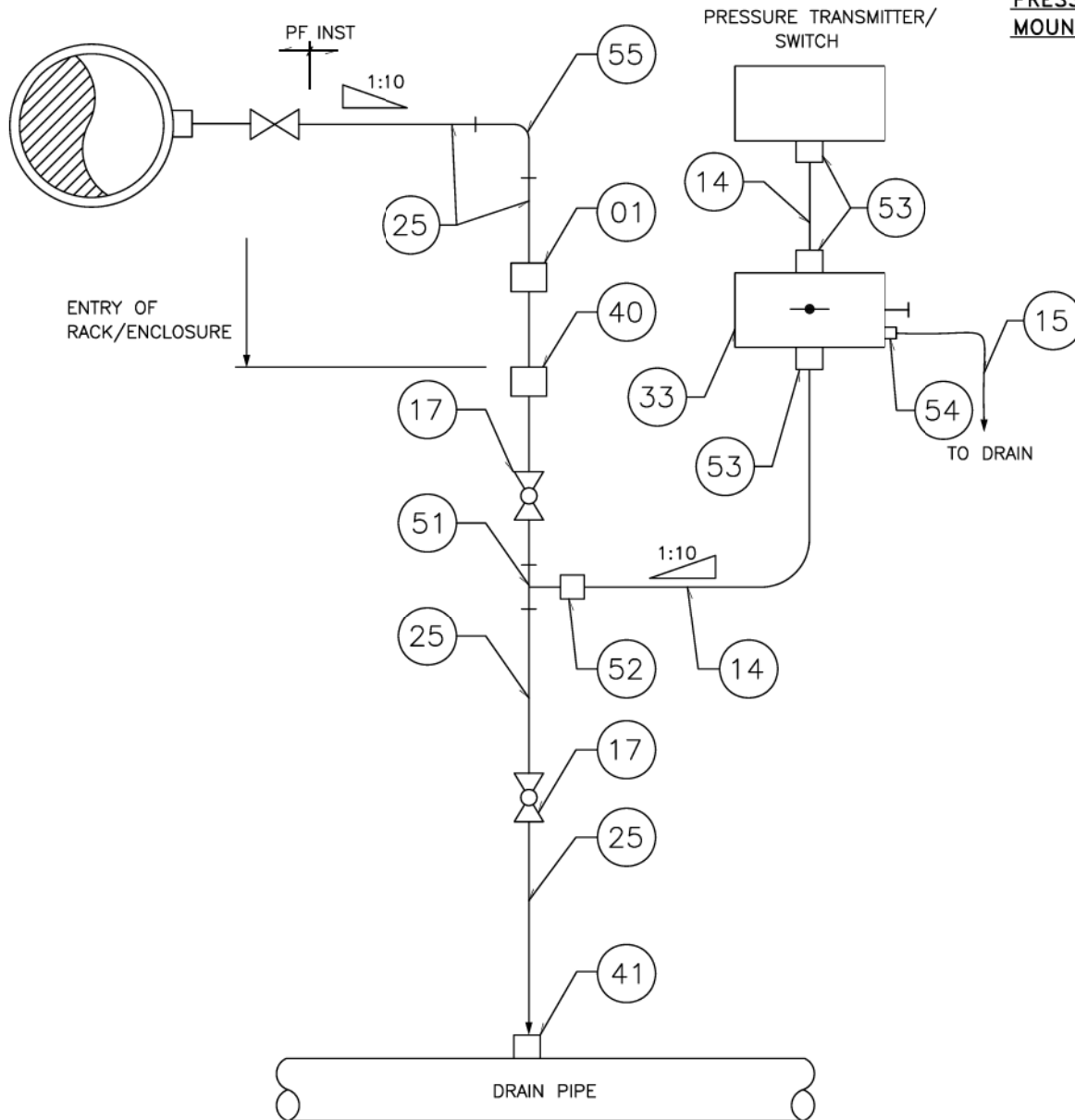
FOR BID PURPOSE ONLY

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

**TECHNICAL SPECIFICATION FOR
DM 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

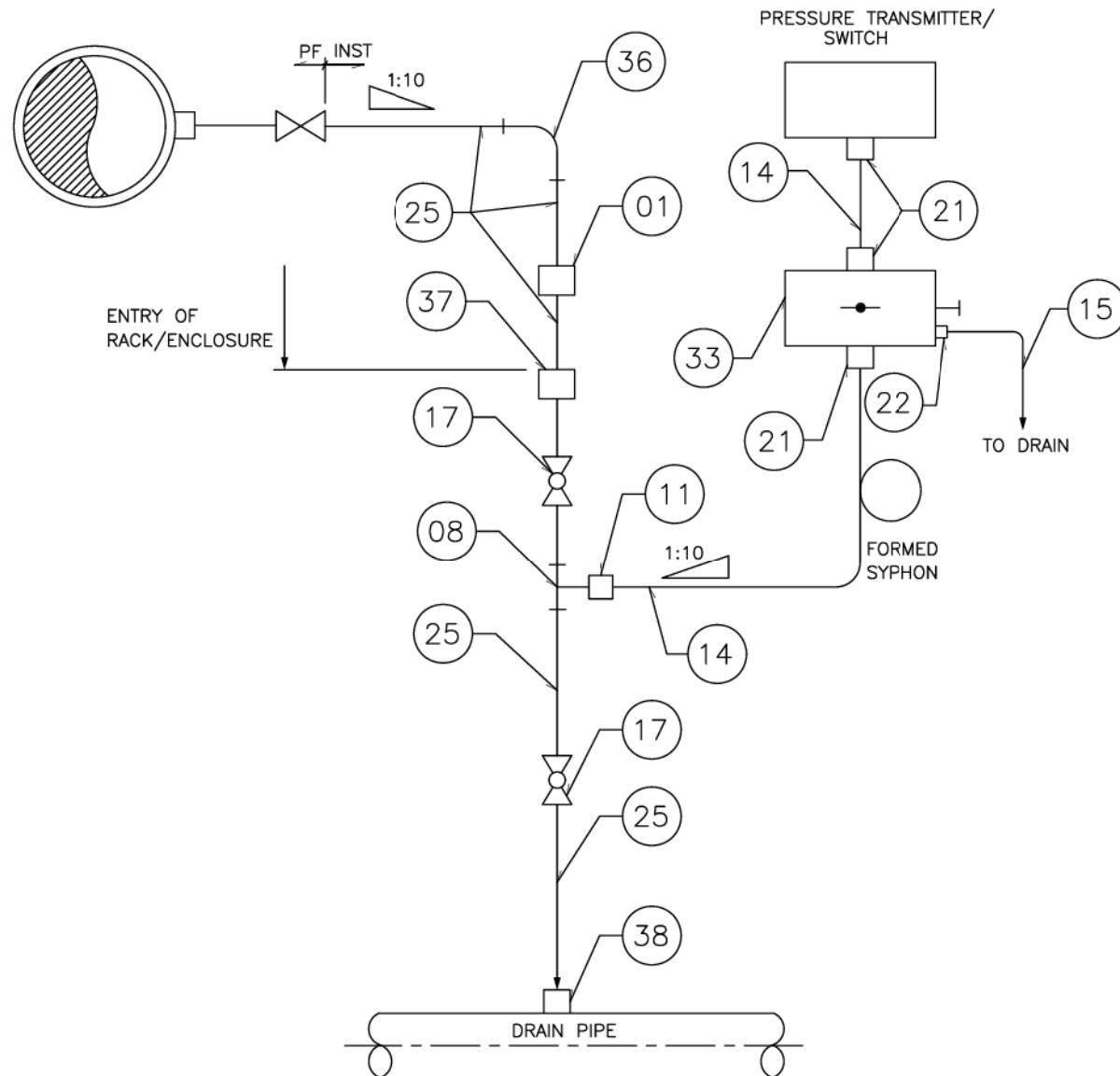
DO NOT SCALE

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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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.

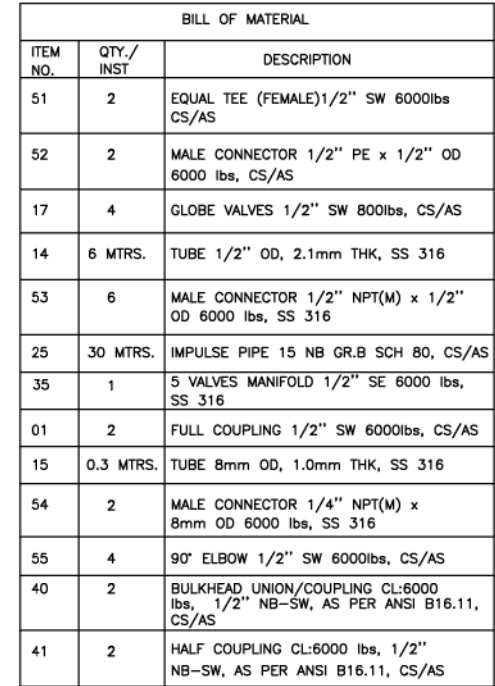
FOR BID PURPOSE ONLY

DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED				APPD	DATE	FOR RO ISSUE ONLY			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	CLEARED			
										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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**



FOR BID PURPOSE ONLY

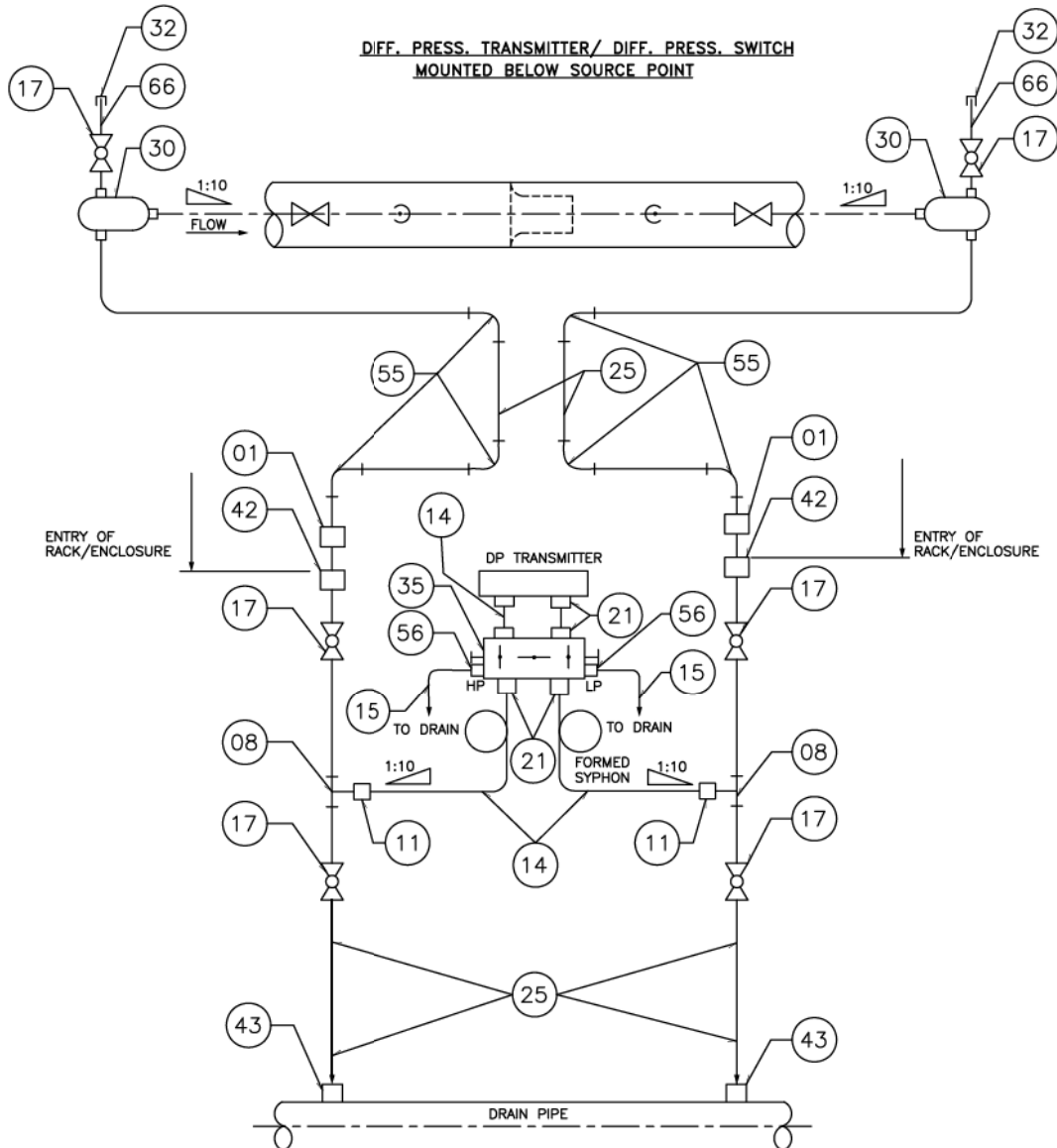
DO NOT SCALE

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

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

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DRAWINGS SIGNED BY PROCON ENGINEER. AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.



BILL OF MATERIAL		
ITEM NO.	QTY./INST	DESCRIPTION
08	2	EQUAL TEE (FEMALE) 1/2" SW 9000lbs, CS/AS
11	2	MALE CONNECTOR 1/2" PE x 1/2" OD 9000 lbs, CS/AS
17	6	GLOBE VALVES 1/2" SW 800lbs, CS/AS
14	6 MTRS.	TUBE 1/2" OD, 2.1mm THICK, SS 316
21	6	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 9000 lbs, SS 316
25	30 MTRS.	IMPULSE PIPE 15 NB GR.B SCH 80, CS/AS
35	1	5 VALVE MANIFOLD 1/2" SE 9000 lbs, SS 316
01	2	FULL COUPLING 1/2" SW 9000lbs, CS/AS
30	2	CONDENSATE POT 1/2" SW NPT(F) 9000lbs, CS/AS
32	2	PLUG 1/2" NPT(F) 9000lbs, CS/AS
15	0.3 MTRS.	TUBE 8mm OD, 1.0mm THICK, SS 316
56	2	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 9000 lbs, SS 316
55	6	90° ELBOW 1/2" SW 9000lbs, CS/AS
42	2	BULKHEAD UNION/COUPLING CL:9000 lbs, AS PER ANSI B16.11, 1/2" NB-SW, CS/AS
43	2	HALF COUPLING CL:9000 lbs/ 1/2" NB-SW, AS PER ANSI B16.11, CS/AS
66	2	15 NB SCH 80, SW x 1/2" NPT(M), SEAMLESS NIPPLE 6000 lbs, CS/AS

SERVICE : STEAM
PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE.

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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		*IF (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION/FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY, INDICATED IN THE SMALL BLOCK AT THE TO 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. FIELD MUST GET DESIGN OFFICE TO CLEAR 'HOLDS' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLDS'. DRAWINGS SIGNED BY PROCON ENGINEER. UNAUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.	
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED			
										DEPT	SIGNATURE		DATE
										CHEM			
										CIVIL			
										ELEC			
										I&C			
										MECH			

ENTRY OF
RACK/ENCLOSURE

SERVICE : DEAERATOR, HEATERS.

FOR BID PURPOSE ONLY

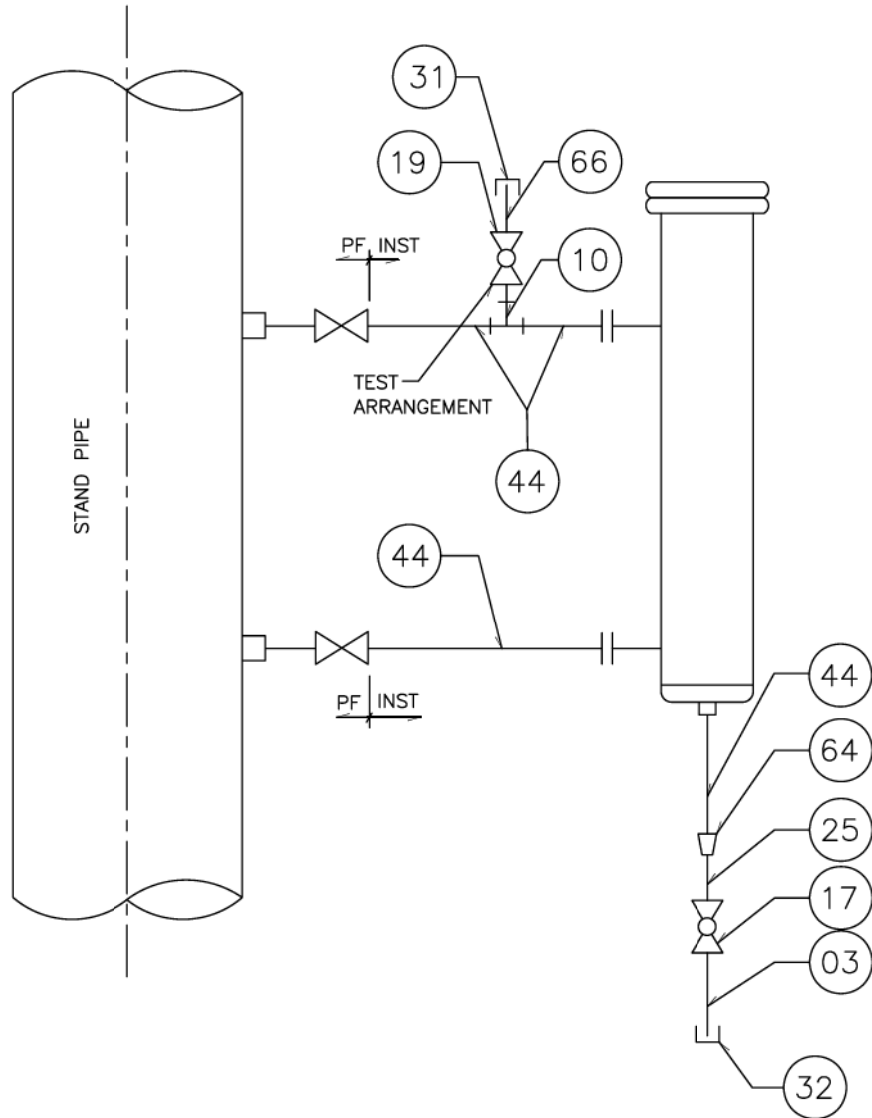
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MAHARASHTRA STATE POWER GENERATION CO.LTD.
MAHAGENCO BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAVAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

FLOAT OPERATED LEVEL SWITCH



BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
17	1	GLOBE VALVES 1/2" SW 800lbs, CS/AS
25	0.5 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
32	1	PLUG 1/2" NPT(M) 3000lbs, CS/AS
10	2	EQUAL TEE (FEMALE) 1" SW 3000lbs, CS/AS
44	2 MTRS.	IMPULSE PIPE 25 NB SCH 80, CS/AS
64	1	REDUCER 1" SW x 1/2" SW 3000lbs, CS/AS
19	1	GLOBE VALVES 1" SW 800lbs, CS/AS
31	1	PLUG 1" NPT(F) 3000lbs, CS/AS
66	1	1" NB SCH 80 SW x 1" NPT(M) SEAMLESS NIPPLE 3000 lbs, CS/AS
03	1	15 NB SCH 80 SW x 1/2" NPT(M) SEAMLESS NIPPLE 3000lbs, CS/AS

SERVICE : CONDENSATE.

FOR BID PURPOSE ONLY

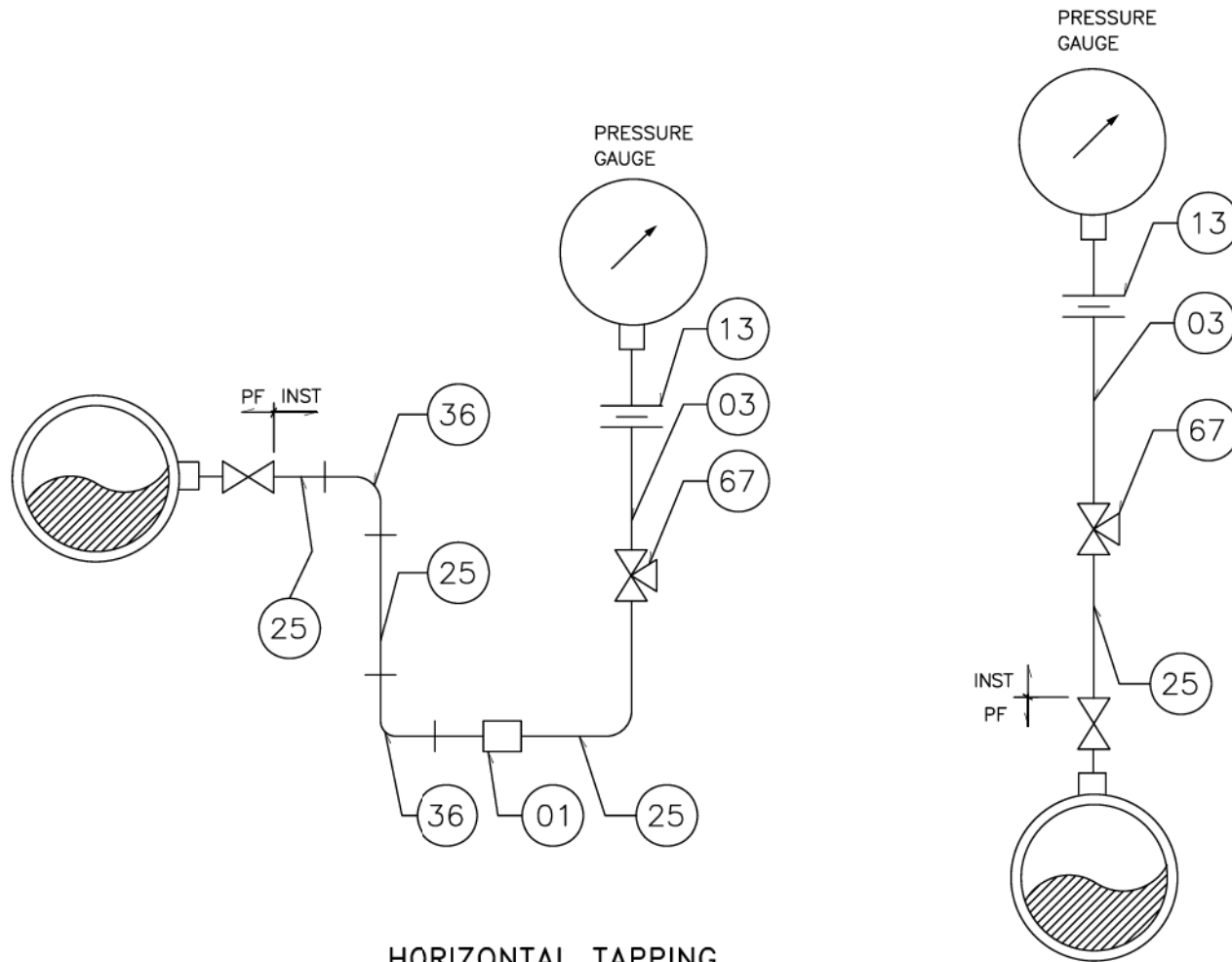
DO NOT SCALE

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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
DM 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
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

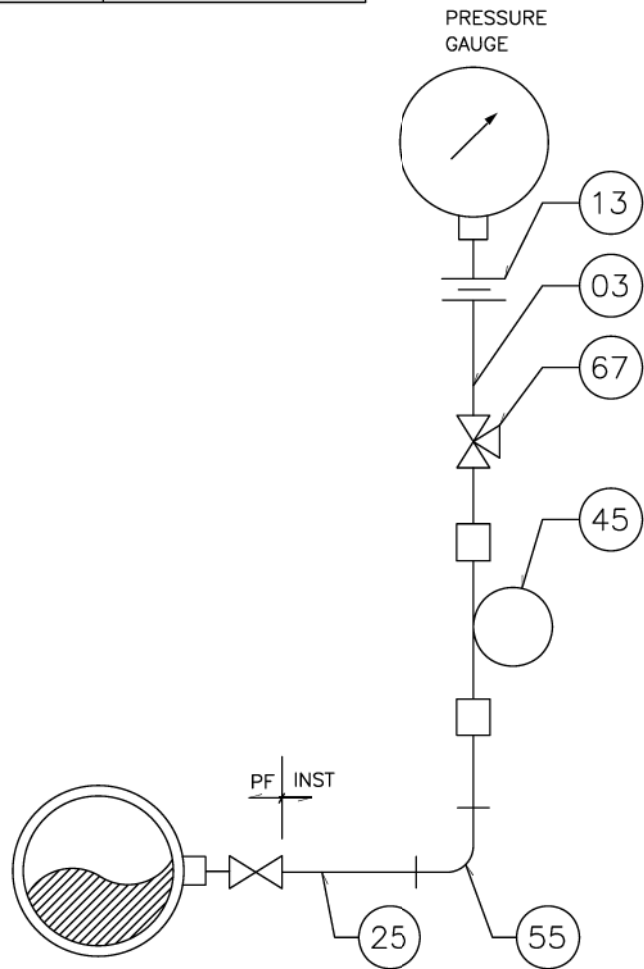
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			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE	



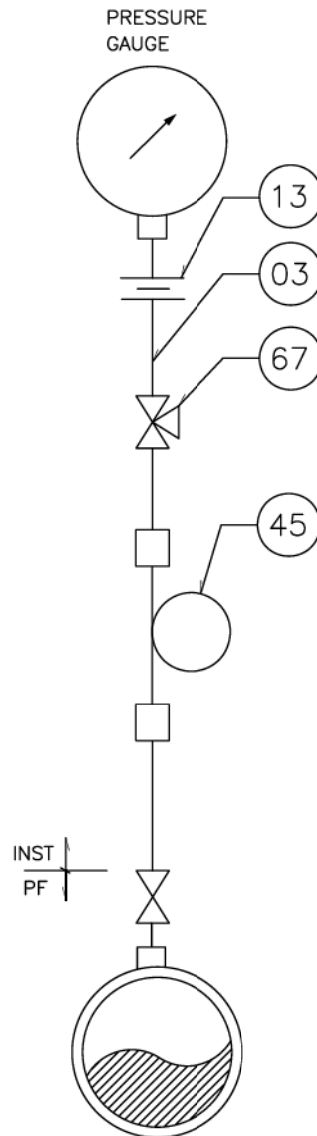
MAHARASHTRA STATE POWER GENERATION CO.LTD.
BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

TECHNICAL SPECIFICATION FOR
DM 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

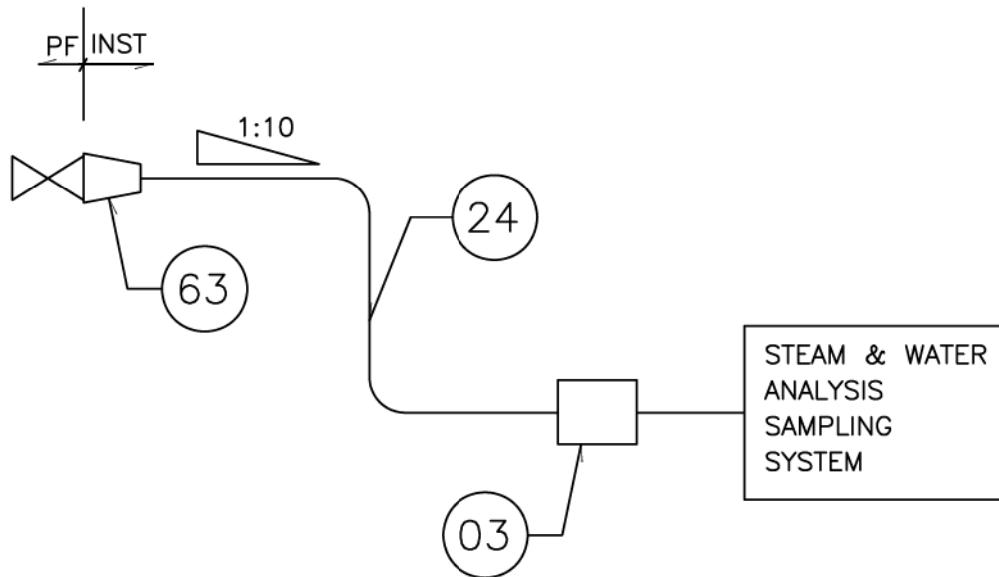
DO NOT SCALE

ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		
			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 DM 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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

SCALE ~ APPROVED

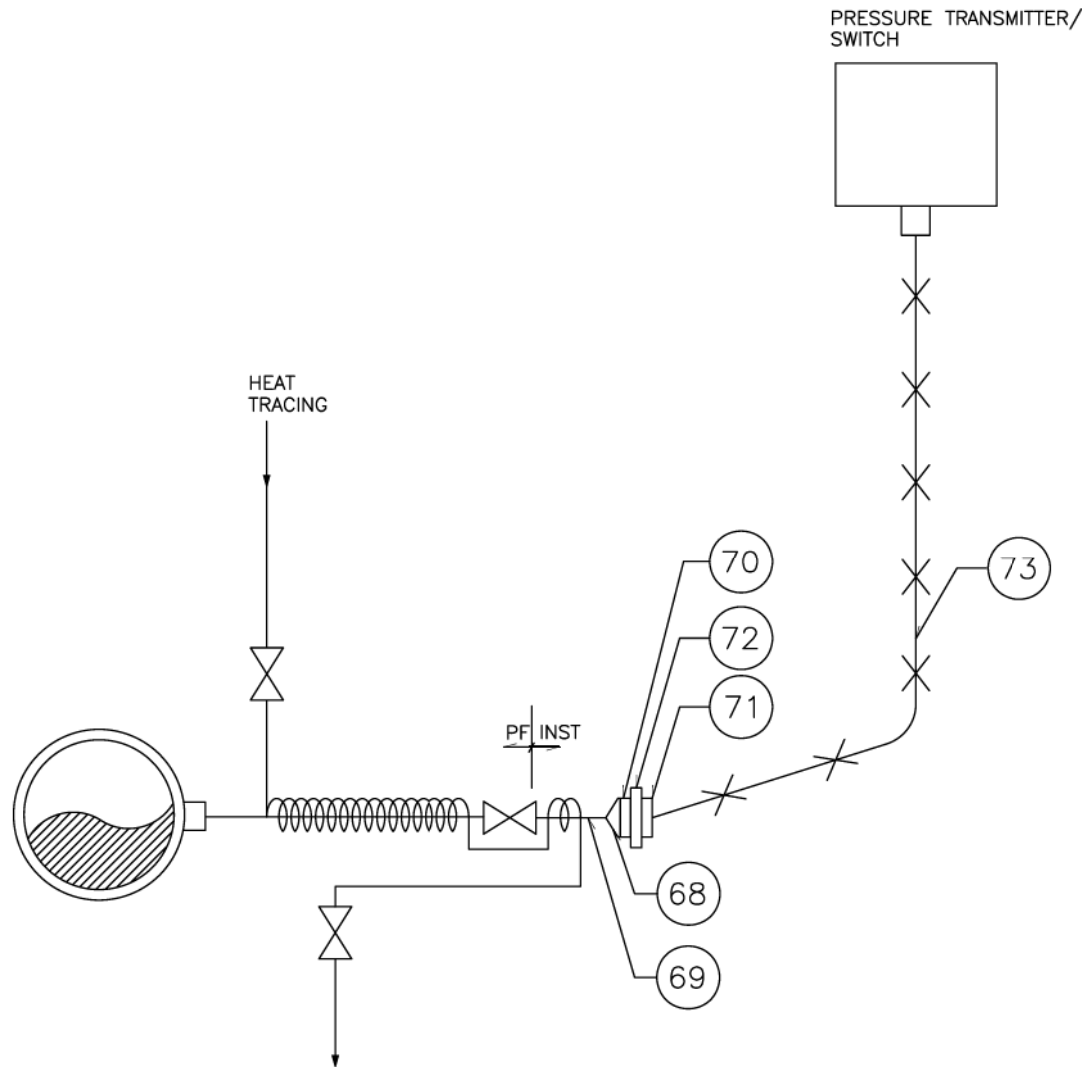
DIV INST.

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

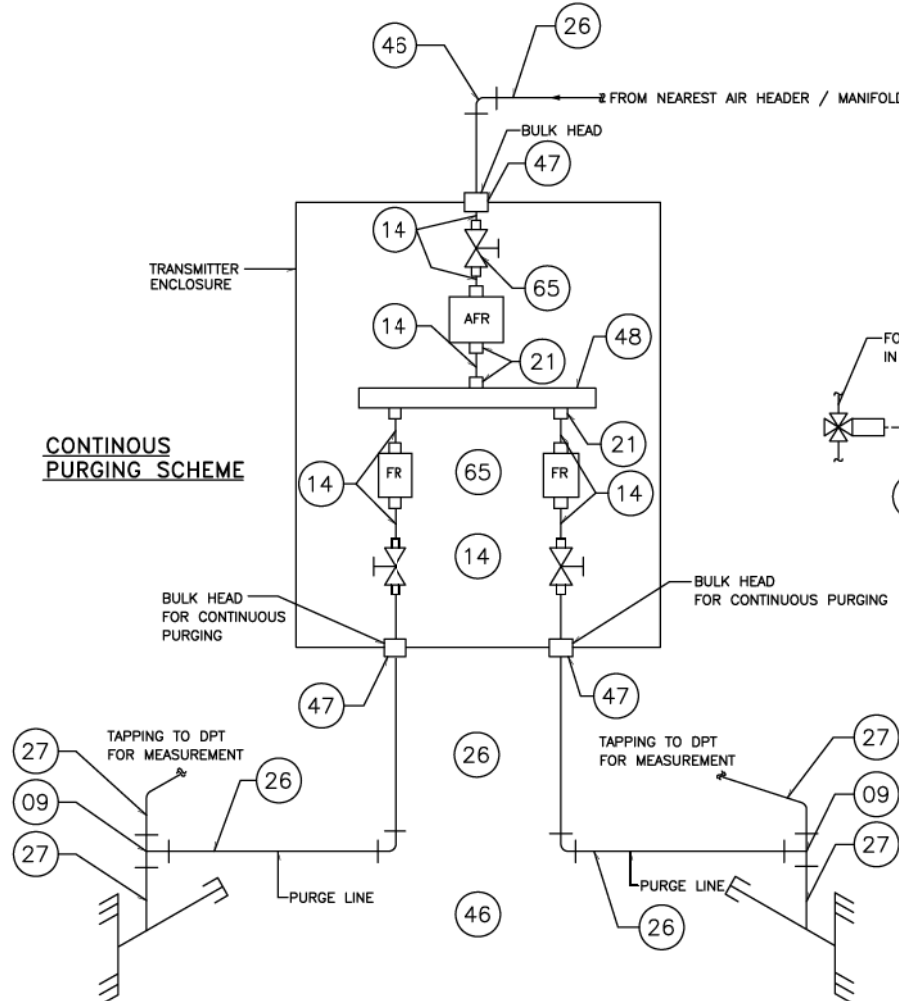
ISSUE	REVISIONS	BY	CLEARED					APPD	DATE	FOR RO ISSUE ONLY		
			CHEM	CIVIL	ELEC	I&C	MECH			DEPT	SIGNATURE	DATE

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

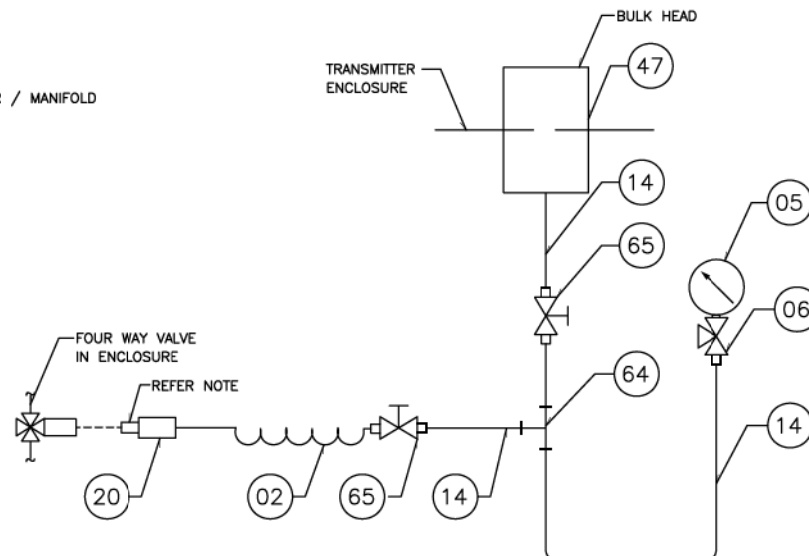
TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

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
DM 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' AUTHORISED REPRESENTATIVE ONLY ARE CONSIDERED VALID DRAWINGS.
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED			
										DEPT	SIGNATURE	DATE	
										CHEM			
										CIVIL			
										ELEC			
					I&C								
					MECH								

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

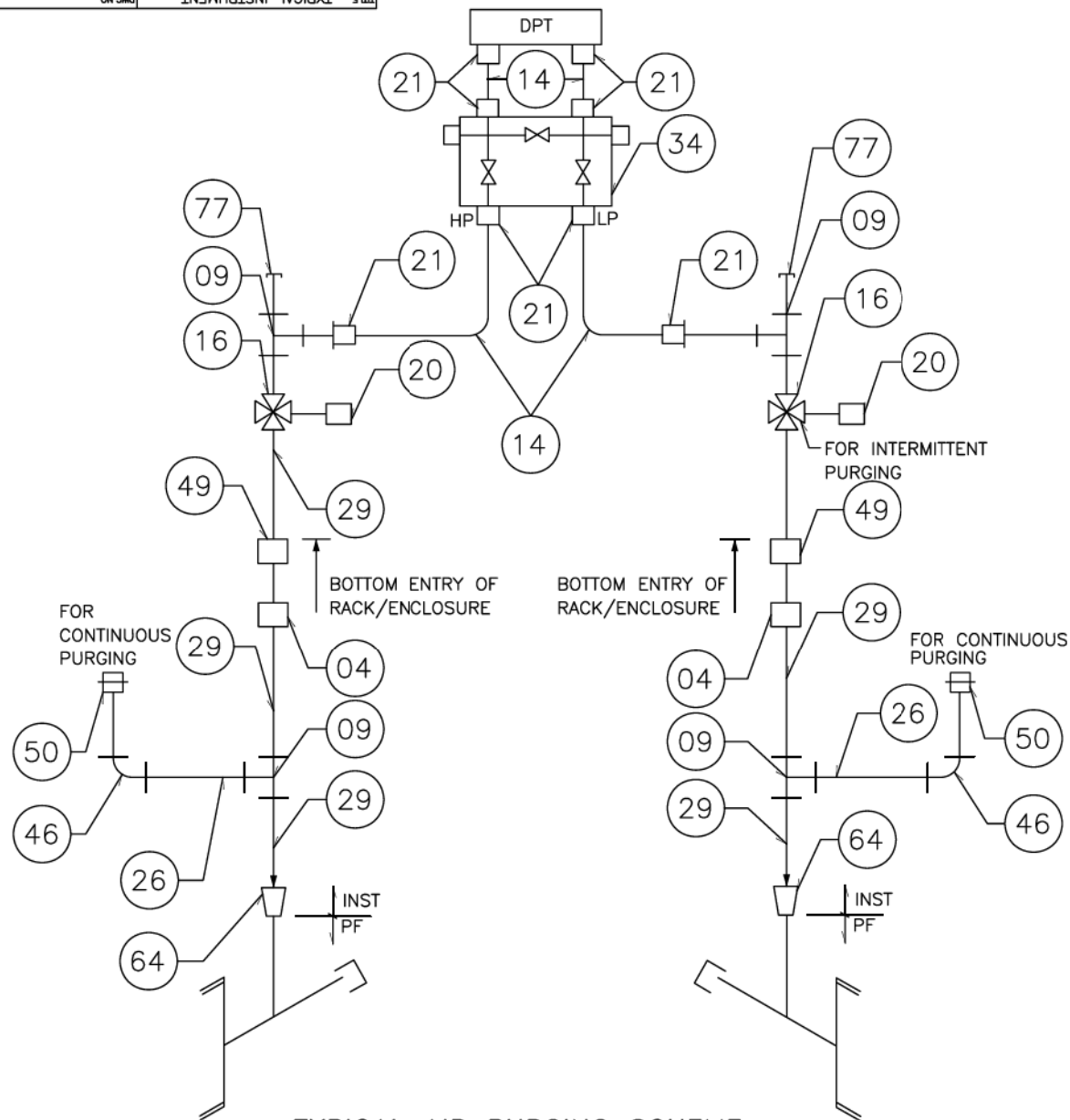
DATE : 23-08-2011

ISSUE	BY	CH	DATE

**TECHNICAL SPECIFICATION FOR
DM 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

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

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 "H" (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.			MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT TYPICAL INSTRUMENT INSTALLATION DIAGRAM		
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TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

DPT

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PF

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

1. AIR PURGING ARRANGEMENT SHALL BE INCLUDED.

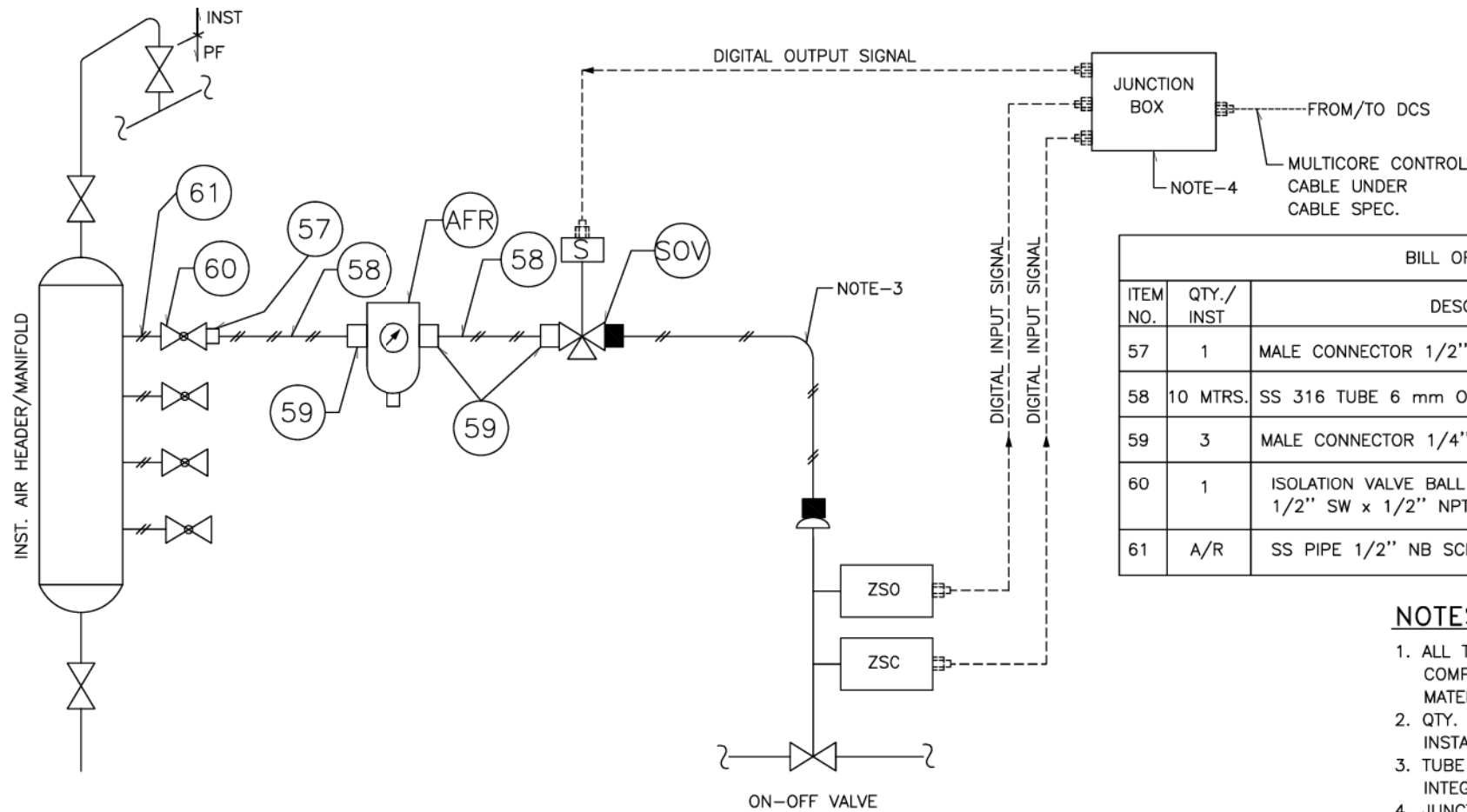
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MAHARASHTRA STATE POWER GENERATION CO.LTD.
CO BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

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



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

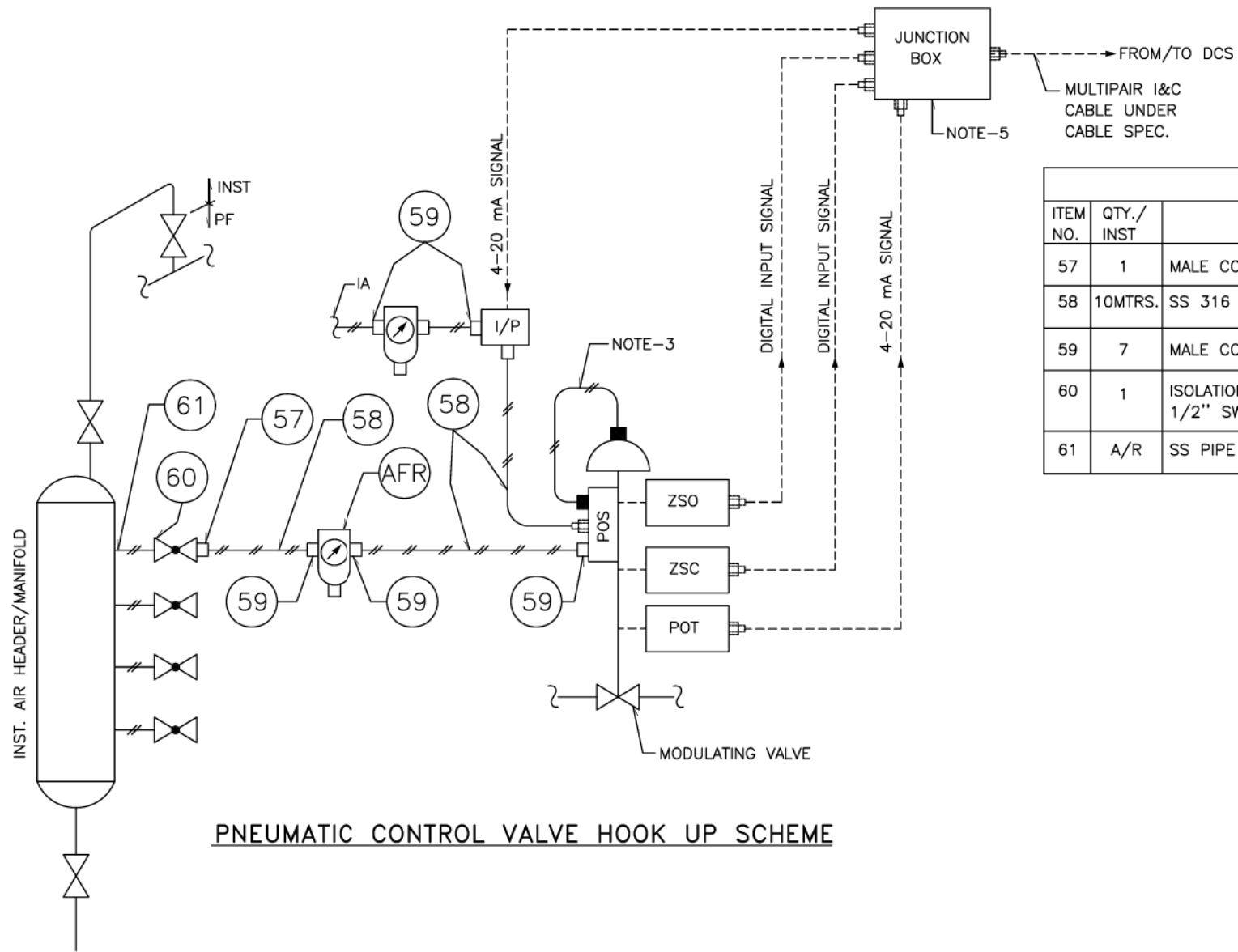
PNEUMATIC SOV HOOK UP SCHEME

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	
DM 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			MAHARASHTRA STATE POWER GENERATION CO.LTD BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT
			CHEM	CIVIL	ELEC	I&C	MECH			CLEARED			
			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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

ERECTION HARDWARE

**TECHNICAL SPECIFICATION FOR
DM 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.

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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.

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

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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

- (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
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

± 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 : ½" NB
- (e) Schedule : 80, 160, XXS as required.
- (f) Standard Length : 6 meter

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

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 |

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

- | | | | |
|---------|-----------------------------|---|--|
| | (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 |

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

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

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

- (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
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

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

**TECHNICAL SPECIFICATION FOR
DM PLANT
1X660MW BHUSAWAL TPS-UNIT:6
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 DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

PLANT TO DCS INTERFACE

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

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
DM 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
DM PLANT
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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.

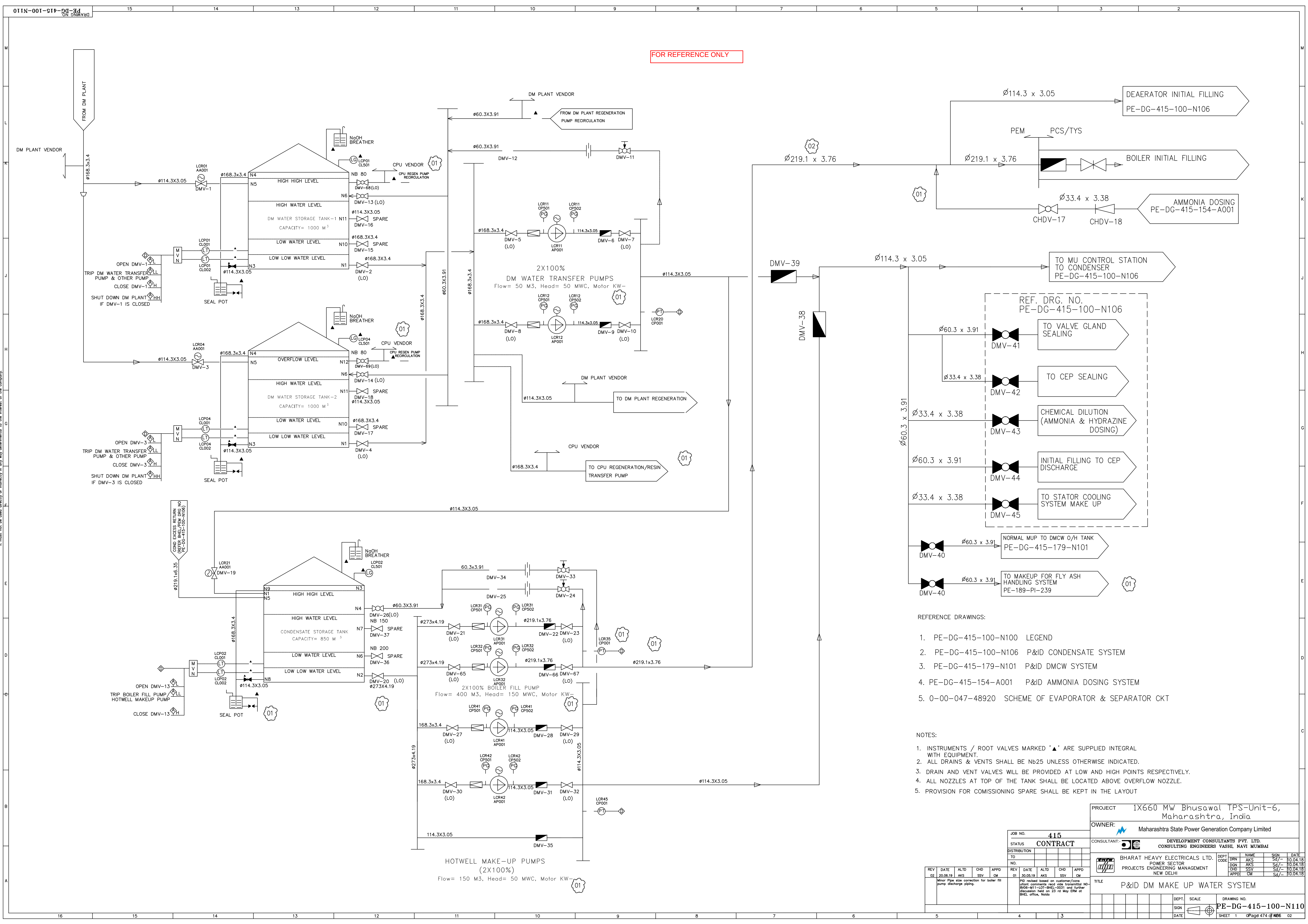
4.35 ~~ELECTRICAL DISTRIBUTION AND MANAGEMENT SYSTEM~~

~~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.~~

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

P&ID FOR DM MAKE UP SYSTEM



- REFERENCE DRAWINGS:
- PE-DG-415-100-N100 LEGEND
 - PE-DG-415-100-N106 P&ID CONDENSATE SYSTEM
 - PE-DG-415-179-N101 P&ID DMCW SYSTEM
 - PE-DG-415-154-A001 P&ID AMMONIA DOSING SYSTEM
 - 0-00-047-48920 SCHEME OF EVAPORATOR & SEPARATOR CKT

- NOTES:
- INSTRUMENTS / ROOT VALVES MARKED '▲' ARE SUPPLIED INTEGRAL WITH EQUIPMENT.
 - ALL DRAINS & VENTS SHALL BE NB25 UNLESS OTHERWISE INDICATED.
 - DRAIN AND VENT VALVES WILL BE PROVIDED AT LOW AND HIGH POINTS RESPECTIVELY.
 - ALL NOZZLES AT TOP OF THE TANK SHALL BE LOCATED ABOVE OVERFLOW NOZZLE.
 - PROVISION FOR COMMISSIONING SPARE SHALL BE KEPT IN THE LAYOUT

PROJECT1X660 MW Bhusawal TPS-Unit-6,
Maharashtra, India

OWNER:Maharashtra State Power Generation Company Limited

CONSULTANT:DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS VASHI, NAVI MUMBAI

JOB NO.415

STATUSCONTRACT

DISTRIBUTION

TO

NO.

REV.0220.06.19AKSSSVCM

DATE30.05.19AKSSSVCM

ALTD

CHD

APPO

REV.0130.05.19AKSSSVCM

DATE30.05.19AKSSSVCM

ALTD

CHD

APPO

Minor Pipe size correction for boiler fill pump discharge piping.

PID revised based on customer/cons. latest comments. See size transmittal NO-8006-M11-LOT-BHEL-0031 and further discussion held on 23 rd May 2019 at BHEL office, Noida

TITLEP&ID DM MAKE UP WATER SYSTEM

DEPT. SCALE

SIGN

DATE

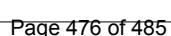
DRAWING NO.
PE-DG-415-100-N110

SHEET 1 OF 474 OF 474

02

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-A001	
		VOLUME: II-B	
		SECTION: D	
		REV NO: 0	DATE:

PLOT PLAN





TITLE:

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

BHEL DOCUMENTS NO.: PE-TS-415-163-A001

VOLUME **III**

REV. NO. 00

LIST OF SCHEDULES



TITLE:

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

SPEC NO: PE-TS-415-163-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL and Customer approval. However any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

For the Drawings/Documents Submission Procedure, please refer **Sec-C1**. The submission of soft copy or hard copy of the drawing/document whichever is later will be considered as final date of submission of the drawing/document. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Bidder to note that the drawings to be submitted by bidder in the event of award of contract shall be as per the below given drawing/document list. Bidder to note that any additional drawings/documents requirement during detailed engineering shall be provided by bidder without any technical, commercial and delivery implications to BHEL. Bidder confirmed that every revised submission incorporating comments – within 7 days.

Bidder further confirmed that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

(a) List and schedule of drawings/documents to be submitted after award of contract:-

DRG/DOC NO	DRG/DOC TITLE	SCH OF SUBMISSION FROM LOI DATE (IN WEEKS)
PE-V0-415-163-A001	P&I DIAGRAM FOR DM PLANT	4
PE-V0-415-163-A002	EQUIPMENT LAYOUT OF DM PLANT ALONG WITH MECHANICAL GA OF DM PLANT SHED	4
PE-V0-415-163-A003	PROCESS DESIGN & SIZING CALCULATIONS , RESIN DS, VESSEL THK & PRESSURE DROP CALCULATIONS FOR DMP	4
PE-V0-415-163-A004	QAP FOR PRESSURE VESSELS FOR DM PLANT	10
PE-V0-415-163-A005	QAP FOR ATMOSPHERIC TANKS FOR DM PLANT	10
PE-V0-415-163-A006	QAP FOR HORIZONTAL / VERTICAL CENTRIFUGALPUMPS WITH MOTOR FOR DM PLANT	10
PE-V0-415-163-A007	QAP FOR METERING PUMPS WITH MOTORFOR DM PLANT	10
PE-V0-415-163-A008	QAP FOR BLOWERS WITH MOTOR FOR DM PLANT	10
PE-V0-415-163-A009	QAP / ICL OF DM PLANT (FOR BALANCE OF ITEMS) FOR DM PLANT	10
PE-V0-415-163-A011	QAP FOR VALVES FOR DM PLANT	10
PE-V0-415-163-A012	PG test procedure for DM plant	18
PE-V0-415-163-A013	GA DRAWING OF ATMOSPHERIC TANKS OF DM PLANT	8
PE-V0-415-163-A014	CIVIL ASSIGNMENT DRAWING FOR DM PLANT	12
PE-V0-415-163-A015	DATA SHEET OF ANALYSER FOR DM PLANT	12



TITLE:

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

SPEC NO: PE-TS-415-163-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

PE-V0-415-163-A016	GA DRAWING FOR PRESSURE VESSELS FOR DM PLANT	10
PE-V0-415-163-A017	TECHNICAL DATA SHEET FOR METERING PUMPS FOR DM PLANT	10
PE-V0-415-163-A018	DATA SHEET FOR HEATER FOR DM PLANT	10
PE-V0-415-163-A019	VALVE SCHEDULE FOR DM PLANT	10
PE-V0-415-163-A020	PIPING LAYOUT OF DM PLANT	10
PE-V0-415-163-A021	TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS FOR DM PLANT	12
PE-V0-415-163-A022	TECHNICAL DATA SHEET OF BLOWER FOR DM PLANT	12
PE-V0-415-163-A023	TECHNICAL DATA SHEET FOR VALVES FOR DM PLANT	12
PE-V0-415-163-A024	DATASHEET OF RESIN TRAP, CARBON TRAP, ACF FOR DM PLANT	12
PE-V0-415-163-A025	OPERATION & CONTROL PHILOSOPHY OF DM PLANT ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM	6
PE-V0-415-163-A026	INSTRUMENT SCHEDULE FOR DM PLANT	6
PE-V0-415-163-A027	DATA SHEET OF INSTRUMENTS FOR DM PLANT	12
PE-V0-415-163-A030	DATA SHEET FOR MOTOR FOR DM PLANT	14
PE-V0-415-163-A031	DATA SHEET AND GA FOR ULTRA FILTRATION SYSTEM	10
PE-V0-415-163-A032	YARD PIPING FOR DM PLANT	14
PE-V0-415-163-A033	GA FOR N-PIT	12
PE-V0-415-163-A034	DATA SHEET FOR EJECTOR	12
PE-V0-415-163-A035	DATA SHEET FOR DIFFUSER	12
PE-V0-415-163-A036	DATA SHEET AND GA FOR STRAINER (PUMP SUCTION AND INSIDE PRESSURE VESSEL)	12
PE-V0-415-163-A037	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM AND EARTHING LAYOUT OF DM PLANT	14
PE-V0-415-163-A038	SUB-VENDOR LIST & INSPECTION CRITERIA FOR DM PLANT	4
PE-V0-415-163-A039	O&M MANUAL FOR DM PLANT	20
PE-V0-415-163-A040	DATA SHEET FOR ACTUATOR	12
PE-V0-415-163-A041	DATA SHEET FOR SAFETY ITEMS	12
PE-V0-415-163-A042	DATA SHEET FOR LIFTING/HANDLING EQUIPMENT	12

(b) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents 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>)



TITLE:

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

SPEC NO: PE-TS-415-163-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

- 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>

NOTES:

1. A= APPROVAL. I = INFORMATION.
2. 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.
3. BIDDER TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/NTPC APPROVED FORMATS LIKE MS EXCEL, MS WORD OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST, FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, ETC. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.
4. DOCUMENTS PERTAINING TO PROVENNESS TO BE SUBMITTED BY THE BIDDER.
5. DWG. / DOCUMENT SHALL BE UPLOADED BY THE SUCCESSFUL BIDDER ON WRENCH /DMS. PROCEDURE FOR THE SAME WILL BE INFORMED AFTER AWARD OF CONTRACT.



TITLE:

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

SPEC NO: PE-TS-415-163-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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Page 481 of 485



TITLE
* SCHEDULE OF DECLARATIONS

BHEL DOCUMENTS NO.: PE-TS-415-163-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



TITLE:

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

BHEL DOCUMENTS NO.: PE-TS-415-163-A001

VOLUME **III**

REV. NO. 00

SUGGESTIVE PRICE FORMAT FOR DM PLANT FOR 1X660MW BHUSAWAL TPS-UNIT:6, MAHARASHTRA, INDIA.

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	HSN/SAC CODE	UNIT	QTY	TOTAL PRICE FOR "FOR" SITE
(1)	(2)	(3)	(4)	(5)	(6)
1.0	Total lump sum firm price on FOR site basis for design, engineering, manufacture, inspection, testing at manufacturer's works, supply/delivery duly packed at site including freight, unloading, storage and handling at site, erection and commissioning, trial run at site, PG test, plant handing over to customer etc. inclusive of all prevailing taxes, duties and other levies of DM PLANT complete with all accessories, start up and commissioning spares as required, mandatory spares for the total scope defined as per BHEL Technical specification - PE-TS-415-163-A001 as required for safe and trouble free smooth operation.		SET	1	
2.0	BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE				
2.1	Total lump sum price on Design, engineering, manufacture, assembly, tests at manufacturer's works, forwarding, transportation, delivery of entire DM PLANT to the site including Start up and commissioning spares as required, as defined subsequently complete with all accessories, auxiliaries as specified in Technical Specification No. PE-TS-415-163-A001 as required for safe and trouble free smooth operation.	84212110	LOT	1	
2.2	Total lump sum price for supply/delivery of mandatory spares as specified in Technical Specification No. PE-TS-415-163-A001 .	84212110	LOT	1	
2.3	Total lump sum price on unloading, handling, storage, and in plant transportation at site, erection, commissioning trial run, performance and guarantee test and handing over to Purchaser the entire DM Plant as defined subsequently complete with all accessories, auxiliaries as specified in Technical Specification No. PE-TS-415-163-A001 as required for safe and trouble free smooth operation.	998732	LOT	1	

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'.

	TITLE: TECHNICAL SPECIFICATION FOR DM PLANT 1X660MW BHUSAWAL TPS-UNIT:6 MAHARASHTRA, INDIA.	SPEC NO: PE-TS-415-163-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.

DEVIATION SHEET (COST OF WITHDRAWAL)									
 PROJECT:-1X660MW BHUSAWAL TPS-UNIT:6, MAHARASHTRA, INDIA									
PACKAGE:- DM PLANT									
TENDER ENQUIRY REFERENCE:-PE-TS-415-163-A001									
NAME OF BIDDER:-									
SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL 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 withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawal 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 withdrawal 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 withdrawal 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 withdrawal 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 withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawal (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.									