

VOLUME : IIF/1

SECTION-III

TECHNICAL SPECIFICATION  
FOR  
ELECTRIC MOTOR ACTUATORS

1.00.00 SCOPE

1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates.

1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification.

2.00.00 STANDARDS

2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.

2.02.00 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

i) IS-9334

ii) IS-325

3.00.00 SERVICE CONDITIONS

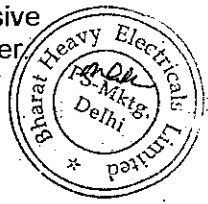
3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.

3.03.00 For actuator motor installed outdoor and exposed to direct sun rays , the effect of solar heat [manufacturer to decide] shall be considered or overhead shed shall be provided locally to avoid direct sun rays.

4.00.00 RATING

4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.



4.02.00 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.

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.

5.02.00 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).

5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.

5.04.00 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.

5.05.00 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.

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

6.01.01 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 non integral type.

6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.

6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

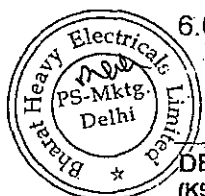
6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

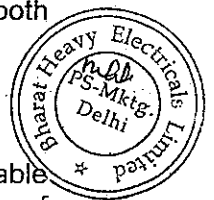
6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.

6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.

6.02.03 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.



- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be non-integral type with separate starter units and operable from remote.
- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 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.
- 6.03.04 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.
- 6.04.00 **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.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, potentiometer type, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **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. All wires shall be fire resistance type.
- 6.08.00 **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.



7.00.00 ACCESSORIES

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00 One (1) triple pole MCCB for local isolation near the actuator
- 7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V or 415/110V control transformer with primary protected by fuse & secondary protected by Miniature Circuit Breaker (MCB).

8.00.00 TEST

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.

9.00.00 DRAWINGS, DATA & MANUALS

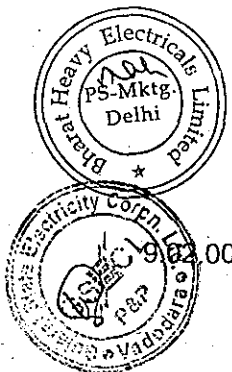
9.01.01 To be Submitted with Bid


Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues.

9.01.02 To be Submitted after Award of Contract

- a) Actuator Data Sheet
- b) Internal wiring diagram and suggested control schematic
- c) Torque switch and limit switch contact development
- d) Manufacturer's Catalogue
- e) Instruction manual indicating clearly the installation methods, check ups and tests to be carried out before commissioning of the equipment.
- f) Any other relevant drawings, documents or data necessary for satisfactory installation, operation and manufacturing.

The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment are submitted with his bid.



	TITLE	SPECIFICATION NO.	
	<b>MOTOR DATA SHEET - C</b>	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	1 OF 7

## LT MOTORS


### A. GENERAL

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

### B. DESIGN AND PERFORMANCE DATA


1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No  
(b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END\_\_
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.		
	<b>MOTOR DATA SHEET - C</b>	VOLUME	II B	
		SECTION	D	
		REV NO. 00	DATE 08/09/2010	
		SHEET	2	OF 7

- a. Voltage (Volts)
  - b. Frequency (Hz)
  - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
- a. Full load current
  - b. No load current
16. Power Factor at
- a. 100% load
  - b. NO load
  - c. Starting.
17. Efficiency at rated voltage and frequency,
- a. 100% load
  - b. 75% load
  - c. 50% load
18. Starting current (amps) at
- a. 100 % voltage
  - b. 85% voltage
  - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
- a. Without driven equipment coupled
  - b. With driven equipment coupled

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			


	TITLE	SPECIFICATION NO.	
	<b>MOTOR DATA SHEET - C</b>	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	3 OF 7

21. Safe stall time with 100% and 110% of rated voltage
  - a. From hot condition
  - b. From cold condition
22. Torques :
  - a. Starting torque at min. permissible voltage(kg-mtr.)
  - b. Pull up torque at rated voltage.
  - c. Pull out torque
  - d. Min accelerating torque (kg.m) available
  - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24.  $GD^2$  value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

**C. CONSTRUCTIONAL FEATURES**


1. Stator winding insulation
  - a. Class & Type
  - b. Winding Insulation Process
  - c. Tropicalised (Yes/No)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.		
	<b>MOTOR DATA SHEET - C</b>	VOLUME	II B	
		SECTION	D	
		REV NO. 00	DATE 08/09/2010	
		SHEET	4	OF 7

- d. Temperature rise over specified maximum ambient temperature of 50 deg C
  - e. Method of temperature measurement
  - f. Stator winding connection
2. Main Terminal Box
- a. Type
  - b. Location (viewed from NDE side)
  - c. Entry of cables(bottom/side)
  - d. Recommended cable size (To be matched with cable size envisaged by owner)
  - e. Fault level (MVA), Fault level duration (sec)
  - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
- a. Motor stator (KG)
  - b. Motor Rotor (KG)
  - c. Total weight (KG)
- D. List of accessories.**
- 1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)
  - 2. Terminal Box for Space Heater (Yes/No)
  - 3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	<p style="text-align: center;"><b>MOTOR</b></p> <p style="text-align: center;"><b>DATA SHEET - C</b></p>	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	5 OF 7

4. Insulation of bearing (Yes/No)
5. Noise reducer(Yes/No)
6. Grounding pads
  - i) No and size on motor body
  - ii) Nos on terminal Box

7. Vibration pads
  - i) Nos and size
  - ii) Location

8. Any other fitments


**E. List of curves.**

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

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


1. Rated armature voltage (Volt)
2. Rated field excitation (Amp)
3. Permissible % variation in voltage
4. Minimum Permissible Starting voltage (volt)
5. At rated voltage
  - i) Full load Armature current.(Amp)
  - ii) Full load Field current (Amp)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	<b>MOTOR</b>  <b>DATA SHEET - C</b>	VOLUME	II B
		SECTION D	
		REV NO. 00	DATE 08/09/2010
		SHEET 6	OF 7

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


NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>	
		<b>VOLUME</b>	<b>II B</b>
		<b>SECTION D</b>	
		<b>REV NO. 00 DATE 08/09/2010</b>	
		<b>SHEET</b>	<b>7 OF 7</b>

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

<b>NAME OF VENDOR</b>			<b>SEAL</b>	<b>REV.</b>	
<b>NAME</b>	<b>SIGNATURE</b>	<b>DATE</b>			

		<b>QUALITY PLAN</b> SHEET 1 OF 2			CUSTOMER :		PROJECT 1X800MW WANAKBORI TPS		SPECIFICATION :			
					BIDDER/ VENDOR :		TITLE		NUMBER :			
		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE			SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'R'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE, TYPE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1*	-	* NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		<b>QUALITY PLAN</b>		CUSTOMER :			PROJECT 1X800MW WANAKBORI TPS		SPECIFICATION :			
				BIDDER/ : VENDOR			TITLE QUALITY PLAN		NUMBER : SPECIFICATION : TITLE :			
SHEET 2 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE, TYPE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. TYPE TEST CERTIFICATES ON SIMILAR RATING OF MOTOR SHALL BE FURNISHED FOR APPROVAL. TYPE TEST CERTIFICATE SHALL NOT BE OLDER THAN FIVE(5) YEARS FROM THE DATE OF INSPECTION, OTHERWISE TYPE TEST TO BE CONDUCTED FREE OF COST. 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.												
<u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)  P. PERFORM W. WITNESS V. VERIFY												
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDER'S/VENDORS COMPANY SEAL</b>			




**QUALITY PLAN**


SHEET 1 OF 9

CUSTOMER :	PROJECT 1X800MW KOTHAGUDEM	SPECIFICATION :
BIDDER/ VENDOR :	TITLE	NUMBER :
SYSTEM	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

1	2	3	4	5	6	7	8	9	10			11
									P	W	V	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

<b>BHEL</b>	<b>PARTICULARS</b>	<b>BIDDER/VENDOR</b>
	<b>NAME</b>	
	<b>SIGNATURE</b>	
	<b>DATE</b>	
		<b>BIDDER'S/VENDORS COMPANY SEAL</b>

		QUALITY PLAN			CUSTOMER :		PROJECT 1X800MW KOTHAGUDEM		SPECIFICATION :			
					BIDDER/ VENDOR :		TITLE		NUMBER :			
					SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
SHEET 2 OF 9					ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)				SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN			CUSTOMER :			PROJECT 1X800MW KOTHAGUDEM		SPECIFICATION :		
					BIDDER/ VENDOR :			TITLE		NUMBER :		
SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP, & MECH. PROP	MA MA	VISUAL ELECT. & MECH. TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE			BIDDER'S/VENDORS COMPANY SEAL						



**QUALITY PLAN**

SHEET 4 OF 9

CUSTOMER :

PROJECT 1X800MW KOTHAGUDEM

SPECIFICATION :

BIDDER/ VENDOR :

TITLE  
QUALITY PLAN  
NUMBER PED-506-00-Q-007, REV-03

NUMBER :  
SPECIFICATION :  
TITLE

SYSTEM

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



**QUALITY PLAN**

SHEET 5 OF 9

CUSTOMER :	PROJECT 1X800MW KOTHAGUDEM	SPECIFICATION :
BIDDER/ VENDOR :	TITLE	NUMBER :
SYSTEM	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR )	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'R'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDER'S/VENDORS COMPANY SEAL</b>			



**QUALITY PLAN**

SHEET 6 OF 9

CUSTOMER :

PROJECT 1X800MW KOTHAGUDEM

SPECIFICATION :

BIDDER/ :

TITLE

NUMBER :

VENDOR

QUALITY PLAN

SPECIFICATION :

SYSTEM

NUMBER PED-506-00-Q-007, REV-03

TITLE

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)

SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDER'S/VENDORS COMPANY SEAL</b>			



**QUALITY PLAN**

SHEET 7 OF 9

CUSTOMER :	PROJECT 1X800MW KOTHAGUDEM	SPECIFICATION :
BIDDER/ VENDOR :	TITLE QUALITY PLAN	NUMBER :
SYSTEM :	NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION :
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	TITLE
		SECTION
		VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
<b>BHEL</b>			<b>PARTICULARS</b>		<b>BIDDER/VENDOR</b>							
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>									
									<b>BIDDER'S/VENDORS COMPANY SEAL</b>			



**QUALITY PLAN**

SHEET 8 OF 9

CUSTOMER :	PROJECT 1X800MW KOTHAGUDEM	SPECIFICATION : NUMBER :
BIDDER/ VENDOR :	TITLE QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>\$</sup>	1	<sup>\$</sup> NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 <sup>\$</sup>	1	<sup>\$</sup> NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>\$</sup>	1	<sup>\$</sup> NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 <sup>\$</sup>	1	<sup>\$</sup> NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 <sup>\$</sup>	1	<sup>\$</sup> NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 <sup>\$</sup>	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY <sup>\$</sup> NOTE - 2

<b>BHEL</b>	<b>PARTICULARS</b>	<b>BIDDER/VENDOR</b>
	<b>NAME</b>	
	<b>SIGNATURE</b>	
	<b>DATE</b>	

BIDDER'S/VENDORS COMPANY SEAL



**QUALITY PLAN**

SHEET 9 OF 9

CUSTOMER :	PROJECT 1X800MW KOTHAGUDEM	SPECIFICATION :
BIDDER/ VENDOR :	TITLE	NUMBER :
SYSTEM	QUALITY PLAN	SPECIFICATION :
	NUMBER PED-506-00-Q-007, REV-03	TITLE
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION
		VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11

**NOTES:**

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
- 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

- P. PERFORM  
W. WITNESS  
V. VERIFY

<b>BHEL</b>	<b>PARTICULARS</b>	<b>BIDDER/VENDOR</b>	
	<b>NAME</b>		
	<b>SIGNATURE</b>		
	<b>DATE</b>		<b>BIDDER'S/VENDORS COMPANY SEAL</b>

## ANNEXURE-I

### SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

<b>S.No.</b>	<b>LIST OF LT MOTORS</b>
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

LOAD TITLE	RATING (KW / A)		FULL LOAD CURRENT FLC(A)	UNIT (U)/STN. (S)	Nos.		VOLTAGE CODE*	FEEDER CODE*	EMER. LOAD (Y)	CONT.(C)/INTT.(I)	STARTING TIME> 5 SEC (Y)	LOCATION (Tag. No.)	RATING & FLC CHECKED FROM MOTOR/VALVE APPROVED DATASHEET (Y/N)	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	KKS NO.	
	NAME PALTE	MAX. CONT. DEMAND (MCR)			RUNNING	STANDBY									SIZE CODE	Nos						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

NOTES: 1. COLUMN 1 TO 14 & 20 SHALL BE FILLED BY THE REQUISITIONER ( ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM ( ELECTRICAL )

2. ABBREVIATIONS : \* VOLTAGE CODE (7):- (AC) A=11 KV, B=6.6KV, C= 3.3 KV, D=415 V, E = 240 V (1 PH), F = 110 V (DC) : G =220V, H = 110 V, J = 48 V, K = +24V, L= -24V

: \*\*FEEDER CODE (8) :- U = UNIDIRECTIONAL STARTER, B = BIDIRECTIONAL STARTER, S = SUPPLY FEEDER, D = SUPPLY FEEDER (CONTACTOR CONTROLLED)

<b>BHEL</b>	LOAD DATA (ELECTRICAL)	JOB NO.						ORIGINATING AGENCY			PEM (ELECTRICAL)		
		PROJECT TITLE						NAME				DATA FILLED UP ON	
		SYSTEM / S						SIGN.				DATA ENTERED ON	
		DEPTT. /SECTION						SHEET 1/2	REV. R0				DE'S SIGN. & DATE



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

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

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

(A) SYSTEM VOLTAGE CODES:

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

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

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

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

(C) CABLE CODES

PVC Copper

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

PVC Aluminium

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

XLPE Copper

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

XLPE Aluminium

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

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



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

**1X800 MW WANAKBORI TPS**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

**VOLUME – II B**  
**SECTION – C4**  
**TECHNICAL SPECIFICATION**  
**(CONTROL AND INSTRUMENTATION SPECIFICATION)**

**SPECIFIC TECHNICAL REQUIREMENTS (C&I)**

**CONTROL AND INSTRUMENTATION  
SPECIFICATION  
FOR  
MILL REJECT HANDLING SYSTEM**

DESIGN	VKV
CHECKED	SCS
APPROVED	SCS
DATE	12.08.15
REV.	00

	1X800 MW Wanakbori STPP	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**TABLE OF CONTENTS**

- A. General & Specific Technical requirement
- B. C&I deliverables list
- C. Specification for Motorized valve actuator
- D. Specification for field instruments
- E. Control panels specification
- F. Drive control philosophy
- G. Applicable codes and standards
- H. Specification for Quality assurance & Testing
- I. VOID
- J. Drawings

|

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**GENERAL & SPECIFIC TECHNICAL  
REQUIREMENT**

|

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**GENERAL REQUIREMENT**

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

2.0. The quantity of instruments for auxiliary system shall be as per tender P & ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.

|

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**Specific Technical Requirements (C&I):**

1) Mill Reject Handling System shall be operated from plant DCS through operator work stations located in central control room. In addition provision of local operation from local control panel shall also be provided.

2) Bidder to provide one no local control panel for mill reject system of each Mills and each pyrite hoppers. This local panel will act as interface between the DCS and the field devices for commands & feedbacks.

3) Local Control Panel for Compressors of Mill Reject Handling System shall be provided with command & feedback interface with plant DCS. In addition provision of local operation (START/STOP) from local control panel shall also be provided.

4) Bidder to include VMS for HT drives, if any.

5) Bidder to include all the instruments (PG, PS, LS, TS, FS etc.) required for the package along with fittings, accessories and valve manifold.

6) The solenoid operated valves/ damper/gates shall have limit switches for Open / close feedback. Solenoid valve shall be rated either for 220V DC or 24 V DC only.

7) The junction boxes for termination of instruments /actuator limit switches/solenoid valve limit switches etc are in bidder's scope.

8) Redundant 230 VAC UPS feeders shall be provided by BHEL at a single point. Further distribution to various instruments shall be in Bidder's scope. Bidder to include necessary power distribution board(ACDB)(as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid.

9) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

10) All field instrument, local panel / cabinet enclosures shall be IP-65.

11) In case of any contradiction most stringent clause/condition shall prevail.

|

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

12) Hardware based monitoring / control / annunciation shall be provided for the systems where HMI workstations are not envisaged or need for such back up is strongly recommended by Bidder for the safe shutdown of the system.

13) All electrical actuators shall be non-integral type.

14) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. RTD's shall be of duplex type.

15) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification.

16) Bidder to comply with codes and standards as mentioned in the specification.

17) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible.

18) Bidder to delegate /depute their persons/experts as per owner/consultants' requirement.

19) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.

20) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

21) Drawings/Documents and data to be furnished after award of the Contract :

- Control & operational write-up for the system
- Recommended control scheme/ logic diagram
- Process manuscript for implementation in DCS
- List of Drives (Solenoid valves etc.)
- I/O list
- GA drawings of local panel/Power Distribution Board(ACDB)(Internal & External)

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I
	<b>SPECIFIC TECHNICAL REQUIREMENTS (C&amp;I)</b>	

- Power requirement.
- Local control panel and field instruments quality plan.
- Local control panel & instruments data sheet.
- JB grouping document.
- Cable schedule and cable interconnection drawing(in BHEL format)
- Instrument schedule
- Any other document decided during detailed engineering
- Mandatory Spares Bill of Material

|

1.00.00      **GENERAL**

1.01.00      In conformity with the guidelines provided in the specification, the scope of works shall completely cover all Instrumentation & Control equipment, functions, activities and documentation specified under the accompanying Technical Specifications and shall not be limited to the following:

- a) Detailed design and engineering of the manufactured equipment; system integration and system engineering.
- b) Complete manufacture including shop testing before shipment.
- c) Specifying, procurement, quality inspection of bought-out items from sub-suppliers. Design co-ordination for and integration with bought-out items.
- d) Coordination, integration and interface between various BOP control systems such as Water Pretreatment plant, Demineralized Water plant, Coal Handling Plant, Ash Handling Plant, ETP etc. and the station DCS for centralized monitoring & selective operation.
- e) Providing engineering drawings, documents, licensed copy of software and developmental tools, data, instruction, operation and maintenance manual etc. for Owner's review / approval / record.
- f) Arranging for Owner's inspection and testing of manufactured as well as bought-out items at the respective works.
- g) Packaging and transportation of instruments, equipments, accessories and erection hardware from the manufacturer's works to the site, including transit insurance.
- h) Pre-assembly (if any), erection, testing and commissioning of all equipments and instruments supplied, in totality.
- i) Performing availability tests, Performance and Guarantee tests.
- j) Prepare and submit approved & as-built drawings and documents in hard and soft copies.
- k) Furnishing of spares, tools and tackle and test instruments.
- l) Fulfilling post-commissioning liabilities.
- m) Arranging for the training of Owner's personnel of different categories at manufacturer's works as well as plant site.
- n) Other activities detailed in subsequent sections of the Specification.
- o) Any other activity, not mentioned explicitly, but felt essential by Bidder for successful completion of work.

1.02.00      Requirements enumerated in this specification are qualitative in nature and are based on typical configuration of various BOP plants for the purpose of bidding. It shall be the responsibility of Bidder to offer Instrumentation &

Control system to meet the actual functional requirements of the BOP systems offered.

1.03.00 Operation and control of various BOP systems like Water system, Coal Handling plant, Ash Handling plant, Compressed air system, Ventilation & AC system, DM plant, PT plant, CW treatment system, DG set, , Fuel unloading system etc. shall be carried out from redundant PLC / Microprocessor based control system. There may be other systems where control is not critical. In such cases hardwired / relay based interlock shall be envisaged.

However, hardware based monitoring / control / annunciation shall be provided for the systems where HMI workstations are not envisaged or need for such back up is strongly recommended by Bidder for the safe shutdown of the BOP systems.

1.04.00 In case of any conflict or contradiction between any two or more sections of this specification the more stringent condition shall generally be applicable. Owner, however, reserves the right to relax this condition at his discretion.

1.05.00 Type of control vis-a vis the plant area are delineated below

1.05.01 Plant Auxiliaries System:

- a) DM Cooling Water System & process Heat exchangers
- b) Condenser Cooling Water (CW system) with tube cleaning system.
- c) Auxiliary Cooling Water System (ACW system) with self-cleaning strainers.
- d) Condensate Transfer (CT) pump
- e) DM Service Water (DMSW) pumps
- f) Mill Reject Handling System
- g) Fuel Oil Pressurizing & Heating System
- h) Condensate On-line Polishing Unit
- i) Chemical Feed system

1.05.02 Interface with Other Off site Plants under BOP Package

Data acquisition / indication of selected parameters / selective operation (as required) from the following off site plants to station DCS are foreseen through MODBUS / OPC protocol:

- a) Pretreatment Plant;
- b) Demineralization Plant;
- c) Coal Handling plant;
- d) Fuel Oil Unloading & Storage;

- e) Turbine Oil Purification system;
- f) ETP Plant;
- g) Ash Handling Plant;
- h) Fire sensing and protection system;
- i) Compressed air system;
- j) AC & Ventilation System.

1.05.03 Off Site Plants shall be operated from their local control stations located in the respective plant local control rooms. Some of the Plants shall have limited operational facility from Central Control Room as well.

1.05.04 All PLC based based control systems for plant auxiliaries and other offsite plants shall be powered from separate redundant UPS. Local control panels for such systems shall be kept in air condition environment.

1.05.05 Control matrix for the Auxiliaary system & off-site systems shall be in general as below:

SL. NO.	AUX.SYSTEM / PLANT	CONTROL SYSTEM	CONTROL LOCATION	DCS INTERFACE
<b>A.</b>	<b>Plant Auxiliaries System</b>			
a)	DM Cooling Water System (Turbine)	DCS	DCS Monitoring & Operation from Central Control Room	
b)	DM Cooling Water System (Boiler)	DCS	DCS Monitoring & Operation from Central Control Room	
c)	CW system	Through Remote I/O Cabinet to DCS	DCS Monitoring & Operation from Central Control Room	
d)	ACW system	Through Remote I/O Cabinet to DCS	DCS Monitoring & Operation from Central Control Room	
e)	Condenser tube cleaning system	PLC	Local operating panel .	Hardware connectivity for alarm and monitoring.
f)	Mill Reject Handling	Redundant PLC	Operator stations in local	MODBUS Soft link for remote

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 9 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**SPECIFICATION FOR MOTORISED VALVE  
ACTUATOR**

|



**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.: PE-ID-408-145-I902

VOLUME II B

SECTION D

REV. NO. 00 DATE: 04.04.15

SHEET 1 OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

408

<b>GENERAL*</b>	* PROJECT		
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	<input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
<b>CONSTRUCTION AND SIZING</b>	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IPW:55	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER FOR <b>INCHING SERVICE - 150 STARTS/HR MINIMUM &amp; FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.</b>	
<b>HANDWHEEL</b>	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
<b>ELECTRIC ACTUATOR</b>	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT- <b>INCLUSIVE OF I.S. TOLERANCE</b>	
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 C: <input type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 D: <input checked="" type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11 E: <input type="checkbox"/> For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	<input type="checkbox"/> BLUE (RAL 5012) <input type="checkbox"/> ..... (TO BE DECIDED BY BHEL DURING DETAIL ENGG.)	
	<b>PAINT TYPE (## Refer Notes)</b>	<input type="checkbox"/> ENAMEL <input type="checkbox"/> EPOXY <input type="checkbox"/> ..... (TO BE DECIDED BY BHEL DURING DETAIL ENGG.)	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	



**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.: PE-ID-408-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 04.04.15

SHEET 2

OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

408

	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V <input checked="" type="checkbox"/> 110 V		
	@ ENCLOSURE CLASS OF MOTOR	<input checked="" type="checkbox"/> IP 65 <input type="checkbox"/> FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos.,1 IN EACH PHASE) <input checked="" type="checkbox"/> ---THERMOSTAT- 1 NO+1 NC CONTACT -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
<b>INTEGRAL STARTER</b>	INTEGRAL STARTER	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	<input type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS		
	TYPE	<input type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)		
	<b>IF SMART</b>			
	a) SERIAL LINK INTERFACE	<input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	<input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> DEVICE NET <input type="checkbox"/> .....		
	c) SERIAL LINK MEDIA	<input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC		
	d) HAND HELD PROGRAMMER	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	e) TYPE OF HAND HELD PROGRAMMER	<input type="checkbox"/> BLUETOOTH <input type="checkbox"/> INFRARED <input type="checkbox"/> .....		
	f) MASTER STATION	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	g) MASTER STN INTRFACE WITH DCS	<input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP		
	h) DETAILS OF SPECIAL CABLE	<input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	<input type="checkbox"/> REQUIRED		
	OPEN / CLOSE PB	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STOP PB	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INDICATING LAMPS	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	LOCAL REMOTE S/S	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
STATUS CONTACTS FOR MONITORING	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)			
<b>INTERPOSING RELAY/OPTO COUPLER</b> (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	<input type="checkbox"/> INTERPOSING RELAY <input type="checkbox"/> OPTO COUPLER <input type="checkbox"/> EITHER		
	QUANTITY	<input type="checkbox"/> 2 NOs. <input type="checkbox"/> 3 NOs.		
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC		
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX		
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ohms - < _____ ohms		
<b>TORQUE SWITCH</b> (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		



**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.: PE-ID-408-145-I902

VOLUME II B

SECTION D

REV. NO. 00

DATE: 04.04.15

SHEET 3

OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

408

<b>LIMIT SWITCH</b> (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input type="checkbox"/> 1 No. <input checked="" type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		

<b>POSITION TRANSMITTER</b>	POSITION TRANSMITTER (For inching duty & other specific applications)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED
	MFR & MODEL NO.	BIDDER TO SPECIFY
	TYPE	<input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA
	ACCURACY	$\pm$ 1% FS
<b>SPACE HEATER</b>	@SPACE HEATER	REQUIRED
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY
	@ RATING	decided as per load data received tender stage
<b>TERMINAL BOX</b>	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ <input type="checkbox"/> IP 68                      @ <input type="checkbox"/> .....
	@ EARTHING TERMINAL	REQUIRED
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED <input type="checkbox"/> 2 NOS. <input type="checkbox"/> .....
<b>CABLE GLANDS</b>	@ POWER CABLE GLAND	SIZE: decided as per load data received tender stage
	@ SPACE HEATER CABLE GLAND	SIZE: decided as per load data received tender stage
	OTHER CONTROL CABLE GLANDS-1	<input type="checkbox"/> 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE : .....



**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.: PE-ID-408-145-I902	
VOLUME	II B
SECTION	D
REV. NO.	00
DATE:	04.04.15
SHEET	4 OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

408

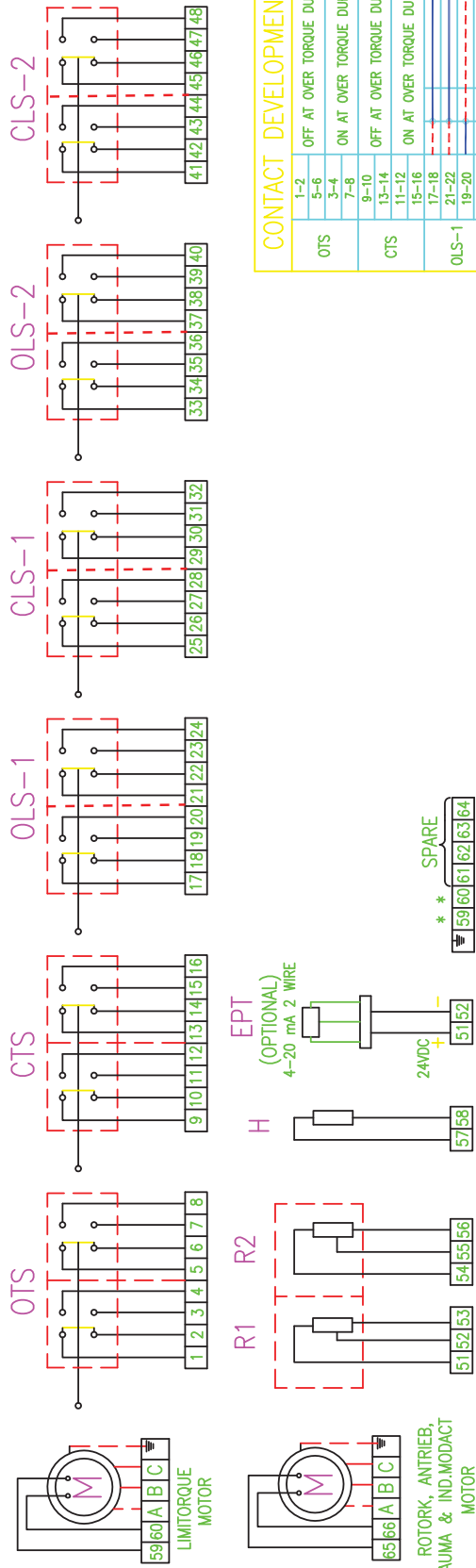
<b>WEIGHT</b>	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.
---------------	---------------------------------------	-------------------	-----------

**NOTES:**

1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
  2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:  
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
  3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
  4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
  5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
  6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
  7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
  8. CANOPY FOR OUTDOOR SERVICES SHALL BE PROVIDED.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**

NAME SIGNATURE DATE	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>VENDOR COMPANY SEAL</b>
				NAME
				SIGNATURE
				DATE

NOTES\* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES



\* - SPARE FOR ROTORK, AUMA, ANTRIEB & IND.MODACT SWITCHES - ALL ARE POTENTIAL FREE AND TWO PAIR OF CONTACTS CAN BE USED FOR DIFFERENT SUPPLY THERMOSTAT - 65-66 (ROTORK, AUMA, ANTRIEB & IND.MODACT), 59-60 (LIMITORQUE).  
 EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)  
 THERMOSTAT TERMINALS - TERMINATED IN MOTOR TB IN ANTRIEB & IND.MODACT AND IN MAIN TB IN OTHER MAKES  
 CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE) - 2 NO+2 NC  
 OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN) - 2 NO+2 NC  
 OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN - 2 NO+2 NC  
 CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE - 2 NO+2 NC  
 OTS, CTS - TWO INDEPENDENT SWITCHES IN ANTRIEB & LIMITORQUE  
 OLS-2 & CLS-2 - CAM DISC IN ROTORK & ANTRIEB  
 R1-R2- POTENTIOMETER 2 x 100 OHMS  
 H - SPACE HEATER 1ϕ 240V AC SUPPLY  
 M - MOTOR 3ϕ 415V 50 Hz AC SUPPLY

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  
 NOTE:  
 1. BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)  
 2. CONNECT THERMOSTAT WITHOUT FAIL IN THE STARTER CIRCUIT

CONTACT DEVELOPMENT DIAGRAM			
1-2	OFF AT OVER TORQUE DURING OPENING TRAVEL		
5-6	ON AT OVER TORQUE DURING OPENING TRAVEL		
3-4	ON AT OVER TORQUE DURING OPENING TRAVEL		
7-8	OFF AT OVER TORQUE DURING CLOSING TRAVEL		
9-10	ON AT OVER TORQUE DURING CLOSING TRAVEL		
13-14	OFF AT OVER TORQUE DURING CLOSING TRAVEL		
11-12	ON AT OVER TORQUE DURING CLOSING TRAVEL		
15-16			
17-18			
21-22			
19-20			
23-24			
25-26			
29-30			
27-28			
31-32			
33-34			
35-36			
37-38			
39-40			
45-46			
43-44			
47-48			
TERMINAL NO.	FULL OPEN	INTERMEDIATE	FULL CLOSE
	a	b	
	VALVE POSITION		
	——— INDICATES CONTACT CLOSED - - - - - INDICATES CONTACT OPEN		

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

<b>BHARAT HEAVY ELECTRICALS LTD.</b> UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPPALLI 620014.			
365-139		TITLE <b>INTERNAL WIRING DIAGRAM</b> FOR <b>ELECTRICAL VALVE ACTUATORS (AC)</b> (DRAWN FOR INTERMEDIATE POSITION OF VALVES)	
DRAWN N.P.ESWAR	CHECKED K.ARUMCHALAM	APPROVED P.LOGANATHAN	DATE 09.09.2000
REV 11	DATE 09.09.2000	APPD CHED	DESCRIPTION CONTACT DEY. FG.ADDED.
DRAWING No.	4-V-MISC-90271	REV	11

RETRACED WITH REVISION 11

**VOLUME : IIF/1**

**SECTION-III**

**TECHNICAL SPECIFICATION  
FOR  
ELECTRIC MOTOR ACTUATORS**

1.00.00 **SCOPE**

1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates.

1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification.

2.00.00 **STANDARDS**

2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.

2.02.00 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

i) IS-9334

ii) IS-325

3.00.00 **SERVICE CONDITIONS**

3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.

3.03.00 For actuator motor installed outdoor and exposed to direct sun rays , the effect of solar heat [manufacturer to decide] shall be considered or overhead shed shall be provided locally to avoid direct sun rays.

4.00.00 **RATING**

4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.

4.02.00 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.

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.

5.02.00 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).

5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.

5.04.00 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.

5.05.00 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.

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

6.01.01 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 non integral type.

6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.

6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

6.02.01 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. Canopy shall be provided for outdoor service.

6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.

6.02.03 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.

- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be non-integral type with separate starter units and operable from remote.
- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 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.
- 6.03.04 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.
- 6.04.00 **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.
- 6.05.00 Position Indicator/Transmitter
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, potentiometer type, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **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. All wires shall be fire resistance type.
- 6.08.00 **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.

7.00.00      **ACCESSORIES**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00      One (1) triple pole MCCB for local isolation near the actuator
- 7.02.00      One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00      One (1) remote-local selector switch.
- 7.04.00      CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00      415/240 V or 415/110V control transformer with primary protected by fuse & secondary protected by Miniature Circuit Breaker (MCB).

8.00.00      **TEST**

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.

9.00.00      **DRAWINGS, DATA & MANUALS**

9.01.01      To be Submitted with Bid

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues.

9.01.02      To be Submitted after Award of Contract

- a)      Actuator Data Sheet
- b)      Internal wiring diagram and suggested control schematic
- c)      Torque switch and limit switch contact development
- d)      Manufacturer's Catalogue
- e)      Instruction manual indicating clearly the installation methods, check ups and tests to be carried out before commissioning of the equipment.
- f)      Any other relevant drawings, documents or data necessary for satisfactory installation , operation and manufacturing.

9.02.00      The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment are submitted with his bid.

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 10 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**SPECIFICATION FOR FIELD INSTRUMENTS**

|

1.00.00 **FIELD INSTRUMENTS**

This section provides general hardware guidelines for field instruments and equipment to be supplied under this specification.

1.01.00 Pressure Transmitter

01. Working Principle : Smart (HART Compatible)
02. Type : 2 - Wire
03. Output Signal : 4-20 mA DC.
04. Signal Processing : Silicon solid state electronic circuitry
05. Measuring Element : Capsule / Diaphragm
06. Element material : AISI-316 (Stainless Steel) or better
07. Static Pressure : 150 % of maximum span continuously, without affecting the calibration.
08. Turn-down ratio : 60: 1.
09. Span and Zero : Locally adjustable non-interacting. Facility for elevation and suppression by 100% of span
10. Enclosure Class : IP-65
11. Output Indicator : LCD
12. Nameplate : Tag number, service engraved in SS tag plate
13. Body : Forged Carbon Steel for air and flue gas application and SS for other application.
14. Operating Voltage : 16 - 48 Volts D.C.
15. Load : 600 Ohms (min.) at 24 Volts D.C.
16. Ambient Temperature : 0 - 50 °C
17. Performance:
  - i) Accuracy :  $\pm 0.1\%$  of Span or better
  - ii) Repeatability :  $\pm 0.05\%$  of Span or better
  - iii) Response time : 100 msec or better
18. Sealing/Isolation : Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.
19. Accessories :
  - a) Universal mounting bracket suitable for 2" pipe mounting.
  - b) High tensile carbon steel U- bolts.
  - c) Siphon for steam and hot water services.
  - d) 1/2" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock.
  - e) Companion flange with nuts, bolts and gaskets.

- f) ½" NPT cable gland
- 1.02.00 Differential Pressure Transmitter / Flow transmitter
01. Working Principle : Smart (HART compatible)
  02. Type : 2-Wire
  03. Output signal : 4-20 mA DC.
  04. Signal Processing Unit : Silicon solid-state electronic circuitry
  05. Measuring element : Capsule/Diaphragm
  06. Element material : AISI-316 (Stainless Steel) or better
  07. Static Pressure/  
Overload Pressure : Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy
  08. Turn-down ratio : 60 : 1 minimum
  09. Span and Zero : Locally adjustable, non-interacting
  10. Enclosure class : IP-65
  11. Zero suppression /  
elevation : At least 100% of Span
  12. Output Indicator : LCD type
  13. Nameplate : Tag number and Service engraved in SS tag plate
  14. Body : Forged Carbon Steel for air and flue gas application and SS for other application
  15. Ambient temperature : 0 - 50 °C
  16. Operating Voltage : 16 - 48 Volts DC
  17. Load : 600 Ohms (min.) at 24 Volts DC
  18. Performance:-
    - i) Accuracy : ±0.1 % of span or better
    - ii) Repeatability : ± 0.05 % of span or better
    - iii) Response time : 100 msec or better
  19. Sealing / Isolation : Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.
  20. Accessories :
    - a) Universal mounting bracket suitable for 2" pipe mounting.
    - b) High tensile carbon steel U-bolts.
    - c) Siphon for steam and hot water services.
    - d) Companion flange with nuts, bolts and gaskets.
    - e) ½" NPT cable gland

- f) ½" NPT generally 5-valve stainless steel manifold, constructed from SS316 bar stock. 3 valve manifold for DP application in flue gas and air.

1.03.00 Displacer Type Level Transmitters

01. Type : Smart (HART compatible)
02. Stages of operation : Continuous
03. Material -
- i) Displacer : AISI 316 SS
  - ii) Suspension wire : AISI 316 SS
  - iii) Torque tube housing : Carbon steel or SS as per application
  - iv) Torque tube : Inconel
  - v) Displacer chamber : CS or SS as per process application
  - vi) Transmitter Housing : Die cast aluminium or better
04. Operating Voltage : 16-48 Volts D.C.
05. Transmission : 2-wire
06. Output Signal : 4-20 mA DC.
07. Signal processing : Solid-state electronic circuitry
08. Static / overload pressure : Maximum static pressure without permanent deformation or loss of accuracy.
09. Turn-down ratio : 10 : 1 or better
10. Zero & Span : Easily accessible (local zero & span adjustment and non-interactive type)
11. Enclosure Class : IP-65
12. Output Indicator : LCD type
13. Nameplate : Tag number and Service engraved in stainless steel tag plate
14. Ambient Temperature : 0 - 50 °C
15. Load Impedance : 600 Ohms at 24 Volts (minimum)
16. Process Connection : 2" Companion flange with nuts, bolts and gaskets
17. Performance -
- Accuracy : ± 0.5 % of span or better
18. Accessories :
- a) Counter Flange, nuts, bolts, gaskets etc.
  - b) Weights for 5 point calibration of instruments.
  - c) Vent and drain plugs
  - d) Special calibration tool/configurator, if any.
  - e) ½"NPT cable gland

19. Preferred Features : a) Test plug connection and cutout terminals physically separated from other electronics.  
b) Electronic Damping facility (adjustable).
- 1.04.00 Mass Flow meter
- 1.04.01 Sensor
01. Measuring Principle : Coriolis Mass flow.
02. Primary Element : Flow Tube of 316SS or better
03. Heating Arrangement : Integral.
04. Temperature Control : For heavy fuel oil application.
05. Process Connection : Flanged of rating as per process requirement.
06. Drain : Self-draining facility
07. Enclosure : Stainless steel
08. Accessories : Counter flanges, Mounting nuts, bolts, gaskets etc.
- 1.04.02 Transmitter
01. Measured quantities : Mass Flow rate, Total Mass Flow, Density.
02. Input Signal Processing : Digital Processing.
03. Display : Digital Display (LCD).
04. Output : 2 off. isolated 4-20mA DC output.
05. Load : < 750 ohms.
06. Power supply : 240V AC, 50 Hz.
07. Turn Down : 100:1
08. Accuracy :  $\pm 0.2$  % of measured value
09. Housing : IP 65
10. Nameplate : Tag number, service engraved in stainless steel tag plate
11. Accessories : a) Handheld configurator  
b) Mounting U-bolts, nuts, bolts, prefab cable etc.  
c)  $\frac{1}{2}$ "NPT cable gland
- 1.05.00 Pressure Gauge and Differential Pressure Gauge
01. Type : Bourdon/Bellows/Diaphragm
02. Sensing & Socket : AISI-316 SS
03. Movement Material : AISI-304 SS
04. Case Material : Stainless steel. IP-65.
05. Dial Size : Generally 150 mm
06. Scale : Black lettering on white in  $270^\circ$  arc.

- |         |                          |   |   |
|---------|--------------------------|---|---|
| 07.     | Window                   | : | Shatterproof glass  |
| 08.     | Range Selection          | : | Normal process pressure: 50~70 % of range   |
| 09.     | Over-range Protection    | : | 125% of maximum range by internal stop. External stop at zero.  |
| 10.     | Adjustment               | : | Micrometer screw for zero. Internal micrometer screw for range.   |
| 11.     | Element Connection       | : | Argon welding   |
| 12.     | Process Connection       | : | 1/2" NPT (M) Bottom for local, back for panel mounting.   |
| 13.     | Performance              | : | Accuracy of $\pm 1.0$ % of span or better.  |
| 14.     | Operating ambient        | : | 0 - 50 °C   |
| 15.     | Safety Feature           | : | Blow out disc /diaphragm at the back  |
| 16.     | Accessories              | : | a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.<br>b) Stainless steel Diaphragm seals for viscous fluids.<br>c) 3-Way SS316 Gauge cock for pressure gauges.<br>d) 5-valve SS316 manifold from barstock for differential pressure gauge.<br>e) Siphons for steam and hot water services. |
| 17.     | Applicable standard      | : | IS-3624 / 1996  |
| 18.     | Nameplate                | : | Tag number, service engraved in stainless steel tag plate   |
| 1.06.00 | Temperature Gauge        |   |   |
| 01.     | Type                     | : | Bimetallic or gas filled.   |
| 02.     | Sensing Element Material | : | Bourdon - AISI-316 SS   |
| 03.     | Capillary Armoring       | : | Stainless steel flexible  |
| 04.     | Movement Material        | : | AISI 304 SS   |
| 05.     | Bulb / Stem Diameter     | : | 12 mm   |
| 06.     | Bulb / Stem Material     | : | AISI 316  |
| 07.     | Capillary                | : | Stainless Steel   |
| 08.     | Connection to well       | : | 1/2" NPT  |
| 09.     | Case Material            | : | Stainless steel   |
| 10.     | Dial Size                | : | 150 mm in general   |
| 11.     | Scale                    | : | Black lettering on white in 270 ° arc.  |
| 12.     | Mounting                 | : | Surface/Panel   |
| 13.     | Over range Protection    | : | 125 % of range or more  |

14. Instrument connection : Bottom for local and back for panel mounting.
15. Range : Normal temperature–50~70% of range.
16. Zero adjuster : Micrometer screw adjustable from front.
17. Window : Shatterproof glass.
18. Accuracy :  $\pm 1\%$  or better
19. Enclosure Class : IP-65
20. Capillary : 5 meters (local surface)/15.0 meters (local panel) - armoured stainless steel
21. Compensation : Capillary and Case Compensation
22. Accessories : a) Forged barstock thermowell screwed as per ASME PTC code. Process connection M 33X2 (M).  
Material of construction of Thermowell:  
- SS 316: In general  
- Inconel: For flue gas application  
- Tungsten carbide: For coal mill application.
23. Nameplate : Tag number, service engraved in stainless steel tag plate
- 1.07.00 Thermocouples
01. Type : a) Type-J (Iron Constantan) / Type-K (Chromel Alumel) / Type-R (Pt.-Rhodium Pt.) / Type-S (90% Pt – 10% Rhodium). [As per application]  
b) Duplex  
c) Ungrounded
02. Wire gauge : 16 AWG for Type-K, 24 AWG for Type-R
03. Standard : ANSI-MC 96.1.
04. Protecting Tube :-  
i) O.D. : 8 mm  
ii) Material : 316-SS Seamless  
iii) Filling : Magnesium Oxide (Purity above 99.4%)
05. Response time : a) < 20 seconds for measurement.  
b) < 10 seconds for control.
06. Accuracy :  $\pm 1.1^{\circ}\text{C}$  up to  $300^{\circ}\text{C}$  & 0.4% of measured temperature range above  $300^{\circ}\text{C}$ .
07. Head:  
i) Type : IP-65 universal screwed type.  
ii) Material : Die cast aluminum or better  
iii) Terminal blocks : Nickel plated Brass - screw type/ silver plated

- iv) Instrument connection : ½" NPT  
to well
- v) Cable connection : ½" NPT gland and grommet.
- vi) Others : Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells.

08. Accessories : a) Adjustable nipple-union-nipple [1/2" Sch 80 X ½" NPT (M)] with thermowell connection
- b) Compression fittings/unions
  - c) Flanges etc. (for flanged connections only)
  - d) Forged barstock thermowell as per ASME PTC code. Process connection M 33X2 (M) in general or 1½" Flanged for Flue gas/Furnace/Air etc. application.

Material of construction of Thermowell:

SS 316: In general

Inconel: For flue gas application

Tungsten carbide: For coal mill application.

09. Nameplate : Tag number, service engraved in stainless steel tag plate

1.08.00 Resistance Temperature Detector

- 01. Type : Platinum (Duplex), Ungrounded
- 02. Resistance : 100 ohm at 0 °C
- 03. Base : Wound on ceramic (anti-inductive)
- 04. Wiring : 3 /4 Wire
- 05. Protecting Tube :-
  - i) O.D. : 8 mm
  - ii) Material : SS-316, Seamless
  - iii) Filling : Magnesium oxide (Purity above 99.4%).
- 06. Response time : a) < 20 seconds for measurement.  
b) < 10 seconds for control.
- 07. Calibration : DIN 43760
- 08. Accuracy : ± 0.5%
- 09. Head :

- |         |                          |   |  |
|---------|--------------------------|---|--|
|         | i) Type                  | : | IP-65 universal screwed type.  |
|         | ii) Material             | : | Die cast aluminum or better  |
|         | iii) Terminal blocks     | : | Nickel plated Brass-screw type / silver plated   |
|         | iv) Cable connection     | : | ½" NPT gland and grommet.  |
|         | v) Others                | : | Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells   |
| 10.     | Accessories              | : | <p>a) Adjustable nipple-union-nipple [1/2" Sch 80 X ½" NPT (M)] with thermowell connection</p> <p>b) Compression fittings/unions</p> <p>c) Flanges etc. (for flanged connections only)</p> <p>d) Forged/barstock thermowell as per ASME PTC code. Process connection M33X2 (M).</p> <p>Material of construction of Thermowell:<br/>SS 316: In general<br/>Inconel: For flue gas application<br/>Tungsten carbide: For coal mill application.</p> |
| 11.     | Nameplate                | : | Tag number, service engraved in stainless steel tag plate  |
| 1.09.00 | Pressure Switch          |   |  |
| 01.     | Type                     | : | <p>i) Piston for high pressure application</p> <p>ii) Bellow / Diaphragm for low pressure application</p>  |
| 02.     | Sensing element material | : | AISI SS-316. All other wetted part SS316.  |
| 03.     | Case Material            | : | Die-cast aluminum alloy, neoprene gasket.  |
| 04.     | Setter Scale             | : | Black graduation on white linear scale. Graduation 0-100% with red pointer for set points.   |
| 05.     | Over range               | : | 150 % of maximum pressure  |
| 06.     | Adjustments              | : | <p>a) Internal Set Point</p> <p>b) Differential adjustment</p>   |
| 07.     | End Connection           | : | 1/2" NPT (M) bottom connected  |
| 08.     | Switch configuration     | : | Two SPDT   |
| 09.     | Switch Rating            | : | 240V, 5A AC/220V, 0.5A DC  |

10. Switch Type : Snap acting, shock & vibration proof
11. Terminal Block : Suitable for full ring lugs.
12. Cable connection : ½" NPT conduit connection.
13. Enclosure Class : IP-65.
14. Performance : a) Repeat accuracy  $\pm 1.0\%$   
b) Accuracy of Setting Indication of  $\pm 1.5\%$
15. Ambient temperature : 0 – 50 Deg.C
16. Nameplate : Tag number, service engraved in SS tag plate
17. Accessories : a) Remote diaphragm seal with SS-316 capillary for viscous & corrosive application.  
b) Siphons for steam and hot water services.  
c) Retention ring and screws for surface mounting.  
d) ½" NPT 2 Valve SS-316 barstock manifold  
e) ½" NPT cable gland
- 1.10.00 Differential Pressure Switch
01. Type : Bellows / Diaphragm / Piston actuated
02. Sensing element material : AISI SS-316. For all other wetted part SS 316
03. Case Material : Die-cast aluminum alloy with neoprene gasket.
04. Setter Scale : Black graduation on white scale with 0-100% graduation and provided with red pointer for set point adjustment
05. Over range : Static pressure on any one side, the other side being open to atmosphere.
06. Adjustments : a) Internal set point adjustment  
b) Differential adjustment
07. Process Connection : ½" NPT (M) bottom / back connected.
08. Switch configuration : Two SPDT
09. Switch rating : 240V, 5A AC/220V, 0.5A DC.
10. Switch type : Snap acting type contacts, shock and vibration proof.
11. Terminal Blocks : Suitable for full ring lugs for cable connection.
12. Cable Connection : ½" NPT conduit connection or compression gland.
13. Performance : a) Repeat accuracy  $\pm 1.0\%$   
b) Accuracy of set point Indication:  $\pm 1.5\%$

14. Operating Ambient : 0 - 50 °C (Maximum Continuous)
15. Enclosure : IP-65
16. Accessories : a) Snubbers for pulsating fluid application.  
b) Syphons for steam and hot water services.  
c) Retention ring and screws for surface mounting.  
d) 1/2" NPT 3-Valve SS-316 manifold constructed from barstock  
e) 1/2" NPT Cable gland
17. Nameplate : Tag number, service engraved in stainless steel tag plate
18. Remote Seal type for special application : a) Silicone oil / fluorolube filled remote diaphragm seal for dirty / viscous / corrosive fluid.  
b) SS armoured capillary at least 3 meters each.  
c) Adapter flanges with nuts, bolts and gaskets for instrument and process side.
- 1.11.00 Level Switch
01. Type : External cage float operated. Magnetically coupled.
02. Float Material : AISI-316 stainless steel or better
03. Other wetted parts : AISI-316 stainless steel or better
04. External Cage : Carbon steel / Stainless steel as per process requirements, welded type / flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.
05. External cage mounting : Side-Side.
06. External cage connection : 25 NB socket welded.
07. Switch housing : Epoxy coated die-cast aluminum alloy with neoprene gasket conforming to IP-65.
08. Type of switch configuration : 2 SPDT (two nos.)
09. Contact rating : 5A, 240V/AC, 0.25A, 220V DC
10. Accessories : a) Counter flange, nuts & bolts, suitable gasket etc.

- b) Steel globe type drain valve.
- c) ½"NPT cable gland
- d) Stainless steel nameplate with alpha-numeric engraved for service and tag.
- 11. Preferred feature : Switch operating point marked on cage
- 12. Mounting : On standpipe
- 1.12.00 Conductivity Type Level Switch
  - 01. Type : Conductivity discrimination.
  - 02. Application : Drain pots viz. on CRH line
  - 03. Mounting : Flanged – on external cage.
  - 04. Probe MOC : Stainless steel with high purity ceramic.
  - 05. Probe rating : > Maximum design pressure of vessel.
  - 06. Input : Four independent channel with selectable switching threshold for water conductivity.
  - 07. Relay Output : Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.
  - 08. Contact type & rating : 2SPDT or 1 DPDT @ 5A 30V DC.
  - 09. Local Display : Coloured LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault.
  - 10. Power supply : Dual 240V AC, 50 Hz, 1Ph.
  - 11. Enclosure : IP-65, corrosion resistant & wall mounting type (Explosion proof for NEC Class-1, Division-1 area).
  - 12. Accessories :
    - a) PTFE cable from probe to electronics
    - b) Mounting accessories
    - c) External cage
    - d) Washer & gasket
  - 13 Test pressure : Two times rated pressure
  - 14. Cable connection : ½" NPT with cable gland
- 1.13.00 Orifice Plate
  - 01. Application : Low fluid velocity flow measurement
  - 02. Design Standard : BS-1042, Part-I
  - 03. Number of Tapings : As required plus one additional pair of taps
  - 04. Diameter Ratio : Between 0.4 to 0.7
  - 05. Thickness : 3 mm for main pipe diameter up to 250 mm, 6 mm for main pipe diameter above 250 mm and 10 mm for main pipe diameter of 500 mm and above.

- |         |                             |   |   |
|---------|-----------------------------|---|---|
|         | 06. Document                | : | Beta ratio calculation, assembly drawing and Flow vs. DP curve.   |
|         | 07. Meter run pipe          | : | Same as pipe material   |
|         | 08. Accessories             | : | Flanges, gaskets, nuts & bolts, root valves jack screw, meter run pipe, Drain & vent hole as per application etc..  |
| 1.14.00 | Flow Nozzle                 |   |   |
|         | 01. Application             | : | High fluid velocity flow measurement  |
|         | 02. Design Standard         | : | ASME PTC 19.5   |
|         | 03. Number of Tappings      | : | As required plus one additional pair of taps  |
|         | 04. Diameter Ratio          | : | Between 0.4 and 0.7   |
|         | 05. Thickness               | : | Suitable for the application  |
|         | 06. Document                | : | Beta ratio calculation, assembly drawing and Flow vs. DP curve.   |
|         | 07. Meter run pipe          | : | Same as pipe material   |
|         | 08. Accessories             | : | Meter run pipe, nipples and root valves.<br><br>(Inspection port assembly for nozzles used in plant performance purpose)  |
| 1.15.00 | Gauge Glass                 |   |   |
|         | 01. Type                    | : | Reflex  |
|         | 02. Glass                   | : | Toughened borosilicate. Resistant to mechanical and thermal shocks.   |
|         | 03. Body material           | : | Carbon steel / stainless steel- As per process requirements (Flanged Connection)  |
|         | 04. Pressure rating         | : | Twice the maximum working pressure  |
|         | 05. Temperature rating      | : | As required   |
|         | 06. Bolts and nuts          | : | Rust proof alloy steel  |
|         | 07. Accessories             | : | Suitable ball check valves of SS-304/316 body, gaskets, companion flange etc.   |
| 1.16.00 | Power Cylinders (Pneumatic) |   |   |
|         | 01. Mounting Type           | : | a) Fixed position mounting (End mounting).<br><br>b) Trunnion mounting  |
|         | 02. Control Signal          | : | 4-20 mA DC to electro-pneumatic positioner. 24V DC operated solenoid valve operating on pneumatic line for open & closing purpose of on & off drive.                        |
|         | 03. Supply Air              | : | 0-7 Kg / Cm <sup>2</sup> .  |
|         | 04. Selection               | : | Based upon thrust / torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc. Provision for air-to-open and air-to-close operation. |

05. Casing : IP-65.
06. Accessories : a) Air lock relay  
b) Hand wheel.  
c) Air filter regulator with gauge.  
d) Volume Booster.  
e) Limit Switches.  
f) Positioner with Input and Output pressure gauges, local keypad & display.  
g) Solenoid Valve  
h) Integral non contact type position Transmitter (4-20 mA DC linear output).  
i) Junction box with cable gland
07. Fail-safe operation : For regulating duty- stay put against power & air fail.
08. Repeatability : Better than 0.5% of full travel.
09. Hysterisis : Less than  $\pm 1\%$  of full travel
10. Operating Temp. limit : 50 Deg. C (min.)
- 1.17.00 Smoke Density Analyzer
01. Type : In-situ infra red
02. Principle of measurement : Transmission & absorption (Dual beam type)
03. Light source : Modulated high intensity LED
04. Display : Back Lit LCD
05. Measurement range : 0-999 mg/m<sup>3</sup>, 0-999 mg/Nm<sup>3</sup>, 0-100% opacity
06. Measurement averaging : Selectable 10 sec to 60 minutes
07. Accuracy : 0.2% opacity
08. Resolution : 0.1% opacity
09. Linearity : 0.1% opacity
10. Repeatability : 0.1% opacity
11. Flue gas temperature : 350 °C (max 600 °C)
12. Ambient temperature : 0 - 60 °C
13. Operating temperature : Transmitter & receiver- 0-90 °C, Electronic unit - 70 °C
14. Mounting : Transceiver on opposite side of the duct
15. Analog output : 4-20mA DC (in 500 ohm resistance) to
16. Alarm output : 2 SPCO potential free rated at 230 VAC, 5A
17. Power Supply : 240V AC, 50 Hz, 1 Phase
18. Automatic misalignment detection : Required

- |         |  |   |   |
|---------|--|---|---|
| 19.     | Automatic compensation of lens contamination   | : | Required  |
| 20.     | Purge air Failure  | : | Purge air to be provided from Blower unit and to be monitored for failure.  |
| 21.     | Span and Zero Check  | : | Automatic periodic with manual override   |
| 22.     | Housing  | : | Corrosion resistant painted aluminium rated at IP-65  |
| 23.     | Fail safe shutter  | : | Automatic fail safe shutter against power and air failure   |
| 24.     | Input normalisation  | : | Correction for temperature, pressure, oxygen and water vapour to be provided.   |
| 25.     | Preferred Features   | : | “Power Supply On” LED visible from front  |
| 26.     | Accessories  | : | a) Mounting pads suitable for mounting projector and receiver units on duct, flanges, etc.<br>b) Blower unit (Purging System) with purge fail alarm at CCR<br>c) Enclosure for electronic units & indicators<br>d) Control unit for interface with PC based data logger |
| 27.     | Application  | : | At chimney<br>At each ESP outlet  |
| 1.18.00 | SO <sub>x</sub> , NO <sub>x</sub> , CO, CO <sub>2</sub> , O <sub>2</sub> & Moisture Analyzer |   |   |
| 01.     | Type   | : | In-situ Probe type combined analyser / Sampling extraction type.  |
| 02.     | Gases to be measured   | : | SO <sub>x</sub> , NO <sub>x</sub> , CO, CO <sub>2</sub> , O <sub>2</sub> and Moisture   |
| 03.     | Principle of measurement   | : | Infrared absorption   |
| 04.     | Flue gas Temperature   | : | 350 ° C   |
| 05.     | Ambient temperature  | : | 60 ° C  |
| 06.     | Mounting   | : | On chimney  |
| 07.     | Measurement range  | : | 0-3000 ppm / mg/Nm <sup>3</sup> for SO <sub>x</sub> , NO <sub>x</sub> , CO, O <sub>2</sub> and 0-25% for CO <sub>2</sub> and Moisture - fully selectable  |
| 08.     | Units of measurement   | : | PPM, mg / Nm <sup>3</sup> and %   |
| 09.     | Power Supply   | : | 240V, 50 Hz, 1 Phase  |
| 10.     | Local Display  | : | Back lit LCD / LED  |
| 11.     | Measurement averaging  | : | 10 sec to 60minutes (selectable)  |
| 12.     | Accuracy   | : | 2% of measured value  |
| 13.     | Repeatability  | : | 2% of full scale  |
| 14.     | Response time  | : | 5 seconds or better for 95% of full scale   |

- |         |                              |   |   |
|---------|------------------------------|---|---|
|         | 15. Zero & Span drift        | : | 2% per month  |
|         | 16. Calibration              | : | Zero and Span calibration in manual and automatic mode. Automatic calibration interval shall be fully selectable.   |
|         | 17. Analog output            | : | 4-20 mA DC (in 500 ohm resistor) to for each channel  |
|         | 18. Alarm output             | : | 1NO + 1NC rated at 230V AC, 5A  |
|         | 19. Input normalisation      | : | Required—online with pressure and temperature sensor and also provision for key pad entry of inputs   |
|         | 20. Probe material           | : | Stainless Steel 316L  |
|         | 21. Enclosure                | : | Corrosion resistant epoxy painted aluminium housing & enclosure rated to IP-65.   |
|         | 22. Accessories              | : | a) Blower unit, tubes & fittings for calibration and purging, purge fail alarm in CCR<br>b) Calibration gas cylinders for SO <sub>2</sub> , NO <sub>x</sub> , CO <sub>2</sub> , O <sub>2</sub> and CO filled in 10 Ltrs. Of WC carbon cylinder with necessary SS regulators with pressure & flow gauges, solenoid valve & SS tubings and SS fittings etc. as required.<br>c) Mounting flanges, gasket etc.<br>d) Control unit for interface with PC based data logger |
|         | 23. Application              | : | On flue gas stack.  |
| 1.19.00 | Stack Gas Velocity Monitor   |   |   |
|         | 01. Type                     | : | Non contact type  |
|         | 02. Measurement              | : | Flue gas velocity   |
|         | 03. Principle of measurement | : | Time delay correlation of flue gas Infrared emission received by two detectors located at a distance apart on the chimney.  |
|         | 04. Flue gas Temperature     | : | Up to 350 ° C   |
|         | 05. Ambient temperature      | : | 60 ° C  |
|         | 06. Mounting                 | : | On chimney  |
|         | 07. Measurement range        | : | As required   |
|         | 08. Units of measurement     | : | velocity- m/sec, flow- m <sup>3</sup> /sec  |
|         | 09. Power Supply             | : | 240V, 50 Hz, 1 Phase  |
|         | 10. Local Display            | : | Back lit LCD / LED  |
|         | 11. Measurement averaging    | : | 10 sec to 60minutes (selectable)  |
|         | 12. Accuracy                 | : | 2% of measured value  |
|         | 13. Linearity                | : | 2% of full scale  |

14. Response time : 5 seconds or better for 95% of full scale
15. Zero & Span drift : 2% per month
16. Calibration : Zero and Span adjustment
17. Analog output : 4-20 mA DC (in 500 ohm resistor) to for each channel
18. Probe material : Stainless Steel 316L
19. Enclosure : Corrosion resistant epoxy painted aluminium housing & enclosure rated to IP-65.
20. Accessories : a) Blower unit, tubes & fittings for calibration and purging, purge fail alarm in CCR  
b) Mounting flanges, gasket etc.  
c) Control unit for interface with PC based data logger
21. Application : On chimney
- 1.20.00 Oxygen Analyzer
01. Type : In-situ, Zirconium sensor, micro-processor-based transmitter, field repairable.
02. Range : 0.1-10% / 0.25-25% by volume
03. Output : 4-20 mA DC linear
04. Probe Length : 1800 mm (approximate depending on duct size)
05. Process Temperature : 850 ° C approx.
06. Measurement Reference : Instrument Air
07. Accuracy : ±1% of F.S.
08. Response Time : Less than 5 (five) seconds
09. Amplifier Housing : IP-65
10. Calibration : Automatic periodic
11. Calibration Frequency : Once every 24 hours
12. Power Supply : 240V, 50 Hz, 1 Phase
13. Material for Gas Carrying Components : Stainless Steel
14. Read Out : LED/LCD Local indicating meter
15. Protection : Automatic cell protection against reducing atmosphere
16. Alarm Facility : 1 HI and 1 LO independently adjustable over span. Contact rating 500 mA at 220 V DC (minimum).
17. Preferred Features : a) HI and LO alarm LED visible from front.  
b) Power Supply On/Failure LED visible from front

18. Accessories : a) Mounting flanges, adaptor plate and protection shield  
b) Gasket, nuts and bolts  
c) Cable with conduit from cell to amplifier (as required) and other special cables (if any)  
d) Automatic calibration kit (complete with all accessories and standard Gas Cylinders)
19. Application : a) At each economizer outlet  
b) At each air preheater outlet
- 1.21.00 CO, NOx & Moisture Analyzer
01. Type : In-situ Probe type combined analyser
02. Gases to be measured : CO, NOx and Moisture
03. Principle of measurement : Infrared absorption
04. Flue gas Temperature : 850 ° C (max)
05. Ambient temperature : 60 ° C
06. Mounting : On duct
07. Measurement range : 0-3000 fully selectable
08. Units of measurement : PPM and mg / Nm<sup>3</sup>
09. Power Supply : 240V, 50 Hz, 1 Phase
10. Display : Back lit LCD / LED
11. Measurement averaging : 10 sec to 60minutes (selectable)
12. Accuracy : 2% of measured value
13. Repeatability : 2% of full scale
14. Response time : 5 seconds or better for 95% of full scale
15. Zero & Span drift : 2% per month
16. Calibration : Zero and Span calibration in manual and automatic mode. Automatic calibration interval shall be fully selectable.
17. Analog output : 4-20 mA DC (in 500 ohm resistor) to for each channel
18. Alarm output : 1NO + 1NC rated at 230V AC, 5A
19. Input normalisation : Required – online with pressure and temperature sensor and also provision for keypad entry of inputs
20. Probe material : Stainless Steel 316L
21. Enclosure : Corrosion resistant epoxy coated aluminium housing & enclosure rated to IP-65.

22. Accessories : a) Blower unit, tubes & fittings for calibration and purging, purge fail alarm in CCR  
b) Calibration gas cylinders for NO<sub>x</sub> and CO filled in 10 Ltrs. of WC carbon cylinder with necessary SS regulator, SS gauges, SS tubings and SS fittings etc. as required.  
c) Mounting flanges, gasket etc.
23. Application : At economizer outlet
- 1.22.00 H2 + CO2 + Air Analyzer
01. Type : Thermal Conductivity
02. Range Selection : 3 ranges (H<sub>2</sub> in CO<sub>2</sub>, H<sub>2</sub> in air and CO<sub>2</sub> in air)
03. Range : As required
04. Output : 4-20mA DC (Isolated)
05. Operating ambient temp. : 10 ° C to 50 Deg. C
06. Power Supply : 240V AC, 50Hz
07. Sample gas flow control : Required
08. Reference gas flow : Required
09. Reference gas pressure regulator : Required
10. Cell response : 95% of change in 30 Sec.(Appox.)
11. Accuracy : 2% of full scale
12. Repeatability : 1% of full scale
13. Local Indicator : Indicating meter of 1% accuracy
14. Alarm facility : Dual (High & Low) independently adjustable.
15. Contact rating : 0.5A at 220 V AC
16. Enclosure : Flame Proof
17. Accessories : Calibration gas, mounting accessories and others as required to be provided
18. Application : Generator Gas Purity.
- 1.23.00 Radar Type Level Measurement
01. Type : Radar based on Time Domain Reflectometry
02. Antenna : Co axial / single rod type guided wave or Horn type as required for the application
03. Communication : Two wire 4-20mA DC, HART or Field Bus protocol.
04. Environmental temperature : 0 – 50 °C
05. Enclosure : Explosion proof /IP 65 as per application
06. Cable Entry : ½" NPT

- 07. Calibration : a) Self calibration with internal reference  
b) Zero & Span calibration
  - 08. Programming : Handheld programmer & Local keypad
  - 09. Process Connection : Flanged /screwed
  - 10. Electronic Housing : Epoxy painted Die-Cast aluminium alloy
  - 11. Antenna / Flange assembly : 316 SS or Hest alloy (as required)
  - 12. Output Indicator : Digital Integral Display
  - 13. Accuracy : 5 mm or 0.1% of probe length
  - 14. Accessories : a) Programming tool kit  
b) Gasket
- 1.24.00 Temperature Switch
- 01. Type : Bimetallic or gas filled.
  - 02. Sensing Element Material : Bellow / Bourdon AISI SS-316
  - 03. Bulb Material : AISI SS-316
  - 04. Capillary : Stainless steel armored
  - 05. Movement Material : AISI SS-304
  - 06. Case material : Epoxy coated steel plate or die-cast aluminum alloy with neoprene gasket and clear glass where applicable cover conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).
  - 07. Scale : Black lettering on white background
  - 08. Over range Protection : 120 %
  - 09. Instrument connection : Bottom
  - 10. Switch configuration : Two SPDT
  - 11. Switch rating : 240V, 5A AC/220V, 0.5A DC
  - 12. Switch type : Snap acting, shock and vibration-proof.
  - 13. Adjustability : Internal Set point adjustable over span range
  - 14. Cable connection : 3/4" ET conduit connection or compression gland.
  - 15. Compensation : a) Capillary compensation with invar wire throughout the capillary length.  
b) Case compensation
  - 16. Performance :
    - i) Scale Accuracy :  $\pm 1.0$  % of full scale
    - i) Repeatability : < 0.5 % of full range
    - ii) Response time : Less than 40 seconds with thermowell
  - 17. Capillary length : 5 meters (minimum) for local mounting/15 meters for local panel mounting.

	18. Nameplate	:	Tag number, service engraved in stainless steel tag plate
	19. Accessories	:	Mounting accessories, 3/4"ETcable gland.
1.25.00	Rotameter		
	01. Type	:	On-line up to 2". By-pass above 2"
	02. Metering tube	:	Borosilicate glass
	03. Float	:	AISI 316-SS unless the process fluid demands some other material.
	04. Body MOC	:	AISI 316-SS
	05. Scale	:	Graduated- Engraved black on white background.
	06. Process connection	:	Flanged
	07. Accuracy	:	± 2% of full scale detection or better for on-line type and ±4% of full-scale detection or better for by-pass type.
	08. Nameplate	:	Tag number, service engraved in stainless steel tag plate
	09. Accessories	:	Slip-on orifice plate of 316-SS and taps of Stainless Steel as per application requirements. Applicable SS Isolation valves and SS Range Orifice - for bypass type rotameters.
1.26.00	I/P Converter		
	01. Type	:	Electro-pneumatic (Outdoor Type)
	02. Input level	:	4-20 mA DC
	03. Output range	:	0.2 to 1.0 Kg/Sq. cm With 'Fail Freeze' feature. ( i.e in case of wire snapping the last good value of pneumatic signal out put will hold for at least six hours )
	04. Split range	:	For typical application wherever required.
	05. Control Action	:	Selectable air to close, air to open and fail freeze application
	06. Supply pressure	:	1.2 to 1.6 Kg/cm <sup>2</sup> (1.4 typical)
	07. Max. supply pressure	:	7 Kg/ sq.cm.
	08. Response Time	:	5 Seconds for 0 to 90% output pressure
	09. Housing	:	IP 55
	10. Repeatability	:	±0.1% of span
	11. Accuracy	:	± 0.25% of span
	12. Supply pressure effect	:	Less than 1%
	13. Span and Zero adjustments	:	Screw
	14. Pneumatic connection	:	¼" NPT

- |         |                      |   |   |
|---------|----------------------|---|---|
| 15.     | Stability            | : | Less than 0.25% of Span / Zero for six months.  |
| 16.     | Cable connection     | : | ¾" ET   |
| 17.     | Mounting             | : | Field (pipe/wall mounting)  |
| 18.     | Accessories          | : | Air filter regulator, mounting accessories, cable gland etc.  |
| 1.27.00 | Air Filter Regulator |   |   |
| 01.     | Filter Element       | : | Sintered Bronze   |
| 02.     | Filter Size          | : | 5 microns   |
| 03.     | Input Air            | : | 10.0 Kg/Sq. cm (maximum)  |
| 04.     | Output               | : | Adjustable from 0-2.0 Kg / Sq. cm or 0-7.0 Kg / Sq. cm (continuous) as applicable for I/P converter, control drives and control valve |
| 05.     | Effect of Supply     | : | Maximum 0.02 Kg/Sq. cm for a change pressure variation in supply pressure of 4 Kg/Sq. cm  |
| 06.     | Bowl Material        | : | Metallic cover around high temperature area / clear transparent polycarbonate with metallic cover for ordinary applications.          |
| 07.     | Accessories          | : | 2" dial size output pressure gauge  |
| 08.     | Desirable Feature    | : | No perceptible drop of pressure on opening the drain port.  |
| 1.28.00 | Solenoid Valve       |   |   |
| 01.     | Operating Principle  | : | Electromagnetic (noiseless)   |
| 02.     | Coil voltage rating  | : | 240 V AC / 220 V DC/24 V DC/110 V (as required)   |
| 03.     | Ways                 | : | Generally 3-ways other depending on requirement   |
| 04.     | Port size            | : | 1/4" NPT all ports  |
| 05.     | Body                 | : | SS bar stock  |
| 06.     | Trim                 | : | SS-316  |
| 07.     | Duty                 | : | Suitable for continuous energization  |
| 08.     | Sealing              | : | Airtight and leak proof   |
| 09.     | Ambient Temperature  | : | 0 - 50 ° C  |
| 10.     | Fluid Temperature    | : | 0-150 ° C (approx.)   |
| 11.     | Coil Enclosure       | : | Stainless Steel   |
| 12.     | Insulation           | : | Class-H   |
| 13.     | Coil Casing          | : | IP-65 (Explosion proof for NEC Class-1, Division-1 area)  |
| 14.     | Mounting             | : | On pipe or on panel   |
| 15.     | Cable Connection     | : | ¾" ET   |
| 16.     | Accessories          | : | Mounting brackets, nuts and bolts   |

17. Preferred feature : a) Solenoid valve directly integral to actuator body shall have NAMOOR interface for uniformity  
b) Local indication for power
- 1.29.00 Sight Glass
01. Type : Flap-type
02. End connection : Screwed / Flanged
03. Material:
- a) Body : CS/SS as per process medium
- b) Indicator : Stainless steel
04. Sight Glass : Toughened Borosilicate
05. Gasket : Neoprene
06. Bolts & Nuts : High tensile steel
07. Hydraulic Test Pressure : 1.5 times maximum working pressure
08. Accessories : As required
- 1.30.00 Flow Indicating Switch
01. Type : On line metal tube Rotameter
02. End connection : Flanged
03. Material:
- a) Body : CS/SS as per process medium
- b) Float : Stainless steel
- c) End fittings/flange : Stainless steel
- d) Other wetted part : Stainless steel
- b) Casing : Di cast Aluminium
04. Accuracy : +/- 2.0% of FSR
05. Rangeability : 10:1
06. Electrical connection : 3/4" ET
07. Switch type : Snap acting hermitically sealed 2 nos. SPDT
08. Contact rating : 5A, 240V AC
09. Protection class : IP-65
10. Accessories : As required

~~2.00.00 **CLOSED CIRCUIT TELEVISION SYSTEM**~~

~~2.01.00 Closed Circuit Television System~~

~~2.01.01 Closed Circuit Television System (CCTV) with all equipment and accessories shall be installed for the purpose of surveillance of major plant areas. Also, cameras shall be installed at the Main plant (TG Hall, Boiler ESP) and other common auxiliary plants.~~

~~2.01.02 The CCTV system shall meet the specific functional & design requirements towards collecting live video information from the various areas of the plant and displaying that information at monitors.~~

**LEVEL SWITCH (RF TYPE)**

Housing for probe head	Cast Aluminium
Enclosure protection for probe head	IP66
Material of probe	SS316
Housing of electronic controller	Cast Aluminium
Enclosure protection for electronic controller	IP 66
No/ type of contact	2 nos SPDT
Contact rating	60 V DC, 6 VA or more
Supply voltage for Electronic controller	230 VAC / 24V DC

CCTV network configuration shall be built on the Stackable Managed Ethernet switches for better control of data traffic & performance and future expansion. Switch configuration shall be redundant with seamless changeover without any upset in the CCTV operation. MTBF of the switch shall be more than 20 Years. Configuration shall be automatic.

**3.00.00 CONTROL PANEL/DESK MOUNTED INSTRUMENTS AND ELECTRICAL SYSTEM ACCESSORIES**

**3.01.00 Coupling Relay**

01. Type : Octal base plug-in type/ DIN rail Mounting
02. Coil voltage : 24 V D.C. in general / other as required
03. Contact : 2 NO & 2 NC (Minimum)
04. Contact rating : 250 V/5A (A.C)/220V/2A (D.C)
05. Operating range : 70 to 110% of rated voltage.
06. Insulation : 2 KV for 1 minutes between terminal & earth.
07. Mechanical life : 20 million operations
08. Coil protection : Diode
09. Indication : Coil on LED
10. Enclosure : Transparent cover
11. Connection : Screw terminals.
12. Mounting : Projection mounting inside panel / DIN rail mounting

**3.02.00 Bar graph Indicator**

01. Type : Bar graph
02. Number of channels : One / Two (as required)
03. Input : 4-20 mA/1-5 V/Thermocouple/RTD
04. Indication : Green LED / LCD
05. Scale : 100 mm vertical one for each channel graduated in engineering unit (linear scale)
06. Readable Distance : 3 meters (minimum)
07. Mounting : Flush panel
08. Face Dimension : 36(W) x 144(H) mm (approx) / 72 x 144 (H) mm
09. Resolution : 1% of scale or better
10. Power Supply : 240V, 1 Phase, 50 Hz AC
11. Operating Conditions :-
  - a) Temperature : 0-50 ° C
  - b) Relative Humidity : 5%-95%
  - c) Supply Voltage : -15% to +10%
12. Connection between

- Indicator and Tray : Prefab Cable
13. Accessories : i) Mounting Tray  
ii) Engraved phenolic nameplate affixed to front flange to identify each indicator by tag number and each point by measured variables.
14. Alarm Facility : 1 HI and 1 LO for each channel independently adjustable over span. Voltage free outputs
15. Reference Junction Compensation : Built-in cold junction compensation for thermocouple inputs
16. Feature : i) Alarm level indication by flashing cursor  
ii) Green Digital display of parameter value in front panel with a 3.1/2 digit display.
- 3.03.00 Valve Position Indicator
01. Input : 4-20 mA DC/1-5 Volts DC
02. Indication : Pointer and Scale. Moving Coil Meter
03. Readable Distance : 3 meters (minimum)
04. Pointer Deflection : 90 Deg Sector or linear
05. Mounting : Flush Panel (Horizontal/vertical)
06. Accuracy :  $\pm 1\%$  or better
07. Protection Class : IP-42
08. Operating Ambient Temp. : 0-50 °C
09. Scale : 0-100%
10. Bezel Size : DIN Standard
- 3.04.00 Digital Indicator
01. Type : Four and half digit LED seven-segment display with sign.
02. Face Dimension : 72 x 144 mm / 48 x 96 mm (as applicable)
03. Display Character : 13.8 mm, Green (LED)
04. Accuracy : 0.1% of reading,  $\pm 2$  digit
05. Input : 4-20mA DC/1-5 V DC/RTD/Thermocouple
06. Mounting : Flush Panel
07. Power Supply : 240V  $\pm 10\%$ , 50  $\pm 2.5$  Hz
08. Output Contact : 2 nos SPDT, contact rating 5A at 240V AC/ 0.25A at 220V DC
09. Power/Signal Connection : Screwed
- Large Display (150x300 mm) indicators shall be provided for MW, MVAR and frequency indications.

- 3.05.00      Push Button
- 01. Type : Shrouded square format
  - 02. Face Dimension : 32 x 32 mm (maximum)
  - 03. Contact Configuration : 2 NO + 2 NC
  - 04. Contact Addition : Add-on block up to 4 each with 2 pairs of contacts
  - 05. Contact Material : Hard Silver Alloy
  - 06. Contact Rating : 500V / 10 A
  - 07. Utilization Category : AC11 / DC11
  - 08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
  - 09. Mechanical Life : 1 million operation
  - 10. Construction : Aluminum shrouding with plastic lens
  - 11. Colors : Red, Green, Yellow, Black, etc.
  - 12. Connection ; Screw terminals
  - 13. Enclosure Class : IP-52
  - 14. Legend : Engraving
- 3.06.00      Illuminated Push Button
- 01. Type : Square format
  - 02. Face Dimension : 32 x 32 mm (maximum)
  - 03. Contact Configuration : 2 NO + 2 NC (minimum)
  - 04. Contact Addition : Add-on-Block up to 4 each with 2 pairs of contacts
  - 05. Contact Material : Hard Silver Alloy
  - 06. Contact Rating : 500 V/ 10A
  - 07. Utilization Category : A C11 / DC11
  - 08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
  - 09. Mechanical Life : 1 Million Operation
  - 10. Lamp : LED with built-in resistors as required
  - 11. Lamp Rating :-
    - a) Voltage : 240 V AC
    - b) Watt : 2 Watt (approx.)
  - 12. Lamp and Lens Replacement : From front
  - 13. Construction : Transparent Plastic Lens
  - 14. Color : Red, Green, Amber, Yellow etc.
  - 15. Connection : Screw terminals

16. Enclosure Class : IP-52
17. Legend : Engraving
- 3.07.00 Selector Switch
01. Type : 2/3/4 position stay put type with rotary lever actuator.
02. Face Dimension : 32 x 32 mm (maximum)
03. Contact Configuration : 4 pair of contacts
04. Contact Addition : Add-on-Block up to 4 each with 2 pairs of contact
05. Contact Material : Hard silver Alloy
06. Contact Rating : 500 V/10 A
07. Utilization Category : AC11 / DC11
08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
09. Mechanical Life : 1 million operation
10. Construction : Aluminum shrouding
11. Connection : Screw terminals
12. Enclosure Class : IP-52
- 3.08.00 Indicating Lamp
01. Type : LED with built-in resistor
02. Face Dimension : 32 x 32 mm (maximum)
03. Voltage : 240 V AC
04. Watt : 2.5 Watt (approximate)
05. Lamp and Lens Replacement : From front
06. Construction : Transparent Plastic lens
07. Color : Red, Green, Amber, Yellow etc.
08. Connection : Screw terminals
09. Legend : Engraving
- 3.09.00 Indicating Meters (A.C)
01. Type : Rectifier type
02. Face Dimension : 96 x 96 mm
03. Scale : Radial arc of 240 Deg.
04. Accuracy : 1.5% of full scale.  
±0.5 Hz for frequency meter
05. Input : 0-1/0-5A for current measurement, 0-240V,  
50 ± 2.5 Hz for voltage / frequency measurement
06. Zero Adjustment : Screw on meter face

- 07. Enclosure : Shielded Case
- 08. Mounting : Flush Panel
- 09. End Scale Suppression : 6 times the measuring range only for motor ammeters

3.10.00 Indicating Meters (D.C)

- 01. Type : Taut band moving coil
- 02. Face Dimension : 96 x 96 mm
- 03. Scale : Radial arc of 240 Deg.
- 04. Accuracy : 1.5% of full scale
- 05. Input : 0-75 mA for current measurement. Direct reading for voltage measurement.
- 06. Zero Adjustment : Screw on meter face
- 07. Enclosure : Shielded case
- 08. Mounting : Flush Panel
- 09. End Scale Suppression : 2 times the measuring range only for motor ammeters.

For electrical system's meter and for synchronization, Bidder shall refer to electrical volume of the specification

3.11.00 Auxiliary Relay

- 01. Type : Electromagnetic
- 02. Coil voltage : 240 V A.C / 220V DC. For any other voltage bidder to make his own arrangement.
- 03. Contact Configuration : 2 NO & 2 NC (Minimum), additional contacts as per requirement with provision for additional contact block expansion
- 04. Contact rating : 250V/5A (A.C/D.C.)
- 05. Operating range : 80 to 110% of rated voltage
- 06. Insulation : 2 KV for 1 minute between terminals & earth.
- 07. Mechanical life : 20 million operations
- 08. Coil protection : Diode/surge suppressor
- 09. Connection : Screw terminals.
- 10. Mounting : Projection mounting inside panel

3.12.00 Electrical Transducer

Transducers shall be provided for conversion of AC electrical quantities such as voltage, current and power. Transducer shall be suitable for 220V DC auxiliary supply. Transducers shall be of low burden type having 4 – 20 mA DC linear galvanically isolated output compatible with secondary indicating instrument. Transducer shall be dual channel type. Accuracy class of Transducers shall be as per IS14570:1998 or IEC688:992

3.13.00 Synchroscope

Synchroscope shall be designed to provide an illuminate and indication of phase and frequency difference between bus voltage and Generator voltage. It shall denote the actual frequency difference corresponding to the inverse of time taken for one rotation of the illuminated vector spot. The instrument shall be designed for industrial applications, which require precise, reliable and robust instruments for the display range and indication. Synchroscope shall be designed as per the DIN / IEC / BS standards.

4.00.00

#### **CONTROL VALVES, ACTUATORS & ACCESSORIES**

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

- a) Bidder shall exercise caution in selecting severe service control valves like BFP recirculation valves, HP & LP bypass valves, superheater & reheater attemperator valves, PRDS valves for Boiler & Turbine, Soot blower steam pressure control valve, control valves whose down stream are connected to vacuum such as HP/LP heater emergency level control, condenser make up water control valve, separator level control and CEP minimum flow control valve. For such critical applications, Bidder shall offer valves which are proven for similar application. Above valves shall have leakage class equal or better than class-V with metal-to-metal seating.
- b) Wherever, steam conditioning calls for Pressure reducing & desuperheating, combined PRDS type valves shall be offered.
- c) Bidder shall provide redundant control valves for Main condensate flow control, Superheat attemperation control and Reheat attemperation control as a minimum for high availability. For other application, if the availability criteria for the plant cannot be met even with the best established product, redundant control valves shall be provided.
- d) Control valves shall be located near floor or platform for ease of access and with adequate clearances for maintenance and lay-down and shall be placed as station with upstream motorized isolating valve, down-stream isolating valve, inching duty motorized bypass valve and manual drain valves. Each redundant control valve shall have its upstream motorized and down-stream manual isolating valves. Where quick shut off requirement is foreseen such as in case of SH & RH attemperation valves, upstream isolation valve shall be pneumatic type.

4.01.00

General

4.01.01

Control valves for regulating service shall normally be globe body, preferably cage guided, metal-to-metal seated, pneumatically operated and shall be provided with characterized plugs having ANSI leakage class-IV except for the control valves indicated above.

4.01.02

Where the operating time is critical for the operation of the plant, as in case of HP or LP bypass valves, hydraulic actuators with electro-hydraulic interface shall be offered.

4.01.03

Bonnet joints for all control valves shall be of flanged and bolted type.

4.01.04

Flanged valve shall be rated at no less than class 300 lbs.

4.01.05

Valve Body / End Connections

- 4.09.00 Valve Accessories  
Accessories shall include side mounted hand wheels, limit switches, junction boxes, airlock relays etc.. Solenoid valve wherever required shall be furnished.
- 5.00.00 **CONTROL DESK / PANEL / RACK**
- 5.01.00 Convenient and logical approach to operational interfaces and aesthetics in the overall view of the panel /desk shall be considered.
- 5.02.00 For items susceptible to vibration, suitable anti-vibration padding shall be provided to prevent damage or malfunction.
- 5.03.00 All items inside the panels/cabinets shall be neatly arranged with easy access/maintenance approach.
- 5.04.00 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.
- 5.05.00 Desk / panel shall be provided with interior illumination, utility receptacles with plug and cooling fan.
- 5.06.00 Panel / Desk shall have gland plate at cable entry to panel. Thickness of gland plate shall not be less than 3 mm.
- 5.07.00 Wire shall be routed / laid through covered trough.
- 5.08.00 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- 5.09.00 Nameplate
- a) Nameplate shall be provided for instrument or device mounted on the panel.
  - b) Nameplates for panels shall be provided both in front and rear.
- 5.10.00 Control Desks
- 5.10.01 Devices mounted on the desks shall be flush type. Devices shall be so mounted that their removal and replacement can be accomplished without interruption of services to others.
- 5.10.02 Desk shall be ergonomically designed to suit working on a 24 X 7 basis. Aesthetics, ergonomics and illumination shall be considered while positioning of the desk, large video screen and panels in control room.
- 5.10.03 Control desk shall be free standing floor mounting type of table-top design with compartments for locating the hardware. Desk shall be constructed from aluminum extrusion with high pressure laminate MDF board for work surface of approved colour. Aluminium structure shall be anodized or powder coated paint finish.
- 5.10.04 Monitors with retractable keyboard, emergency push buttons shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate..
- 5.10.05 Desks shall be of modular, scalable and industrially ruggedized design and shall have Telephones and Intercom connections.
- 5.10.06 Desks shall have concealed cable trays for wire dressing.

- 5.10.07 Design shall include Earthing bolts.
- 5.10.08 Back installed items shall be suitably concealed from front view.
- 5.11.00 Back Up Panel
- 5.11.01 Construction shall be from sheet steel of thickness not less than 3mm.
- 5.11.02 Electrical upright Panel construction & design shall be similar to back up panel. Control switches, meters, indicators, synchronizer, excitation control switch, annunciation window etc. along with associated mimic diagram, as recommended, shall be provided for manual synchronization of generator.
- 5.12.00 Cabinets / Enclosure / Panels
01. Material of construction : Cold rolled steel sheet
  02. Thickness of Sheet :
    - a) 3.0 mm for faces supporting instruments / terminals.
    - b) 2 mm for other sides and top.
  03. Construction : Welded throughout as per approved National Standards.
  04. Panel height : 2300 mm (approx)
  05.
    - i) Corners : 7 mm inner radius
    - ii) Dimensional Tolerances :
      - a) In height & length - 3 mm
      - b) In height between adjacent sections - 2 mm.
      - c) Total for a group - 6 mm
  06. Doors : Double, recessed, turned back edges
    - i) Thickness of Sheet : 2 mm
    - ii) Hinges : Stainless steel
    - iii) Door latches : Three point type
    - iv) Door gaskets : Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure.
    - v) Opening of the doors : Outward
    - vi) Louvers : With removable wire mesh to ensure dust and vermin proof.
  07. Color of interior : Brilliant white
  08. Colour external : RAL 7032
  09. Painting : Epoxy powder coated or better
  10. Gland plates : Removable 4 mm thick (bottom)
  11. Cable entry : Bottom
  12. Hardware :
    - a) Anti vibration pad- 15 mm
    - b) Predrilled base channel ISMC - 100 or equivalent for all sides.

- c) Stainless steel buff- finished 2 mm thick kick plate for all sides.
- d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws.
- e) Rubber strips to ensure air tightness between kick plate and finished floor.
- f) Lifting hook / Eye bolt
- g) Drawing pocket
- h) Door switch, lamps, thermostat, heaters and fans

13. Enclosure Protection : As per environment condition of the area of installation. Refer section-I of this vol.

5.13.00 Local Instrument Racks & Enclosure

5.13.01 General Requirements

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

Four way valve shall have two position operations. One position for service and other one for purging. Required pressure gauges shall be provided for monitoring of air pressure. Complete purging arrangement shall be integral to the enclosure and racks.

- i) Gate or ball type (full ported) instrument isolation valve and globe type blow down drain valve adequate for duty requirement and for withstanding continuous design pressure and temperature of main process medium shall be provided in the hook up plumbing. For process pressure equal or above 40 kg / sq.cm single instrument isolation valve and double blowdown valves shall be used before connecting to blowdown header. Whereas for line pressure less than 40 kg/ sq.cm, single instrument isolation valve and single blow down valves can be used before connecting to blow down header. Instrument manifolds shall be non integral and shall be installed close to the instrument.
- j) Drawing K9213R-DWG-I-0200 shall be referred for typical arrangement of Local instrument enclosure and rack.

5.13.02 Closed Instrument Rack

- a) Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load-bearing posts shall be suitably supported by gusset plates or moment members.
- b) Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.
- c) 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any member, which would reduce access, shall be avoided.
- d) Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.
- e) Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box.
- f) Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.
- g) All internal wirings between the instruments and junction box shall run through flexible conduits.
- h) Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Header shall be of 2" NB ASTM A 106, Sch-80 Gr. C installed at a slope of 1:25 and extended beyond the rack for connection to plant drain header.
- i) Each rack shall be provided with one receptacle, light fixtures each at instrument & Junction box compartments with wire guard.

5.13.03 Open Instrument Rack

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

5.13.04 Junction Box

Junction boxes of FRP construction with protection class conforming to IP 55.

- a) Junction box shall be provided at a dry compartment at one side of the enclosure / rack with front opening type door. Earth stud shall be furnished at rack for safety grounding.
- b) Terminals shall be screwless cage clamp type of reputed make and 20% spare terminals shall be furnished in the junction box.

~~6.00.00 **DISTRIBUTED CONTROL SYSTEM (DCS)**~~

~~6.01.00 System Functional Description~~

~~6.01.01 Integrated functionally 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.~~

~~6.01.02 System shall be highly reliable with the availability of not less than 99.7% with adequate redundancy and fault tolerant configuration.~~

~~6.01.03 The system shall be unitized and connectivity with other plant control system.~~

~~6.01.04 Remote input output stations as a data concentrator for acquisition and monitoring of Boiler metal temperature are foreseen. RIO shall be industrially ruggedized and shall be provided with integral air conditioner considering the harsh environment.~~

~~6.01.05 For Power supply to system refer Volume IIE Section I.~~

~~6.01.06 Controls of some plant auxiliaries for CW & ACW Pumps and Fuel oil heating & pressurizing system controls shall be realized in DCS through Remote I/O (RIO) cabinets.~~

~~6.01.07 Off-site & BOP plants such as Coal Handling Plant, Ash Handling Plant, Raw water & Pretreatment plant, Compressed Air System, Mill Reject System and Demineralized water plant etc. having microprocessor based or PLC based~~

8.18.01 A Portable data collector shall be provided for taking periodic collection of non critical machine data. Machine condition monitoring system shall be capable to analyze the data. Instrument shall be microprocessor based and ready for use in harsh environment. Integral LCD display shall provide the necessary display of readings & spectral data. Minimum 02 channels along with additional input for phase reference measurement shall be available with the instrument.

8.18.02 Instrument shall include necessary accelerometers and other devices with accessories for collection of machine parameters. A long life Ni-Cd battery pack shall be used. Replacement of battery shall not lead to loss of stored data.

8.18.03 Shaker table shall be provided for testing & calibration.

9.00.00 **INSTRUMENTATION & CONTROL CABLE**

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

9.02.00 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.

9.03.00 Sequential length marking shall also be provided at every meter interval on outer sheath of cable.

9.04.00 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.

9.05.00 Thermocouple Extension & Compensating Cable

- |                             |   |  |
|-----------------------------|---|--|
| 01. Conductor               | : | Solid conductor  |
| 02. Conductor size          | : | 0.75 sq.mm   |
| 03. Type                    | : | KX (Extension) (Chromel Alumel)<br>RX (Compensating) (Copper-Copper alloy)<br>JX (Extension) (Iron Constantan)   |
| 04. Conductor Insulation    | : | HR PVC Type-C (IS-5831,1984) 0.6 mm thick  |
| 05. Operating Voltage       | : | 300V /500V RMS (Core to earth / core to core)  |
| 06. Twisting                | : | Pair twisted with lay of 60 mm (max)   |
| 07. Twisting Direction      | : | All pairs in the same direction. Lapped to form bunch with mylar tape.   |
| 08. Screen (Pair & Overall) | : | Aluminium mylar tape with a thickness of 28 $\mu$ m (min.) for individual pair screen and 60 $\mu$ 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. |

09. Drain wire : Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm)
10. 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
11. Rip Cord : Non metallic under sheath
12. Armouring : GI wire / strip as per IS 3975
13. 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
14. Filler : Non hygroscopic with FRLS property
15. Temperature Range : Up to 85 °C
16. Insulation at 20<sup>0</sup> C : 100 MOhms/Km [Min]
17. Capacitance at 800 Hz : 120 nf/km
18. Cross talk : 60 dB
19. Attenuation : 1.2 dB/Km
20. Codes & Standards : a) IEC 332-1  
b) ANSI MC 96.1  
c) IS-8784-1987
21. Tests : a) Oxygen Index: Min.29 at room temp. (ASTM-D-2863)  
b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I  
c) Temp Index : Min 250 DEG C at 21Oxy. Ind. (ASTM-D-2863)  
d) Smoke Density Rating : Max.60% (ASTM-D-2843).  
e) Flammability Test : as per IEC 332 Part-I /IEEE-383  
Swedish Chimney Test - SS-424-1475 F3  
f) High voltage test  
Core to core- 1.5 KV for 1 min.  
Core to screen- 1.0 KV for 1 min.  
g) Insulation Resistance 100 M Ohm / Km Min

- h) Rodent & Termite repulsion test  
(Presence of lead shall be confirmed)

22. 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

23. Durable printed or embossed numbering at regular interval of 50mm shall be provided for identification of pairs.

9.06.00 Instrumentation multi Paired Signal Cable

01. Conductor type : Stranded (7) annealed tinned copper
02. Conductor size : 0.5 / 1.0 / 1.5 Sq.mm (as required)
03. Conductor resistance : 39 Ω/Km/18 Ω/Km/12 Ω/Km
04. Conductor Insulation : HR PVC Type-C (IS-5831,1984) 0.6 mm thick
05. Operating Voltage : 300 / 500V RMS (Core to earth / core to core)
06. Twisting : Twin twisted with lay of 60 mm
07. Twisting Direction : All pairs in the same direction. Lapped to form bunch with mylar tape.
08. 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.
  - \* Analog signals- Individual pair & overall shield to be considered.
  - \* Binary signals- overall shield to be considered.

09. Drain wire : Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm)
10. 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
11. Rip Cord : Non metallic under sheath
12. Armouring : GI wire / strip as per IS 3975
13. Outer 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
14. Filler : Non hygroscopic with FRLS property.
15. Temperature Range : 85 °C
16. Insulation at 20 Deg.C : 100 MOhms/Km [Min]
17. Capacitance at 800 Hz : 120 nf/km
18. Cross talk : 60 dB
19. Attenuation : 1.2 dB/Km
20. Codes & Standards : a) IPCEA-S-61-402  
b) BS 5308  
c) IEC 332-1  
d) ASTM-B-33  
e) IS-8130-1984  
f) IS 1554 Part-1  
g) IS 10810
21. Sheath colour : Inner- Black and Outer- Gray
22. Tests : a) Oxygen Index: Min.29 at room temp. (ASTM-D-2863)  
b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I  
c) Temp Index : Min 250 ° C at 21Oxy. Ind. (ASTM-D-2863)  
d) Smoke Density Rating : Max.60% (ASTM-D-2843).  
e) Flammability Test : as per IEC 332 Part-I  
f) Swedish Chimney Test-SS-424-1475 F3  
g) Insulation Resistance 100 M Ohm / Km Min

- h) High voltage test
  - Core to core- 1.5 KV for 1 min.
  - Core to screen- 1.0 KV for 1 min.
- i) Rodent & Termite repulsion test  
(Presence of lead shall be confirmed)

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

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

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 1<sup>st</sup>. unit, double band for 2<sup>nd</sup>. 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.

9.07.00 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.

9.08.00 Control & power Cable

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

10.00.00 **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.

10.01.00 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.
- 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.

10.02.00

Electrical Junction Box

1.	Type of Enclosure	: Dust tight & weatherproof conforming to IP 65
2.	Material	: 3 mm sheet steel
3.	Type of Cover	: Solid unhinged with retention chain
4.	Paint	: RAL 7032
5.	Mounting	: Surface
6.	Cable Entry	: 3 mm (min) Gland plate
7.	Gasket	: Neoprene
8.	Grounding	: Brass earth lug with green screw head External-2 nos , Internal-1no.M6
9.	Number of Drain Holes	: Two at bottom capped
10.	Identification	: Label for JB and Tags for cable

11.	Accessories	: Rail mounted cage clamp type screwless terminals with markers, Cable gland, Ferrules, Canopy at top
-----	-------------	---

10.03.00 Cable Gland

1.	Type	: Double compression
2.	Entry Thread	: NPT
3.	Material	: Brass
4.	Finish	: Cadmium Plated.
5.	Protection	: IP 54 or better
6.	Accessories	: Neoprene gasket, locknuts, reducers etc

10.04.00 Cable Tray

1. Material : Mild steel, slotted
2. Thickness : not less than 2.0 mm
3. Finish : Hot dip galvanized
4. Perforation : As per MFR standard
5. Cover : Suitable for tray

10.05.00 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.

10.05.01 Seamless Stainless Steel Pipe

1. Reference : ASTM A-312 TP 316
2. Material Grade : TP 316
3. Type : Seamless /Plain end
4. Size : ½" NB
5. Schedule : 40
6. Standard Length : 5 meter

10.05.02 Stainless Steel Pipe Fittings

1. Reference : ASTM A-182 F 316 / ANSI B16.11

2. Type : Forged
3. Rating : 3000 lbs / 6000 lbs / 9000 lbs
4. Size : ½" NB
5. End connection : Generally socket weld
6. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

10.05.03 Seamless Stainless Steel Tube

1. Reference : ASTM A-213 TP 316
2. Material Grade : TP 316
3. Size : ½" OD X 2.1 MM Thick
4. Type : Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube.
5. 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.
6. Test Pressure : 400 Kg/Sq. cm (minimum)
7. Tolerance : ± 0.13 mm for outside diameter  
: ± 15 % for wall thickness
8. Standard Length : 5 meter
9. Test : Flare, Hardness, Ball and Bubble Test

10.05.04 Stainless Steel Tube Fittings

1. Reference : ASTM-A-182
2. Type : Double ferrule double compression
3. Material : 316 Stainless steel forged
4. Ferrule : 316 Stainless Steel
5. Type of Fittings : Male / female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation.
6. Size : To suit SS tubing and NPT end connection

- 10.05.05 C.S. Pipe
1. Reference : ASTM-A 106 Gr. C
  2. Material : Cold drawn seamless black C.S.
  3. Type : Seamless / Plain ends
  4. Size : ½" NB
  5. Schedule : 80, 160, XXS as required
  6. Standard Length : 5 meter
- 10.05.06 C.S. Pipe Fittings
1. Reference : ASTM-A 105 / ANSI B16.11
  2. Type : Forged
  3. Rating : 3000 lbs / 6000 lbs / 9000 lbs
  4. Size : ½" NB
  5. End connection : Generally socket weld
  6. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.
- 10.05.07 A.S. Pipe
1. Reference : ASTM-A 335 P22 AS PER ANSI B 36.10
  2. Material : Cold drawn seamless A.S.
  3. Type : Seamless / Plain ends
  4. Size : ½" NB
  5. Schedule : XXS
  6. Standard Length : 5 meter
- 10.05.08 A.S. Pipe Fittings
1. Reference : ASTM-A 182 F22 AS PER ANSI B 16.11
  2. Type : Forged
  3. Rating : 9000 lbs
  4. Size : ½" NB
  5. End connection : Generally socket weld

6. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.
- 10.05.09 Carbon Steel Globe Valve
1. Reference : ASTM A-105
  2. Type : Globe
  3. Construction : Forged Body Cadmium Plated
  4. End Connection : ½" Socket Weld
  5. Rating : Cl. 800 / CL. 2500
  6. Material : Body - Carbon steel  
: Stem - Hardened Steel  
: Plug - AISI 316 SS  
: Seat- Stainless steel stellited
  7. Packing : Teflon / Grafoil as required
  8. Yoke : ASTM A105
  9. Hand wheel : Carbon steel
  10. Design standard : As per ANSI B 16.34
- 10.05.10 Stainless Steel Globe Valve
1. Reference : ASTM A-182 F316
  2. Type : Globe
  3. Construction : Forged Body
  4. End Connection : Socket Weld
  5. Proof Pressure : 400 Kg/Cm2
  6. Material : Body - Stainless steel  
: Stem - Hardened Steel  
: Plug - AISI 316 SS  
: Seat- Stainless steel stellited
  7. Packing : Teflon as required
  8. Yoke : ASTM A182 F316

9. Handwheel : Carbon steel
10. Design standard : As per ANSI B 16.34
- 10.05.11 Alloy Steel Globe Valve
1. Reference : ASTM A-182 F22
2. Type : Globe
3. Construction : Forged Body
4. End Connection : ½" Socket Weld
5. Rating : CL. 2500
6. Material : Body - Alloy steel  
: Stem - Hardened Steel  
: Plug - AISI 316 SS  
: Seat- Stainless steel stellited
7. Packing : Grafoil as required
8. Yoke : ASTM A182 F22
9. Handwheel : Carbon steel
10. Design standard : As per ANSI B 16.34
- 10.05.12 Condensate Pot
1. Reference : ASTM A182 F22 /ASTM A105
2. Material : Alloy steel / carbon steel as per application
3. Construction : Drilled from barstock
4. End connection : 3 nos. ½" socket weld end
5. Accessories : Vent valves
- 10.05.13 Instrument Valve Manifold
1. Type : Two valve manifold  
: Five valve manifold
2. Mounting : Remote 2" Pipe Mounting
3. Construction : Single block (bar stock)
4. Material : Forged body and bonnet AISI 316 stainless

- steel
5. Ports : 1/2 " NPT (F)
  6. Rating : 420 Kg/Sq. cm at ambient
  7. Operating Temperature : (-)30 to (+)170 Deg C
  8. Packing : PTFE Wafer
  9. Seat & Stem : AISI 316 SS
  10. Plug : AISI 316 SS free to turn on stem / 17-4 PH
  11. Handle Bar : AISI 316 SS
  12. Connection : Straight
  13. Accessories : Plugs for all ports, Mounting Bracket , bolts , nuts

10.06.00 Pneumatic Hook Up Accessories

10.06.01 Air Header

<b>Technical Particulars</b>	<b>For Panel</b>	<b>For Field</b>
Material of Construction	: Stainless steel	: Stainless steel
Inlet Connection	: 2" NPT (M)	: 1" NPT (M)
Header Take-off Material	: Stainless steel	: Stainless steel
Take off connection	: 1 / 2" NPT (M)	: 1/ 2" NPT (M)
Take-off Valves Material	: stainless steel	: stainless steel
Tube Take-off	: Tube adapter on valve	: Tube adapter on valve
Drain	: SS drain valve at lowest point	: SS drain valves at lowest point

10.06.02 Seamless Stainless Steel Tube

1. Reference : ASTM A-269 TP 316
2. Material Grade : TP 316
3. Size : ¼" OD X 0.049" wall thickness

4. Type : Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube.
5. 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.
6. Test Pressure : 400 Kg/Sq. cm
7. Tolerance :  $\pm 0.13$  mm for outside diameter  
:  $\pm 15$  % for wall thickness
8. Standard Length : 5 meter
9. Test : Flare, Hardness, Ball and Bubble Test

11.00.00 **SPECIAL TOOLS & TACKLE AND TEST EQUIPMENT FOR AND OTHER SYSTEMS**

- 11.01.00 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.
- 11.02.00 The tools & tackle and Test Equipment shall be shipped in separate container, clearly marked with names of the equipment for which they are intended.
- 11.03.00 Bidder shall furnish list of tools & tackle and test equipment proposed to be supplied along with the bid.

material with suitably colored lettering engraved on the back.

- c) The nameplates shall be held by self-tapping screws. The size of nameplate shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for the panels.
- d) Items of plant such as valves, which are subject to handling, are to be provided with an engraved chromium plated nameplate or label with engraving filled with enamel, suitably mounted or affixed with strong rustproof chain.
- e) All such nameplates, instruction plates, lubrication charts etc. shall be with English inscriptions.

8.00.00 **METERING BASES AND CHART UNITS**

The following system of units shall be followed for various displays and scales unless otherwise mentioned:

- i) Pressure : Kg/cm<sup>2</sup>  
Differential Pressure : mm of H<sub>2</sub>O column / Kg/cm<sup>2</sup>
- ii) Draught : mm of H<sub>2</sub>O column
- iii) Vacuum : Kg/cm<sup>2</sup> (abs)/mm of Hg column
- iv) Temperature : Degree Celsius (° C)
- v) Flow (Steam, Water) : Tonnes / hr, M<sup>3</sup>/Hr
- vi) Flow (Oil) : M<sup>3</sup> / Hr, Litter/Hr
- vii) Flow Air : Tonnes / hr / M<sup>3</sup> / Hr.
- viii) Density : gms / c.c.
- ix) Level : mm /%
- x) Conductivity : μS / cm or mS/cm
- xi) Gas Analyzer : Percentage by weight or as specified in respective case.
- xii) Dissolved Oxygen / Silica / Sodium : ppm /ppb

9.00.00 **PROCESS CONNECTION & INSTRUMENT HOOK UP**

9.01.00 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.

- 9.02.00 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.
- 9.03.00 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.
- 9.04.00 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 425OC 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.
- 9.05.00 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.

INSTRUMENTS	EQUIPMENT / PIPE SIDE	INSTRUMENT SIDE
<b>Level Instruments</b>		
Internal Displacer	4" - Flanged	4" - Flanged
External Displacer	2" - Flanged	2" - Flanged
Level gauge	¾" -Flanged	¾" - Flanged
DP Type	½" (min.)-welded	½"- NPT
	1" – welded for vessel like HP heaters, LP heaters, De-aerator etc. application	
External cage Level switch	1"- welded	1"- welded
<b>Flow Instruments</b>		
DP Type	½" - welded in general	½" - NPT
	1" – welded for high pressure / temperature main steam, feed water, PRDS etc. application	
<b>Pressure Instruments</b>		
Conventional	½" (min.)-welded	½" - NPT
	1"- welded for high pressure/	

INSTRUMENTS	EQUIPMENT / PIPE SIDE	INSTRUMENT SIDE
	temperature main steam, feed water, PRDS etc. application	
Diaphragm type-HFO application	3"- Flanged	3"- Flanged
<b>Temperature Instruments</b>		
Thermowell	Generally - M 33 X2 (M); 1½" Flanged- For air/FG path application	½" NPT
<b>Analyzer</b>		
Liquid analyzer	½"- 1" - welded	½"

- 9.06.00 Size of impulse pipe for pressure measurement in air and flue gas duct path of boiler shall not be less than ¾" NB.
- 9.07.00 Separate stubs and take-off points with thermo well / root vlves shall be provided for performance guarantee test.
- 9.08.00 Impulse pipes shall be clamped at suitable interval not exceeding 1.5 meter. Process pipe shall not be used for supporting the impulse pipe.
- 9.09.00 Fittings shall conform to ANSI B 16.11. Threads of piping component shall be of tapered construction.
- 9.10.00 Instrument blowdown header shall in no case be lower than the material grade ASTM A 106 Gr. C.
- 9.11.00 Impulse pipe shall be laid at least with slope of gradient 1:10 to avoid any air pocket or water accumulation.
- 9.12.00 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.
- 9.13.00 Siphon shall be provided in the impulse pipe or tube to protect the instruments where fluid temperature is 100 OC or more.
- 9.14.00 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.

9.15.00 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.

9.16.00 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.

9.17.00 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.

9.18.00 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. 316 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.

#### ~~10.00.00 POWER SUPPLY SYSTEMS~~

~~10.01.00 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.~~

~~10.02.00 Type of power supply systems envisaged for the various I & C system including DCS are as follows:~~

~~a) 240V AC Redundant UPS system HMIs, Main Plant Field devices / equipment, CCTV, EWLI, CEMS, SWAS etc. and PLC of package System~~

~~b) 24V / 48 VDC Supply for DCS~~

#### ~~11.00.00 ENVIRONMENTAL CONSIDERATIONS~~

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

~~11.01.00 Temperature~~

~~11.01.01 Where the environmental extreme exceeds the capabilities of the selected system, Bidder should take appropriate steps to control the environment.~~

~~11.02.00 Humidity~~

~~11.02.01 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~~



**STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)**

**CHECK LIST FOR PRESSURE SWITCH**

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks		
				M	C	B			
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V			
	1.1 MODEL NO/TAG NO								
	1.2 RANGE								
	1.3 END CONN								
1.4 NO. OF CONTACT									
2	CALIBRATION					P	V	V	
	2.1 REPEATABILITY								
	2.2 SET POINT ADJUSTMENT								
	2.3 DIFFERENTIAL								
3	OVER PR & LEAK TEST			P	V	V			
4	ELECT. INSULATION/HV TEST	ONE			P	V	V		
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT			V	V	V		
	5.1 SENSOR								
	5.2 MOVEMENT								
	5.3 PROCESS CONNECTION								
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST			V	V	V		
	REVIEW OF TC OF MICROSWITCH	FOR LOT			V	V	V		

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

**Note :**

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS	P		W	V		
6	EFFECT OF TEMP VARIATION ON ACCURACY	P		W	V		
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION		P	W	V		
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

**Legend :**

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

**Note :**

1. Quantum of check shall be as below :  
100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. When material corelation are not available manufacturer's compliance to be provided.
4. Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION	ONE	APPROVED SPEC./ DATA SHEETS	P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST			P	W	V	
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V	
5	REVIEW OF TC FOR	FOR LOT	APPROVED SPEC./ DATA SHEETS	V	V	V	
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



**STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)**

**CHECK LIST FOR LEVEL GAUGE**

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
END CONNECTION							
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW	P	W	V		
6	ACCESSORIES AS APPLICABLE		P	W	V		

**Legend :**

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

**Note :**

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

Legend :

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

For Other details as given in sub-section of Battery & Battery charger specification

4.07.00 **Step-down transformer and voltage stabilizer**

- a) A three phase to single phase transformer along with associated voltage stabilizer shall be furnished with the UPS system.
- b) The transformer and stabilizer shall be sized for 100% UPS load and shall coordinate with the largest branch circuit protection device for feeder short circuit current without sacrificing voltage regulation.
- c) The voltage stabilizer shall employ silicon solid state circuitry and shall maintain the specified output voltage for 0 to 100% load with maximum input voltage variation as indicated in the annexure.
- d) Provision shall be kept for dead closing of static transfer switch from stabilizer circuit to inverter when the output of the stabilizer is zero, but at that time the inverters are running.

4.08.00 **A.C. Distribution Boards**

- a) The distribution boards shall be fixed type, of modular design in freestanding gasketed sheet steel enclosure conforming to IP-52. Sheet steel thickness shall be 2 mm minimum for load bearing members and 1.6mm for non-load bearing members.
- b) Each module shall be housed in a separate compartment complete with individual front access door. Working height shall be limited to 1800 mm from floor level.
- c) A full height vertical cable alley shall be provided in each panel to facilitate module wiring. The alley shall be liberally sized and shall have removable cover at the front. Removable back covers shall be provided at the back of the panels.
- d) Incomer shall be provided with Moulded Case Circuit Breaker (MCCB) and outgoing feeders shall be provided with Switch-fuse units.  
  
MCCB shall be suitable to make & break rated short-circuit current (25kA minimum) having in-built short circuit & over-load (adjustable type) protections.
- e) Switches shall be double pole, air break, heavy duty (AC 22) type, capable of safely making and breaking the full load current of associate circuit.
- f) Switch handle shall have position indicator and provision of padlocking in ON & OFF positions. Further it shall be interlocked with access door for safety.
- g) Fuses shall be HRC, preferably link type, design to permit easy & safe replacement. Visible indication shall be provided for indication of fuse.

- h) Incomer feeder shall be provided with Ammeter, Voltmeter, Power factor meter & bus energizes indicating lamp with fuse and outgoing feeders with feeder energizes indicating lamp with fuse.
- i) All indicating meters are 96 mm sq. digital type with LED display and all indicating lamps are clustered LED type so that lamp can be replaceable from front of the panel.

4.09.00

**UPS Cabinets/Enclosures**

- a) The UPS system components shall be housed in a sheet steel freestanding IP-42 enclosure with all access from the front. Sheet steel thickness shall be 2 mm minimum.
- b) The enclosure shall consist of vertical cabinets housing modules in rack type sub-assemblies, connected mechanically and electrically to form a rigid, self-supporting, metal enclosed structure.
- c) The modular units shall be mounted in pull out and/or swing trays. Each module shall be capable of being easily removed to provide for the ready inspection of major solid-state devices.
- d) Vertical wiring trough shall be provided for the entire height of the UPS cabinet. Cable entry shall be from bottom only.
- e) Adequate ventilating louvers and screens shall be provided. The top of the panel shall be protected by a suitable drip cover to prevent entrance of falling liquid and foreign material.
- f) If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirement :
  - i) Two (2) nos. 100% cooling fans shall be provided for each vertical panel.
  - ii) Completely independent duplicate protection, control and wiring systems shall be provided for the cooling fans for redundancy.
  - iii) The cooling fans shall be powered from the output of the associated inverter. Normally one fan will be running while the other is on stand-by.
  - iv) Each cooling fan shall be equipped with an airflow switch having an alarm contact that closes upon failure of airflow.

4.10.00

**Alarms**

- a) Solid state audio-visual annunciation system shall be provided for inverters, static transfer switch, battery charger.
- b) Alarm facia shall be provided on each charger and inverter panel, complete with proper actuating devices, circuitry and legends.

- 5.05.00 Cooling : Natural convection or forced cooling using redundant fans.
- 5.06.00 Design Ambient Temperature : 50 Deg.C
- 5.07.00 A.C. input :
- a) Supply : 415V, 3-phase, 50 Hz
  - b) Voltage variation :  $\pm 10\%$
  - c) Frequency variation :  $\pm 5\%$
  - d) Combined volt frequency variation : 10% (absolute sum)
  - e) Short-circuit level : 50 KA
  - f) System earthing : Solidly grounded
- 5.08.00 D.C. output : 100% UPS load plus restoring fully discharged battery to full charge condition in 8 hours.
- 5.09.00 Blocking Diode, Peak inverse voltage : 800 V (minimum)
- 5.10.00 Performance Requirement
- a) The output voltage of the charger shall be regulated within  $\pm 1\%$  of the set value for any load variation from 0 to 100% and A.C input voltage and frequency variation as indicated above in 4.06.00
  - b) The ripple content in charger D.C. output shall be limited to less than  $\pm 1\%$  with battery and less than  $\pm 2\%$  without battery.
- 6.00.00 DISTRIBUTION BOARDS
- 6.01.00 Type : Fixed, Modular construction.
- 6.02.00 Enclosure : Sheet Steel, IP52
- 6.03.00 Mounting : Free standing  
(can be attended from both front & back)

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 13 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**CONTROL PANELS SPECIFICATION**

|

7.12.00 Panels, Cubicles and Enclosures

7.12.01 General

- a) All panels, cubicles and enclosures shall be furnished complete with integral piping, internal wiring, convenience outlets, internal lighting, grounding, ventilation, space heating, vibration isolating pads and other accessories.
- b) Unless otherwise specified cable entry for panels / desks / cabinets shall be through bottom via glanding plate. Fireproof seal shall be used to seal the bottom to prevent entry of dust.
- c) Panels and cabinets shall be constructed from steel sheet reinforced as required to provide true surface and adequate support for devices mounted thereon. Thickness of the steel plate shall conform to the requirements of UL 50 or equivalent standard. Panels and cabinets shall be of adequate strength to support mounted components during shipment and to support a concentrated load of 100 Kilograms on their top after erection.
- d) Panel /cabinet shall have eyebolt on top for lifting.

7.12.02 Surface Preparation and Painting

Sheet metal exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below:

- a) Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale. Oil, grease and salts etc. shall be removed from by one or more solvent cleaning methods prior to blasting.
- b) Two spray coats of epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:
  - i) Exterior – RAL 7032.
  - ii) Interior - Brilliant White.
- c) Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections shall not be acceptable.

7.12.03 Wiring

Wiring within the panels shall conform to NEC standards and shall be factory installed and tested at the works. All interior wiring shall be installed neatly. Features shall not be limited to the following :

- a) All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks.
- b) Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized print shall be used with cross- identification.
- c) Wire termination shall be made with insulated sleeve and crimping type lugs. All external connections shall be made with one wire per terminal. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs shall not be used.
- d) Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables.
- e) Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring.
- f) All low-level signal cables shall be separately bundled from control cable.
- g) Wires shall be dressed and run in troughs with clamp-on type covers. Wirings shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.
- h) Shield wires shall be terminated on separately.
- i) Common connections shall be limited to two wires per terminal.
- j) Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue to the conductor.
- k) Wiring shall be arranged to enable instruments or devices to be removed and/or serviced without disturbing the wiring. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices.
- l) Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.
- m) Panels /cabinets /desks shall be provided with removable gasketed cable gland plates and cable glands. Split type grommets shall be used for prefab cables.
- n) Wire shall be multistranded annealed flexible high purity copper conductor with heat resistant FRLS PVC insulation and shall pass vertical flame test per IPCEAS-1981.

- o) Wire sizes used for internal wiring shall not be lower than the followings :
- Control wiring (switches, pushbuttons etc.) : 1.5 Sq.mm
  - Power supply/receptacle /illumination wiring : 2.5 sq. mm or higher as per load
  - 4-20mA DC current and low voltage signal upto 48V DC : 1.0 Sq. mm
- p) Identification of conductors shall be done by insulation color-coding identified on drawings or by printed wiring lists.

7.12.04 Grounding

- a) System cabinet AC and DC ground shall be electrically isolated from each other and also electrically isolated from the Instrumentation signal ground. All the above ground shall be individually connected to the single point on the ground pit. Dedicated redundant earth pit shall be provided which shall be away from the HV equipment. This earth pit shall not be shared with other electrical equipment ground and shall also be insulated from other electrical system ground to ensure single point grounding of the system. Grounding resistance shall be better than 1.0 ohm. IEEE guideline shall be followed while designing the grounding system.
- b) Panels and cabinets shall be provided with a continuous tinned copper ground bus bar of minimum 25 mm x 3 mm cross section, extending along the entire length of the panel / desk / cabinet assembly. The ground bus shall be bolted to the panel structure and effectively ground the entire structure.
- c) The panel /desk /enclosure /JB ground shall have two (2) bolt drilling with GI bolts and nuts at each end to connect to GI/ copper flat ground riser by means of insulated copper ground cable of required cross section with lug.
- d) Circuits requiring grounding shall be individually and directly connected to the panel ground bus.
- e) For electronic system cabinets, the electronic system ground bus shall be similar but insulated from the cabinet and shall be separately connected to the system ground. Signal cable shields shall be grounded at the panel end only and shall not be left open. The ground in between panels of a shipping section shall be firmly looped.
- f) Electrical meters, relays, transmitters and switching devices, operating at a voltage less than 50V may be grounded through the steel structure.

7.12.05 Panel / Cabinet/ Desk/Enclosures Environmental Protections

- a) Panels, cabinets, desks, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall suit the environmental condition of the area and shall not be inferior than the requirement indicated in the following table.

SL. NO.	LOCATION	ENCLOSURE TYPE
1.	Indoor type non- ventilated enclosure in non-hazardous area	IP-54
2.	Indoor type ventilated enclosure in non-hazardous area	IP -42
3.	Enclosure in Air conditioned area	IP-22 with suitable canopy at top to prevent ingress of dripping water.
4.	Outdoor type in non-hazardous areas	IP-55
5.	Outdoor in hazardous areas	As per requirements of the NEC Code for the location

- b) The construction of electrical enclosures located in areas subject to conditions classified in the National Electrical Code (NEC) as hazardous shall be of a type designated suitable for the environment in which they are located.

7.12.06 Terminal Blocks

- a) Terminals shall be chromated galvanized DIN rail mounted screwless cage clamp type. Terminals shall have screwed connection for conductor cross-section above 2.5 mm<sup>2</sup>. Terminal blocks shall conform to IEC 947-7-1.
- b) The characteristics of the terminal blocks shall be as follows.
- i) High contact force, independent of conductor cross-section and large contact surface area.
  - ii) Self-loosening protection.
  - iii) Resistant to thermal aging and vibration.
  - iv) Low and constant voltage drop
- c) Tension spring shall be made of high quality, non-rusting, acid-resistant steel. The current bar shall be of tin-lead plated copper or brass.

- d) Terminals shall be of non flammable suitable thermoplastic material such as polyamide.
- e) Terminal blocks shall be mounted vertically in panels and cubicles with clearance for at least 100 mm between two sets and between wall and terminal block.
- f) Terminal blocks shall be provided with white marking strips / self-adhesive marker cards. Power terminals shall have protection covers.
- g) At least 10%percent spare unwired terminals shall be provided for all panels /cabinets /desks /junction box etc.. This shall be in addition to 10%spare wired terminals of spare IO channels and 10% wired spare modules.
- h) Bottom of the terminal block shall be at least 200 mm above the cable gland plate for bottom entry type panels.
- i) For extending 24 V / 48 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.
- j) Other requirements of the terminal blocks are as follows:
  - i) The last block in a rail-mounted assembly shall be closed with an end plate and end bracket.
  - ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.
  - iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.
  - iv) It shall be possible to use jumper plugs through the test plug socket to connect adjacent terminals.
  - v) Where more than one connection to a terminal block is required, two tier terminals shall be used.
  - vi) Terminal blocks shall be of different colors depending on voltage levels.

7.12.07 Nameplates and Labels

- a) Each item shall have permanently attached to it, in a prominent position, a rating plate of non-corrosive material upon which is to be engraved the manufacturer's name, equipment, type / model number, range, serial number, together with details of the loading conditions under which the item of plant in question has been designed to operate.
- b) Such nameplates or labels are to be of white non-hygroscopic material with engraved black lettering, or alternatively of transparent plastic

material with suitably colored lettering engraved on the back.

- c) The nameplates shall be held by self-tapping screws. The size of nameplate shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for the panels.
- d) Items of plant such as valves, which are subject to handling, are to be provided with an engraved chromium plated nameplate or label with engraving filled with enamel, suitably mounted or affixed with strong rustproof chain.
- e) All such nameplates, instruction plates, lubrication charts etc. shall be with English inscriptions.

#### 8.00.00 **METERING BASES AND CHART UNITS**

The following system of units shall be followed for various displays and scales unless otherwise mentioned:

- i) Pressure : Kg/cm<sup>2</sup>  
Differential Pressure : mm of H<sub>2</sub>O column / Kg/cm<sup>2</sup>
- ii) Draught : mm of H<sub>2</sub>O column
- iii) Vacuum : Kg/cm<sup>2</sup> (abs)/mm of Hg column
- iv) Temperature : Degree Celsius (° C)
- v) Flow (Steam, Water) : Tonnes / hr, M<sup>3</sup>/Hr
- vi) Flow (Oil) : M<sup>3</sup> / Hr, Litter/Hr
- vii) Flow Air : Tonnes / hr / M<sup>3</sup> / Hr.
- viii) Density : gms / c.c.
- ix) Level : mm /%
- x) Conductivity : μS / cm or mS/cm
- xi) Gas Analyzer : Percentage by weight or as specified in respective case.
- xii) Dissolved Oxygen / Silica / Sodium : ppm /ppb

#### ~~9.00.00 **PROCESS CONNECTION & INSTRUMENT HOOK UP**~~

~~9.01.00 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.~~

As a rule tap orientation of high and low pressure side should be parallel and symmetrical.

9.15.00 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.

9.16.00 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.

9.17.00 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.

9.18.00 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. 316 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.

#### 10.00.00 **POWER SUPPLY SYSTEMS**

10.01.00 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.

10.02.00 Type of power supply systems envisaged for the various I & C system including DCS are as follows:

- a) 240V AC Redundant UPS system HMIs, Main Plant Field devices / equipment, CCTV, EWLI, CEMS, SWAS etc. and PLC of package System
- b) 24V / 48 VDC Supply for DCS

#### 11.00.00 **ENVIRONMENTAL CONSIDERATIONS**

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

11.01.00 Temperature

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

11.02.00 Humidity

11.02.01 I & C system shall be designed to withstand the humidity limits specified for the project. Condensation shall not be allowed to form in the cabinets nor

should water be allowed to be admitted through conduit entering the cabinets from top or sides.

11.03.00 Atmospheric Contamination

11.03.01 Particulate contamination from fly ash and coal dust and gaseous contaminants such as SO<sub>2</sub> and other flue gas constituents in the coal fired plant are foreseen. This hazard shall be taken into design considerations.

11.04.00 Vibration

11.04.01 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.

11.05.00 Lightning

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

12.00.00 **SECURITY**

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

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

12.03.00 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.

13.00.00 **ACCEPTANCE TESTS**

The Bidder shall be required, as part of his Tender, to fully integrate and test all the equipment, included in his Tender, at site and respective Control packages at the manufacturer's works. Owner / Consultants shall witness these tests.


However, for DCS the Bidder shall consider in his Tender the following tests:

(a) Factory Acceptance Test (FAT)

After completion of manufacture of DCS and prior to delivery to Site, the manufacturer shall functionally test the assembled system. The test shall be carried out with all input / output cubicles, control processors, data highway, operator's consoles, Engineer's console and peripheral devices connected in the specified configuration. The fully configured software shall also be loaded and tested at the same time.

The FAT shall include the following activities:

- Complete hardware inspection;

	<b>SPECIFICATION FOR LOCAL PANELS</b>	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	1 OF 6

**1.0 SCOPE**

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

**2.0 CODES AND STANDARDS**

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

a)	IS-6005 : 1998	:	Code of practice for phosphating of iron and steel.
b)	IS-5 : 2007	:	Colors for ready mixed paints and enamels.
c)	IS-1248:2003	:	Direct Acting Indicating Analog Elec Measuring Instruments.
d)	IS/IEC 60947:Part 1:2004	:	Low Voltage switchgear & control gear: Part-I (General Rules)
e)	IS-8828:1996	:	Circuit breaker for household and similar installations.
f)	IS-13947 (Part-I):1993	:	Low Voltage switchgear & control gear : Part-I (General Rules)
g)	ISA-18.1:1979	:	Annunciator Sequences and Specification
h)	NFPA-496:2003	:	Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

**3.0 TECHNICAL REQUIREMENTS**

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.


3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel  
Frame thickness: Not less than 3.0mm  
Enclosure thickness: Not less than 3.0 mm for load bearing sections (Mounted with instruments)  
2.0 mm for doors and Not less than 2.0 mm for others  
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)  
Gland plate thickness: 3.0mm  
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

	<b>SPECIFICATION FOR LOCAL PANELS</b>	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	2 OF 6

3.1.7 The class of protection shall be in accordance with IP-55 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.  
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm<sup>2</sup> size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.


3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm<sup>2</sup> to 2.5mm<sup>2</sup> external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.


3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm<sup>2</sup> size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte

	<b>SPECIFICATION FOR LOCAL PANELS</b>	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	3 OF 6
<p>Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.</p> <p>3.1.18 Vendor shall furnish electric load and heat load list ( in case panel is to be placed in ac environment ) of each panel.</p> <p>3.2 Hazardous Area Panel Requirement</p> <p>3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.</p> <p>3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.</p> <p>3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.</p> <p>3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 &amp; suitable for area classification.</p> <p>3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.</p> <p>3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).</p> <p>3.3 Control &amp; Monitoring devices</p> <p>3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.</p> <p>3.3.2 Alarm Annunciator System It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.</p> <p>3.3.3 Relays The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC &amp; 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.</p> <p>3.3.4 Timers The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC &amp; 2 Amp DC as applicable.</p>			

	<b>SPECIFICATION FOR LOCAL PANELS</b>	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	4 OF 6

3.3.5 Control / Selector Switches  
Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights  
The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters  
Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)  
These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.


3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

**4.0 TESTING AND INSPECTION**

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

	<b>SPECIFICATION FOR LOCAL PANELS</b>	SPECIFICATION NO.: PE-SS -999- 145 -054A	
		VOLUME	II B
		SECTION	D
		REV. NO. 03	DATE : 16-09-2013
		SHEET	5 OF 6

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

**5.0 SPARES AND CONSUMABLES**

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

**6.0 DRAWINGS AND DOCUMENTS**

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

**7.0 MARKING AND PACKING**

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrossion, incidental damage due



**SPECIFICATION FOR  
LOCAL PANELS**


SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
REV. NO. 03	DATE : 16-09-2013
SHEET	6 OF 6


to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.


**8.0 APPLICABLE DATA SHEET FORMS**

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

	<b>DATA SHEET FOR LOCAL PANELS</b>		SPECIFICATION NO.: PES-145-054A		
			VOLUME		
			SECTION		
			REV. NO. 01	DATE: 22.03.2011	
			SHEET 1	OF 2	
TAG No. .... Qty.....		Data Sheet No.: <b>PES-145A-DS1-0</b>			
<b>Data Sheet A &amp; B</b>					
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
<b>GENERAL</b>	MANUFACTURER				
	CONSTRUCTION		<input type="checkbox"/> FOLDED <input type="checkbox"/> WELDED (As per requirement EDN)		
	ENCLOSURE SHEET THICKNESS	FRONT	<input checked="" type="checkbox"/> 3.0 mm (FOR FACES SUPPORTING INSTRUMENTS/TERMINALS)		
		OTHER	<input checked="" type="checkbox"/> 2.0 mm (FOR OTHER SIDES AND TOP)		
		DOOR	<input checked="" type="checkbox"/> 2.0 mm		
		HEIGHT	<input type="checkbox"/> 2365 mm for stand alone panels. (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)		
	OTHER	<input type="checkbox"/>			
<b>TECHNICAL</b>	INPUT POWER SUPPLY *		<input type="checkbox"/> 240V 50 Hz AC <input type="checkbox"/> 220V DC <input type="checkbox"/> 415V 3 PHASE 3W <input type="checkbox"/> 415V 3 PHASE 4W		
	NO. OF FEEDERS		<input type="checkbox"/> ONE <input checked="" type="checkbox"/> TWO		
	CONTROL SUPPLY		<input type="checkbox"/> 110V AC <input type="checkbox"/> 220V AC <input type="checkbox"/> 220V DC <input type="checkbox"/> Other. (As per requirement)		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____ NOS. (AS REQUIRED)		
	PAINT TYPE		<input type="checkbox"/> EPOXY ENAMEL <input checked="" type="checkbox"/> EPOXY POWDER COATED OR BETTER (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)		
	PANEL COLOUR (EXTERNAL)		<input type="checkbox"/> LIGHT GREY (Shade 631 IS-5) <input type="checkbox"/> OPALINE GREEN (Shade 275) . <input checked="" type="checkbox"/> RAL 7032 (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)		
	FINISH (EXTERNAL)		<input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input type="checkbox"/> SEMI GLOSSY		
	PANEL COLOUR (INTERNAL)		<input type="checkbox"/> WHITE <input type="checkbox"/> CREAM <input type="checkbox"/> OFF WHITE <input checked="" type="checkbox"/> BRILLIANT WHITE		
	FINISH (INTERNAL)		<input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input type="checkbox"/> SEMI GLOSSY		
	CLASS OF PROTECTION		<input type="checkbox"/> IP-42 (FOR INDOOR SERVICE) <input checked="" type="checkbox"/> IP-55 (FOR OUTDOOR SERVICE) <input type="checkbox"/> ANY OTHER		
	CONTROL HARDWARE		<input checked="" type="checkbox"/> RELAY BASED		
	FOUNDATION ARRANGEMENT		<input type="checkbox"/> FOUNDATION BOLTS <input type="checkbox"/> ANCHOR FASTENERS		
	WEIGHT OF PANEL (Kg.)				
	PANEL TYPE		<input type="checkbox"/> PRESSURISED <input type="checkbox"/> UNPRESSURISED As per Requirement		
	CABLE GLAND		<input checked="" type="checkbox"/> DOUBLE COMPRESSION		
AMMETER (TYPE OF INPUT) *		<input type="checkbox"/> 1 Amp CT <input type="checkbox"/> 4-20 mA			

	<b>DATA SHEET FOR LOCAL PANELS</b>			SPECIFICATION NO.: PES-145-054A	
				VOLUME	
				SECTION	
				REV. NO. 01	DATE: 22.03.2011
				SHEET 2	OF 2
TAG No. .... Qty.....			Data Sheet No.: <b>PES-145A-DS1-0</b>		
<b>Data Sheet A &amp; B</b>					
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
* TO BE CO-ORDINATED WITH PEM ELECTRICAL					
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY		
					COMPANY SEAL NAME: SIGNATURE: DATE:

	<b>DATA SHEET FOR LOCAL PANELS</b>			SPECIFICATION NO.: PES-145-054A		
				VOLUME		
				SECTION		
				REV. NO. 01	DATE: 22.03.2011	
				SHEET 2	OF 2	
TAG No. .... Qty.....			Data Sheet No.: <b>PES-145A-DS1-0</b>			
<b>Data Sheet C</b>						
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)						
<b>GENERAL</b>	MANUFACTURER					
	CONSTRUCTION		<input type="checkbox"/> FOLDED <input type="checkbox"/> WELDED (As per requirement EDN)			
	ENCLOSURE SHEET THICKNESS	FRONT				
		OTHER				
		DOOR				
		HEIGHT				
		OTHER				
<b>TECHNICAL</b>	INPUT POWER SUPPLY					
	NO. OF FEEDERS					
	CONTROL SUPPLY					
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)					
	PAINT TYPE					
	PANEL COLOUR (EXTERNAL)					
	FINISH (EXTERNAL)					
	PANEL COLOUR (INTERNAL)					
	FINISH (INTERNAL)					
	CLASS OF PROTECTION					
	CONTROL HARDWARE					
	FOUNDATION ARRANGEMENT					
	WEIGHT OF PANEL (Kg.)					
	PANEL TYPE					
	CABLE GLAND					
	AMMETER (TYPE OF INPUT)					
NAME SIGNATURE DATE	<b>PREPARED BY</b>		<b>CHECKED BY</b>		<b>APPROVED BY</b>	
	Shiv Kumar		Anisha B Singhal		Anisha B Singhal	
					COMPANY SEAL	
					NAME:	
					SIGNATURE:	
					DATE:	



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

SHEET 1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
1.0	<b>INCOMING</b> Sheet Steel (CRCA & HR)	<ol style="list-style-type: none"> <li>Chemical Composition</li> <li>Bend Test</li> <li>Surface finish</li> <li>Waviness</li> <li>Thickness</li> <li>Mill marking</li> </ol>	MA CR MA MA MA MA	Chemical analysis Mech. test Visual Visual Measurement Visual	Sample Sample 100% 100% 100% 100%	IS:1079 IS:513 IS:1079 IS:513 Factory Standard / Sample Factory Standard BHEL Spec. Factory Standard	IS:1079 IS:513 IS:1079 IS:513 Factory Standard / Sample No Waviness BHEL Spec. Factory Standard	Test Certificate Log Book Log Book Log Book Log Book Log Book	3 2 2 2 2 2	--- --- --- --- --- ---	2 --- --- --- --- 1		
2.0	Flats / Angles / Channels	<ol style="list-style-type: none"> <li>Dimensions</li> <li>Surface Defects</li> <li>Straightness</li> <li>Mill marking</li> </ol>	MA MA MA MA	Measurement Visual Measurement Visual	Sample 100% 100% 100%	IS:2062 Factory Standard / Sample Factory Std. IS:2062	IS:2062 Factory Standard / Sample Factory Std. IS:2062	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	--- --- --- 1		
3.0	Cables / Wires	<ol style="list-style-type: none"> <li>Visual / Surface defects</li> <li>IR and HV</li> </ol>	MA MA	Visual Electrical	100% 100%	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694	Log Book Log Book	2 2	--- ---	--- ---	--- ---	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**  
 VOLUME IIB  
 SECTION D  
 REV. NO. **01** DATE: **22-02-2008**  
 SHEET 2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	CR CR CR MA MA MA MA	Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical	Sample 100% Sample+ 100% 100% 100% 100%	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	---	---	+ for relay & contactors only @ for all components except relays & contactors.

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**  
 VOLUME IIB  
 SECTION D  
 REV. NO. **01** DATE: **22-02-2008**  
 SHEET 3 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
5.0	Misc. Components like <b>Gaskets, Terminal Blocks etc.</b>	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
<b>IN PROCESS</b>												
6.0	Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
			MA	Visual	100%	<b>Factory Standard</b>	<b>Factory Standard</b>	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
			MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
<b>ASSEMBLY</b>												
8.0	Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
			MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
			MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
			MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

SHEET 4 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	<ol style="list-style-type: none"> <li>1. Pretreatment Process</li> <li>2. Process parameters like bath temp. concentration etc.</li> <li>3. Dipping / Removal Time</li> <li>4. Surface quality after every dip</li> <li>5. Primer after phosphating</li> <li>6. Putty Application &amp; Rubbing after primer</li> <li>7. Paint first coat</li> <li>8. Putty Application and Rubbing after first coat of paint</li> <li>9. Paint second coat</li> </ol>	MA	<p>Visual</p> <p>Measurement</p> <p>Measurement</p> <p>Visual</p> <p>Visual, Thickness</p> <p>Visual</p> <p>Visual, Thickness</p> <p>Visual</p> <p>Visual, Thickness, Scratch test Colour adhesion</p>	<p>100%</p> <p>Periodic</p> <p>100%</p> <p>100%</p> <p>100%</p> <p>100%</p> <p>100%</p> <p>100%</p> <p>100%</p>	<p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p> <p>Factory Standard &amp; IS: 6005</p>	<p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p> <p>Log Book</p>	<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>	<p>---</p> <p>---</p> <p>---</p> <p>---</p> <p>---</p> <p>---</p> <p>---</p> <p>---</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>		

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**  
 VOLUME IIB  
 SECTION D  
 REV. NO. **01** DATE: **22-02-2008**  
 SHEET 5 OF 7

Sl. No.	Component / operation	* Category	Characteristics Checked	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
10.	Panel Wiring	MA	<ol style="list-style-type: none"> <li>Wiring Layout</li> <li>Wiring Termination (Crimped Lugs)</li> <li>Ferrule numbers</li> <li>Colour of wiring</li> <li>Size of Conductor</li> </ol>	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		MA		Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		MA		Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		MA		Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		MA		Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	MA	<ol style="list-style-type: none"> <li>Correct components</li> <li>Fixing</li> </ol>	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		MA		Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
	<b>FINAL</b>											
12.	Final Inspection	MA	<ol style="list-style-type: none"> <li>Workmanship</li> <li>Component layout (neatness, accessibility &amp; safety) Mounting / Proper fixing of all components</li> <li>Components identification Marking / Name plates</li> </ol>	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		MA		Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		MA		Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

SHEET 6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**  
 VOLUME **IIB**  
 SECTION **D**  
 REV. NO. **01** DATE: **22-02-2008**  
 SHEET **7** OF **7**

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
13.	<b>TYPE TEST</b>	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1	
14	<b>ROUTINE TEST</b>	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	<b>FUNCTIONAL TEST</b>	1. Control Logic Operation 2. Instrument Calibration 3. Temperature rise	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
			CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

LEGEND: \* CR - Critical characteristics  
 MA - Major characteristics  
 MI - Minor characteristics

\$ P - Agency Performing the Test.  
 W - Agency Witnessing the Test.  
 V - Agency Verifying the Test.

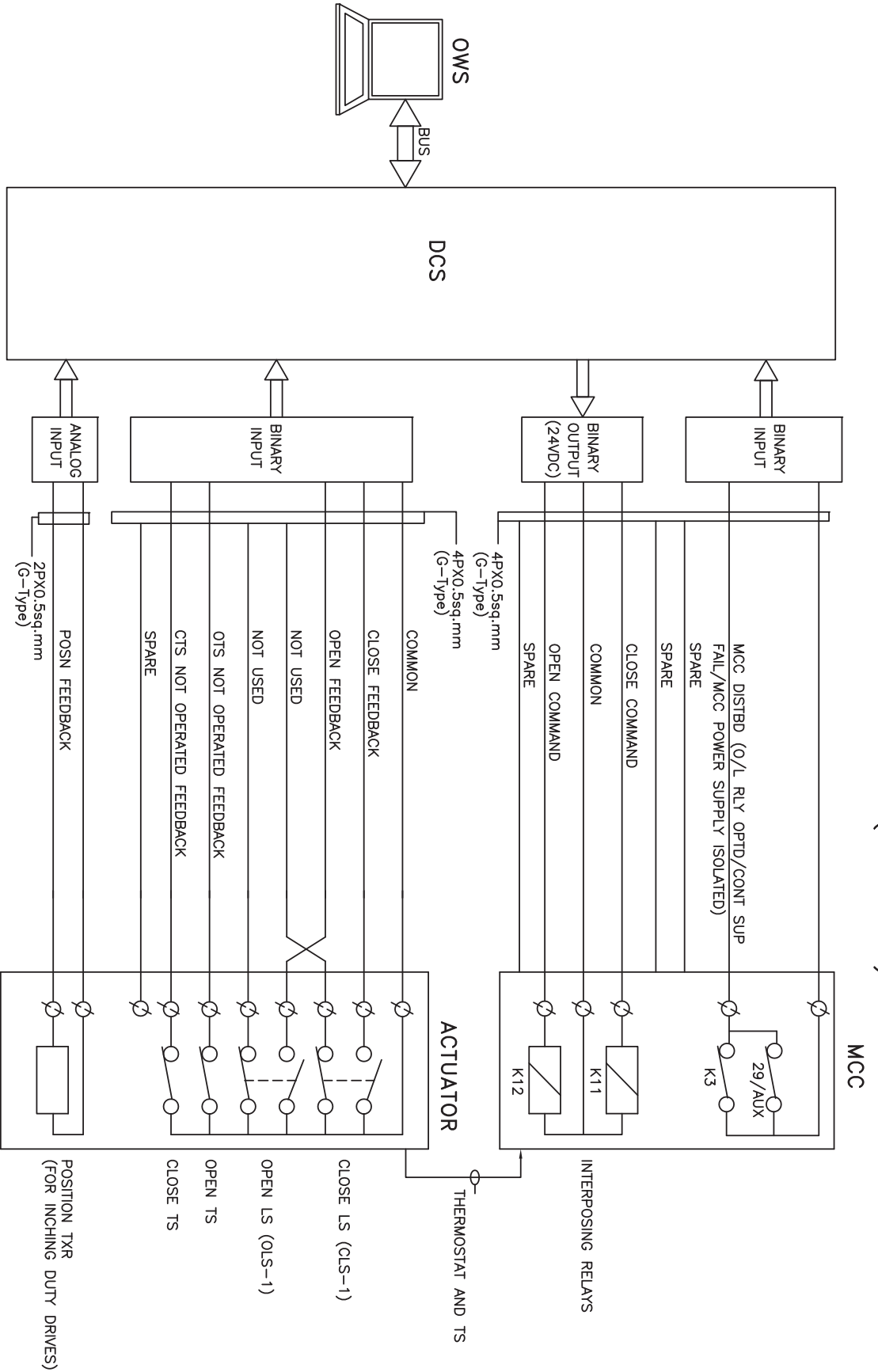
1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 14 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**DRIVE CONTROL PHILOSOPHY**

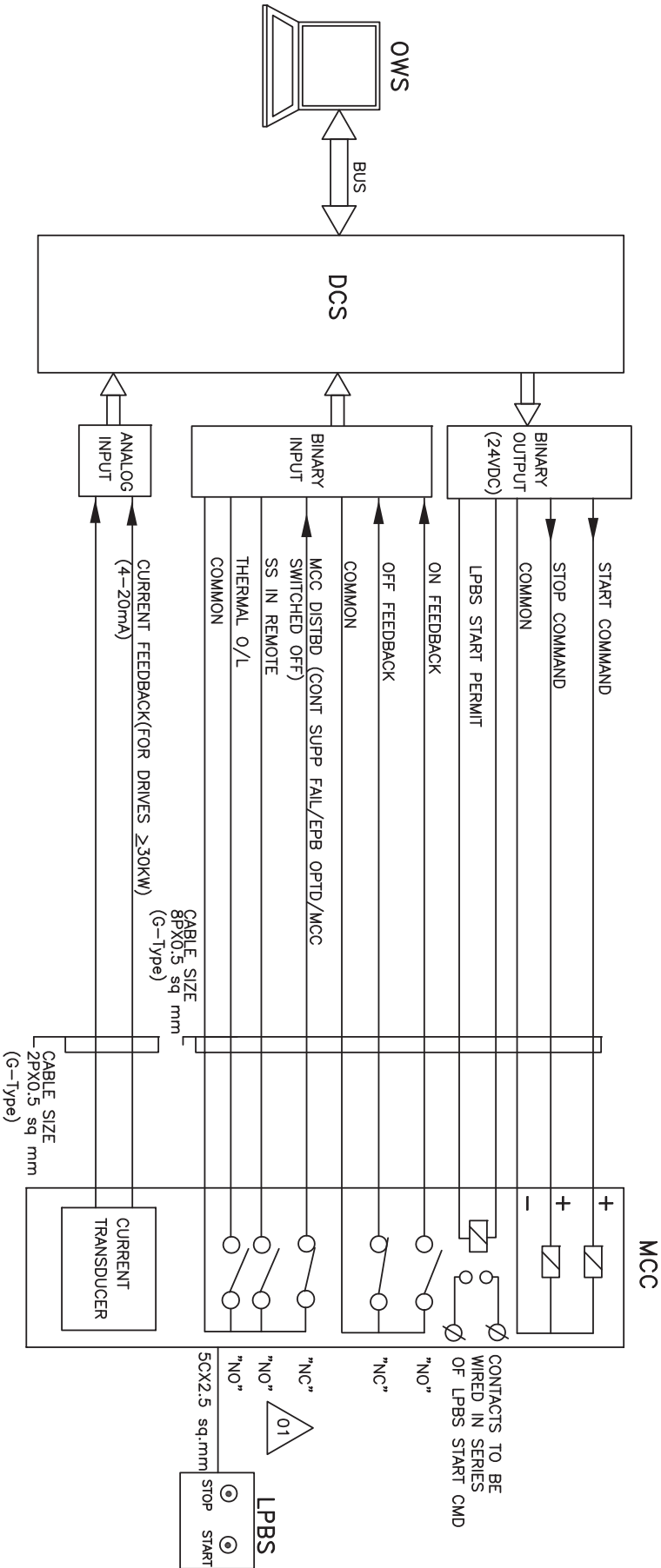
|


# DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH MCC)



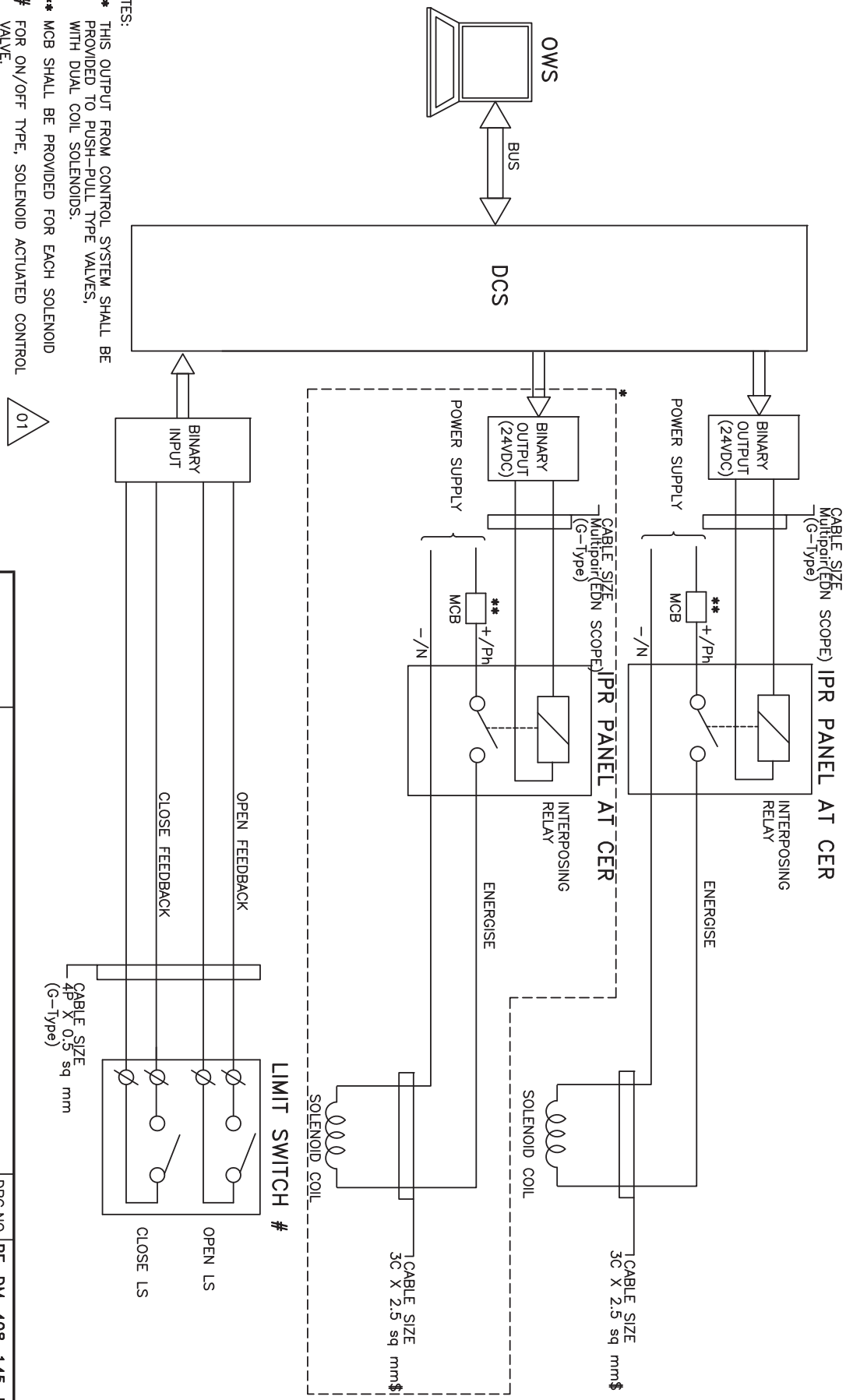
<b>PROJECT:</b> 1X800MW WANKABORI THERMAL POWER STN. EXTN. UNIT-8	
<b>TITLE :</b> 01 DCS INTERFACE FOR BIDIRECTIONAL DRIVE	
DRG.NO.:	PE-DM-408-145-1002
DATE:	16.02.15
REV.NO.:	01
SHT	7 OF 11

# DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



		PROJECT: 1X800MW WANKABORI THERMAL POWER STN. EXTN. UNIT-8	
TITLE : <span style="border: 1px solid black; padding: 2px;">01</span> DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE		DRG.NO.: PE-DM-408-145-1002	DATE: 16.02.15
REV.NO.: 01	SHT: 8 OF 11		

# DCS INTERFACE FOR SOLENOID DRIVE (24V DC/220V DC/ 240V AC UPS)

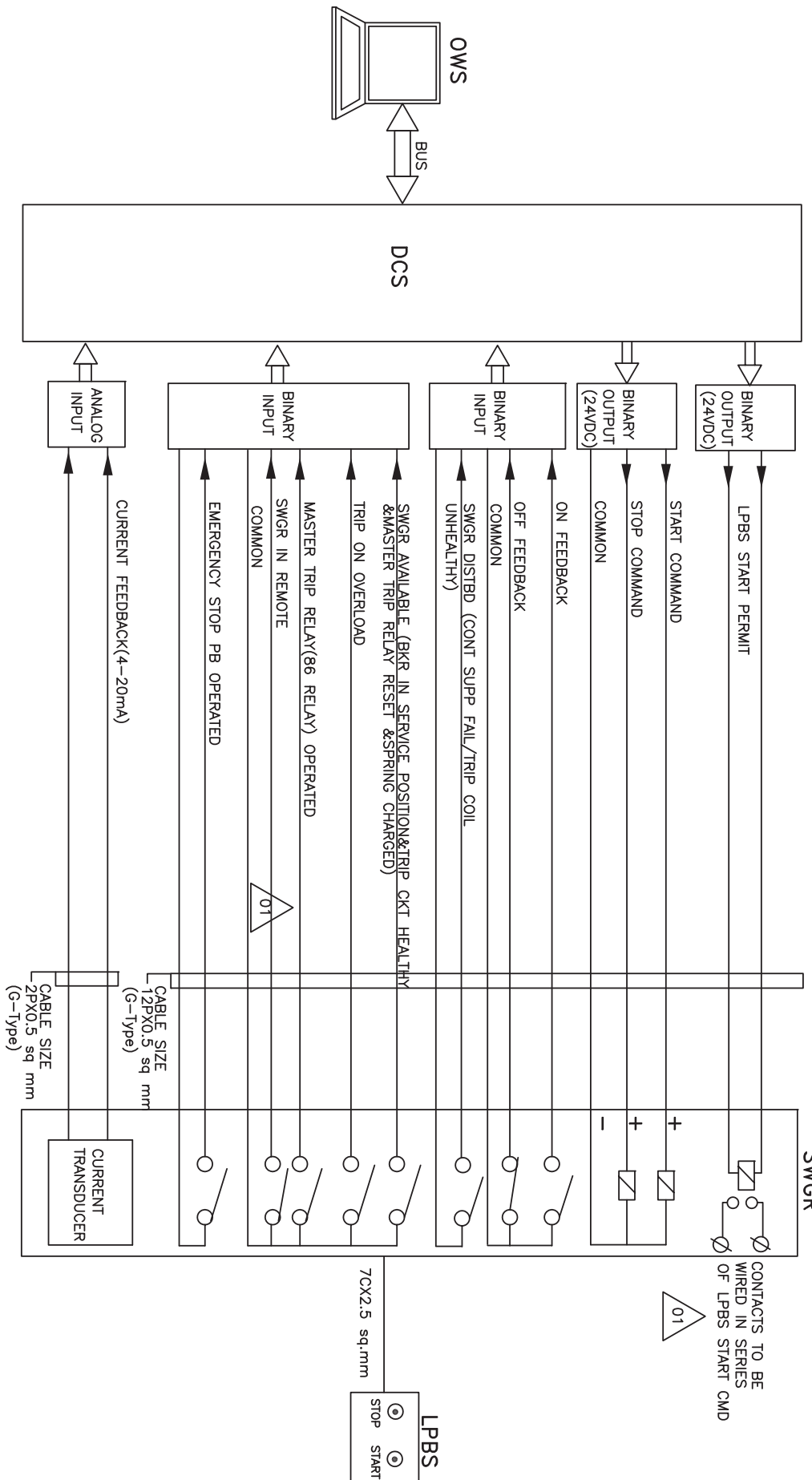



- NOTES:
- \* THIS OUTPUT FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.
  - \*\* MCB SHALL BE PROVIDED FOR EACH SOLENOID
  - # FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.
  - CER:-CONTROL EQUIPMENT ROOM
  - IPR:-INTER POSING RELAY
  - \$ SYSTEMS WHERE EVER MULTIPLE SOLENOIDS CAN BE GROUPED,MULTI CORE CABLE SHALL BE USED.



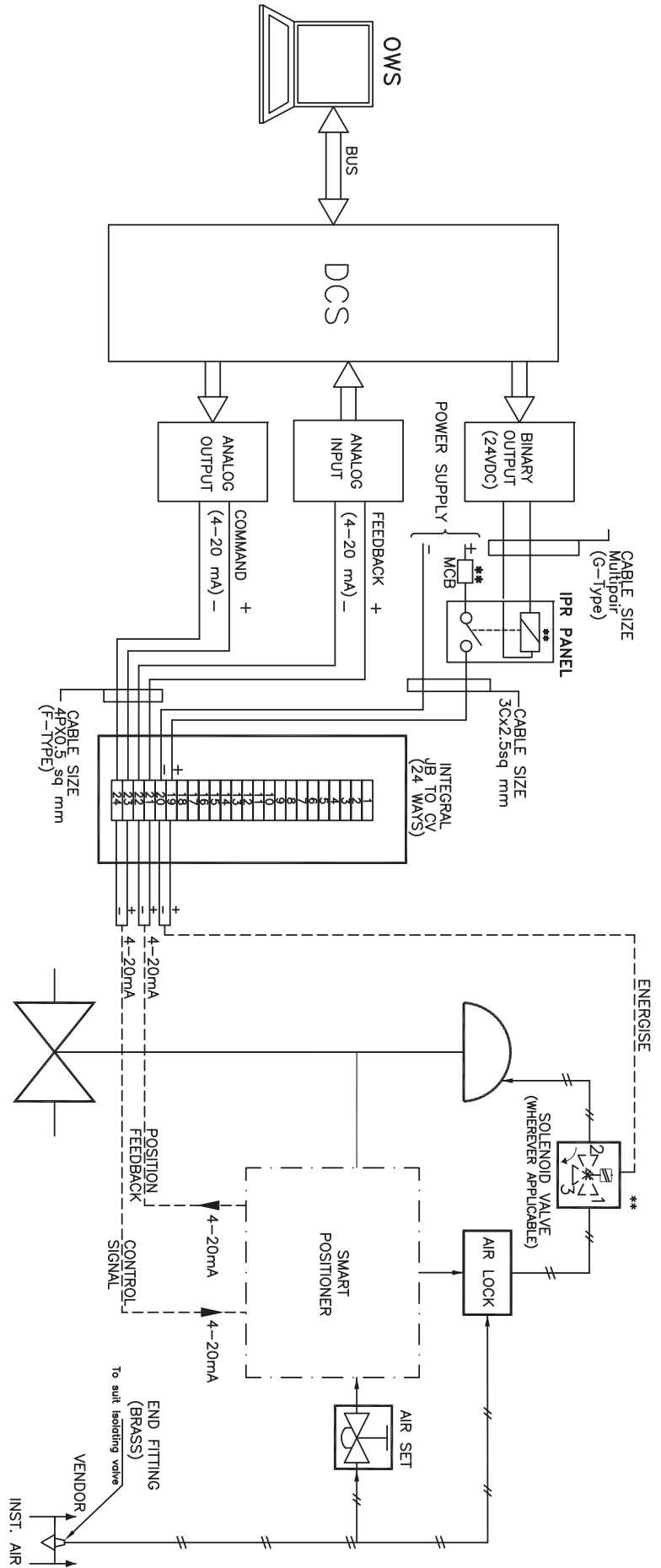
<b>PROJECT:</b> 1X800MW WANKABORI THERMAL POWER STN. EXTN. UNIT-8		<b>DRG.NO.:</b> PE-DM-408-145-1002
<b>TITLE :</b> 01 DCS INTERFACE FOR SOLENOID DRIVE	<b>DATE:</b> 16.02.15	<b>REV.NO.:</b> 01
<b>SHT</b> 9	<b>OF</b> 11	

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




		PROJECT: 1X800MW WANKABORI THERMAL POWER STN.	
		EXTN. UNIT-8	
TITLE : 01 DCS INTERFACE FOR UNIDIRECTIONAL HT DRIVE		DRG.NO.:	PE-DM-408-145-1002
DATE:	16.02.15	REV.NO.:	01
SHT:	10 OF 11		

# DCS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:  
 \*\* APPLICABLE TO THOSE VALVES ONLY WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.

	
PROJECT: 1X800MW WANKABORI THERMAL POWER STN. EXTN. UNIT-8	DRG:NO. PE-DM-408-145-1002 DATE 16.02.15
TITLE : TYPICAL HOOK-UP DIAGRAM ANALOG DRIVE (WITH SMART POSITIONER)	REV.NO. 01 SHT 11 OF 11

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 15 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**APPLICABLE CODES AND STANDARDS**

|

box or enclosure shall leave from terminal blocks and not from other devices in the enclosure.

The required quantities of cable accessories shall be similarly estimated on the basis of number of terminations and proposed routing of the cables. Any shortfall in the quantity of accessories observed during actual laying shall be compensated at no extra cost.

5.00.00 **PROVEN PRODUCT**

If Bidder is offering their own system or through their collaborator, then same is acceptable subject to satisfactory performance in last 3 years for at least one unit of not less than 600 MW capacity.

If DCS is bought out for bidder then same shall be from following vendors meeting specification and satisfactory performance in last 3 years for at least one unit of not less than 600 MW capacity.

Latest system from following vendors

M/s Siemens

M/s Yokagawa

M/s Honeywell

M/s ABB

Ovation.

5.01.00 Similarly, all other I & C equipment / systems / sub-systems / instruments and accessories in the power cycle shall also be of make and model whose guaranteed and trouble-free performance has been proven at least for two (2) years in not less than two (2) different reheat type pulverized coal fired units of unit size not less than 600 MW.

5.02.00 Bidder shall furnish required information to fully satisfy Owner regarding successful operation and high reliability of products / systems furnished.

6.00.00 **CODES AND STANDARDS**

6.01.00 Items such as thermowells, control valves, flow elements and other in line devices in high and medium pressure steam, feed water and similar services, which fall under the purview of Indian Boiler Regulation Act shall be either certified by IBR or shall be certified by authorities acceptable to IBR. It shall be responsibility of Bidder to obtain the necessary approval of the concerned Authority / Chief Inspector of Boilers for the design and design calculations, manufacturing and erection procedure as called for under the IBR Act for all items requiring such certification.

6.02.00 Generally, the following latest edition of codes and standards prevailing at the time of award of contract shall be applicable.

- 1) Temperature Measurement

- a) Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
  - b) Temperature Measurement - Thermocouples - ANSI - MC 96.1 - 1982.
  - c) Temperature Measurement by electrical resistance thermometers - IS: 2806
  - d) Thermometer-element-Platinum resistance - IS: 2848 / DIN 43760.
- 2) Pressure Measurement
- a) Instrument and apparatus for pressure measurement - ASME PTC 19.2 (1964).
  - b) Bourdon tube pressure and vacuum gauges - IS: 3624/1996.
- 3) Flow Measurement
- a) Instruments and apparatus for flow measurement - ASME PTC 19.5 (1972) Interim supplement, Part-II
  - b) Measurements of fluid flow in closed conduit - BS 1042.
- 4) Electronic Measuring Instruments and Control Hardware
- a) Automatic null balancing electrical measuring instruments -ANSI C 39.4 (Rev. 1973), IS 9319
  - b) Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 / 1974.
  - c) Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1: ANSI MC 12.1 / 1975.
  - d) Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975) - ISA -S26 (1968).
  - e) Surge withstand capability (SWC) tests - ANSI C 37.90A (1989), IEC-255.4.
  - f) Printed circuit boards - IPC TM-650, IEC 326C.
  - g) General requirements and tests for printed wiring boards - IS-7405 (Part-I)/1973.
  - h) Edge socket connectors - IEC 130-11.
  - i) Requirements and methods of testing of wire wrap terminations--DIN 41611 Part-2.
  - j) Dimensions of attachment plugs and receptacles- ANSI C73-1973.(Supplement ANSI C73a – 1980)
- 5) Instrument Switches and Contacts

- a) Contact Rating - AC services NEMA ICS Part-2 125, A-600
- b) Contact Rating - DC services NEMA ICS Part-2 125, N-600
- 6) Enclosures
  - a) Enclosures for Industrial Controls and Systems--NEMA ICS-6-110.15 through 110.22
  - b) Racks, panels and associated equipment -EIA: RS-310-B-1983 (ANSI C83.9 - 1972).
- 7) Apparatus, Enclosures and Installation Practices in Hazardous Area
  - a) Classification of hazardous area - NEMA Article 500, Volume-6, 1978.
  - b) Electrical Instruments in hazardous dust locations - ISA-RP 12.11.
  - c) Intrinsically safe apparatus - NFPA Article 493 Volume-4 1978.
  - d) Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Article 496 Volume-4, 1978.
- 8) Sampling System
  - a) Stainless Steel material of tubing and valves, for sampling system - ASTM A 269-79 GRTO-316.
  - b) Submerged helical coil heat exchangers for sample coolers -- ASTM D11-98.
- 9) Annunciators
  - a) Specifications and guides for the use of general-purpose annunciators - ISA RP 18.1.
  - b) Surge withstand capability tests -ANSI C37.90 a -1971 and IEEE Standard 472-1974.
- 10) Interlocks, Protections
  - a) Relays and relay system associated with electric power apparatus - IEEE Standards 3.13.
  - b) Surge withstand capability tests - ANSI C37.90 a - 1971 and IEEE Standard 472-1974.
  - c) General requirements and tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I)/1973.
  - d) Turbine water damage prevention - ASME-TDP-1-1980.
  - e) Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F, 85G.
- 11) UPS System

- a) Practice and requirements for semi-conductor power rectifiers - ANSI C34.2.
- b) Relays and relay systems associated with electrical power apparatus IEEE Standard - 3.13.
- c) Surge withstand capability tests - ANSI C 70.90 A/1971, IEC-255.4.
- d) Recommended practice for sizing large lead storage batteries for generating stations and sub-stations - -IEEE-485.

12) Control Valves

- a) Control valve sizing (Incompressible fluids) - ISA-S39.2 / 1972.
- b) Control valve sizing (Compressible fluids) - ISA-S39.4 / 1972.
- c) Control Valve seat leakage – ANSI / FCI 70.2
- d) Face to face dimensions of Control Valves - ANSI B16.10
- e) Control Valve Capacity Test Procedure – ISA – S75.02

13) Instrument Tubing

- a) Seamless Carbon Steel Pipe - ASTM-A-106.
- b) Forged carbon steel fittings - ASTM-A-105.
- c) Dimensions of fittings - ANSI-B16.11.
- d) Code for pressure piping, welding, hydrostatic testing - ANSI-B 31.1.
- e) Nomenclature for instrument tube fittings - ISA-RP 42.1 / 1982.
- f) Seamless Stainless Steel Tube ASTM A-213 TP 316 / ASTM A-269 TP 316
- g) Seamless Alloy Steel Pipe ASTM A 335 P22
- h) Seamless Stainless Steel Pipe ASTM A-312 TP 316

14) Cables

- a) Thermocouple extension wires / cables - ANSI MC96.1.
- b) Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy-IPCEA S-61-402
- c) Guide for design and installation of cable system in power generating station (insulation, jacket materials) -IEEE Standard 422.
- d) Requirements of vertical tray flame test - IEEE 383
- e) Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B33.

15) Electronic Cards, Subassemblies and Components

a) Unpackaged

- i) Vibration : IEC-68.2.6
- ii) Shock : IEC-68.2.27
- iii) Drop & Topple : IEC-68.2.31

b) Packaged

Vibration, Drop & Static Compression - NSTA.

c) Electromagnetic Compatibility

- i) Electrical Fast Transient : IEC-801.4
- ii) Surge Withstand : IEC-255.4
- iii) Radiated Electromagnetic Field : IEC-801.3
- iv) Electrostatic Discharge : IEC-801.2
- v) Electromagnetic Emissions : VDE 0871, Class-B

16) Cable Trays, Conduits

- a) Guide for the design and installation of cable system in power generating station (cable trays, support systems, conduits)- IEEE Standard 422, NEMA VE-1, NEC-1981. Test Standards NEMA VE-1-1979.
- b) Galvanizing of carbon steel cable trays - ASTM A-386.

7.00.00 **DESIGN CRITERIA**

This section lays down the general design criteria to be adapted in designing the instrumentation and control system of the plant.

7.01.00 General Requirements

7.01.01 Instrumentation, control and automation devices and accessories shall be designed with the following considerations:

- a) Stable in spite of temperature fluctuations.
- b) Able to withstand high humidity.
- c) Weather proof.
- d) Dust proof.
- e) Corrosion resistant.
- f) Erosion resistant.


	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 18 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

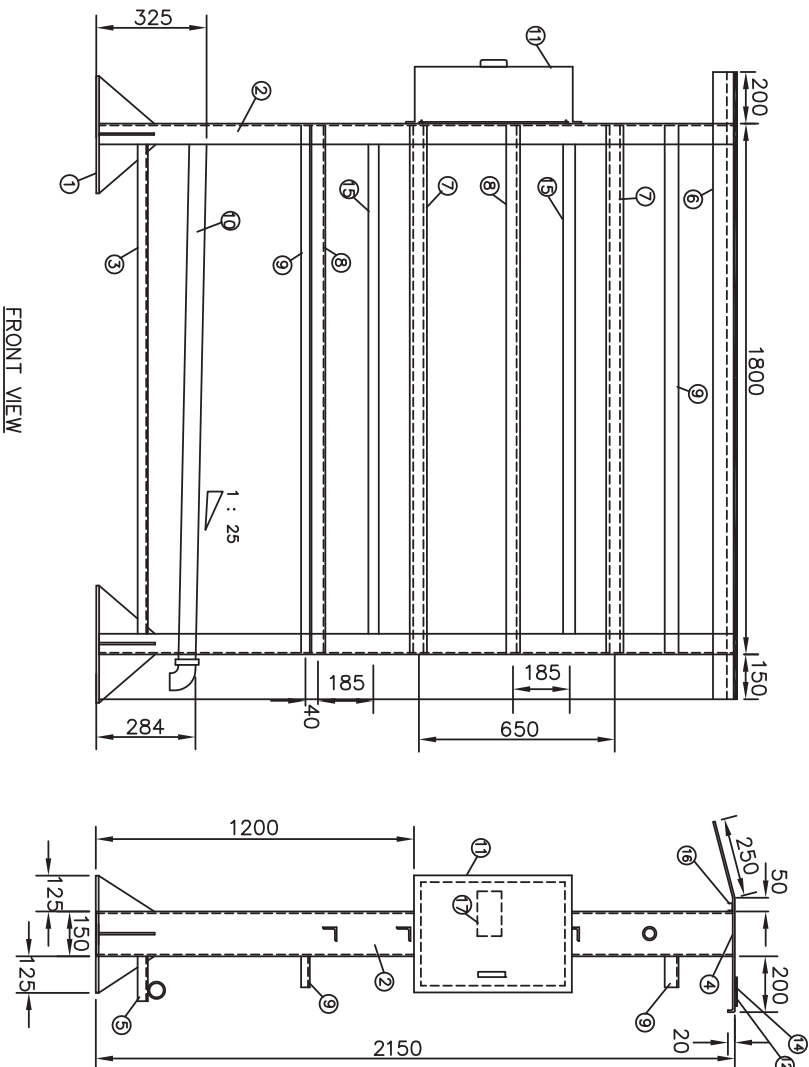
**DRAWINGS**

|

GA DRAWING  
TRANSMITTER RACK

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10
			<b>GA DRAWING-TRANSMITTER RACK</b>		
<p style="font-size: small; margin: 0;">1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAQBORI THERMAL POWER STATION, GUJARAT) GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT</p>					
 <p style="font-size: x-small; margin: 0;">KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p> <p style="margin: 0;"><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b> CONSULTING ENGINEERS</p>		JOB NO. DGPL-K9213R DWG. NO. K9213R-DWG-I-0200	SCALE NIL SHT. 1 OF 10	REV. 0	



UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

**LEGEND:**

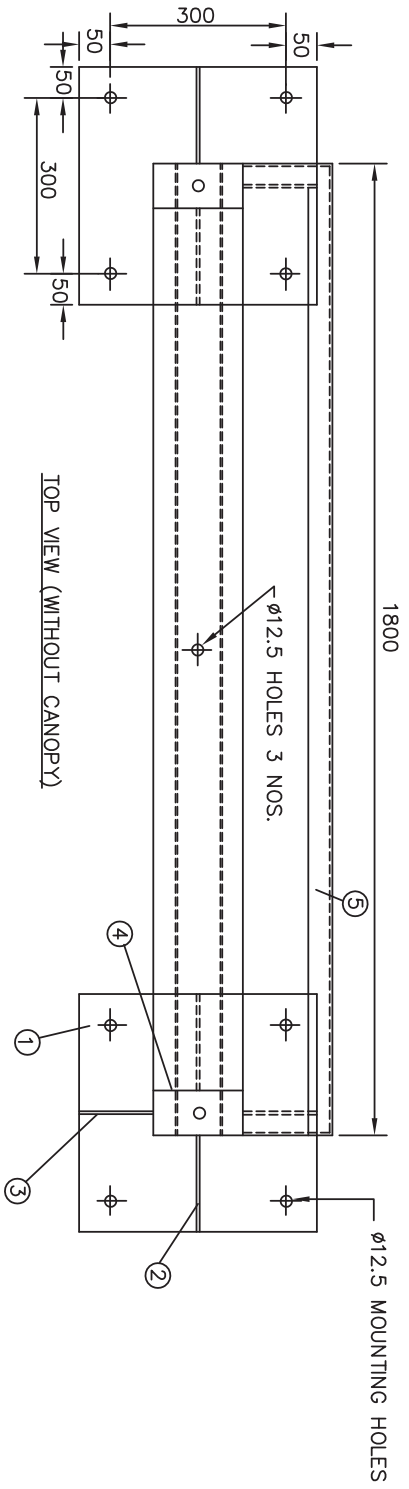
- 1..M.S. PLATE 400 X 400 X 10 mm.
- 2..ISMC 150 X 75 X 6 mm.
- 3..ISMC 75 X 40 X 5 mm.
- 4..CANOPY MOUNTING PLATE 5 mm THICK.
- 5..BRACKET FOR DRAIN PIPE.
- 6..CANOPY ASSEMBLY 3.0 mm THICK CRCA SHEET.
- 7..GI PIPE 2" NB CLASS B FOR TRANSMITTER MOUNTING.
- 8..M.S.ANGLE 40 X 40 X 5 mm.
- 9..BRACKET FOR IMPULSE PIPE SUPPORT.
- 10..DRAIN PIPE MATERIAL ASTM A106 GR. 'C' SIZE 2" NB SCH 80.
- 11..JUNCTION BOX SIZE: 480 (H) X 360 (W) X 180 (D).
- 12..BULKHEAD M.S. PLATE 5 mm THICK.
- 13..COMPACT FLUORESCENT LAMP FOR RACK ILLUMINATION.
- 14..XLPE GASKET IN BETWEEN BULKHEAD PLATE & CANOPY MOUNTING PLATE.
- 15..PVC CABLE TRAY/FLEXIBLE CONDUIT FOR CABLE.
- 16..'C' CHANNEL FOR LIGHT FITTING.
- 17..TAG PLATE.

**NOTES:**

- 1..POWER SOCKET & TB SHALL BE PROVIDED IN JB.
- 2..COLOUR: GREY IS5-631. OVERALL THICKNESS > 100 MICRONS.
- 3..TAG PLATES SHALL BE PROVIDED FOR EACH INSTRUMENT.
- 4..20% TERMINALS SHALL BE PROVIDED AS SPARE.
- 5..ANTIVIBRATION PAD & FOUNDATION BOLTS SHALL BE PROVIDED.
- 6..DIMENSIONS SHOWN ARE TENTATIVE AND SHALL BE FINALISED AT DETAILING.

PRELIMINARY  
TENDER PURPOSE ONLY

G.A. DRAWING FOR LOCAL INSTRUMENT RACK		1x800kW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAQBORI THERMAL POWER STATION, GUJARAT)		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI	
GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADDARA, GUJARAT		JOB NO. DCPL-K9213R SCALE NIL		SHT. 2 OF 10	
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10



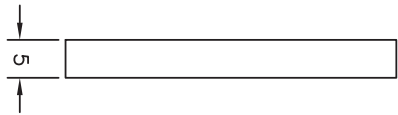
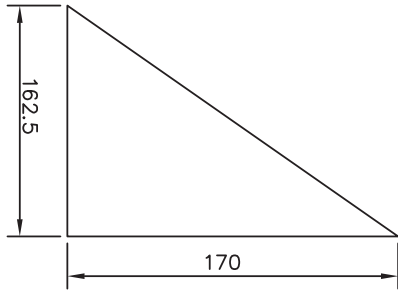
TOP VIEW (WITHOUT CANOPY)

- NOTES:**
1. M.S. PLATE 400 X 400 X 10 mm.
  2. RIB M.S. PLATE 162.5 X 170 X 5 mm THICK.
  3. RIB M.S. PLATE 125 X 170 X 5 mm THICK.
  4. RIB M.S. PLATE 134 X 165 X 5 mm THICK. (CANOPY MOUNTING PLATE SUPPORT)
  5. BRACKET FOR IMPULSE PIPE SUPPORT.

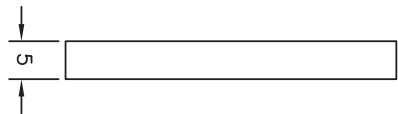
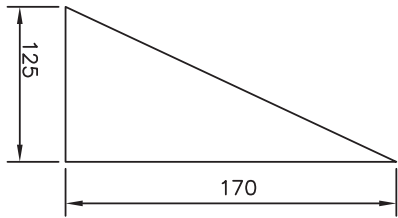
UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

PRELIMINARY  
TENDER PURPOSE ONLY

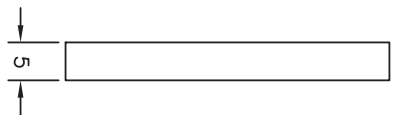
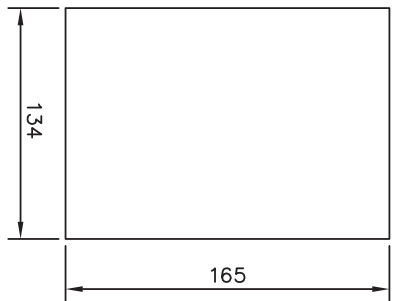
						VIEW OF LOCAL INSTRUMENT RACK W/O CANOPY	
						1x800W SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)	
						GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADDARA, GUJARAT	
						DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI	
JOB NO. DCP1-K9213R		SCALE NIL		SHT. 3 OF 10		REV. 0	
DWG. NO. K9213R-DWG-I-0200							
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE		
SB	SR	SD		0	21.04.10		



DETAIL OF-1



DETAIL OF-2



DETAIL OF-3

UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

**NOTES:**

- 1..RIB M.S. PLATE 162.5 X 170 X 5 mm THICK.
- 2..RIB M.S. PLATE 125 X 170 X 5 mm THICK.
- 3..RIB M.S. PLATE 134 X 165 X 5 mm THICK.

PRELIMINARY  
TENDER PURPOSE ONLY

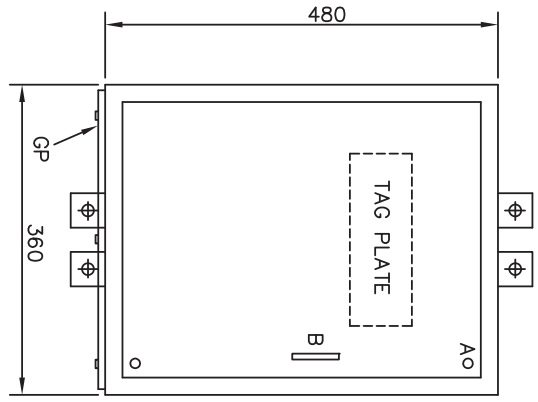
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
	SR	SD		0	21.04.10

G. A. DRAWING OF CLEATS FOR  
LOCAL INSTRUMENT RACK  
1x800kW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADDARA, GUJARAT

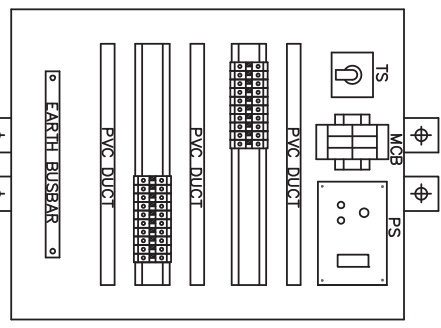


DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

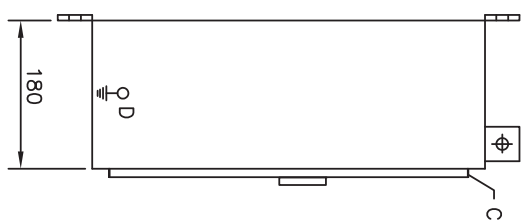
JOB NO. DGPL-K9213R SCALE NIL SH. 4 OF 10  
DWG. NO. K9213R-DWG-I-0200 REV. 0



FRONT VIEW



INTERNAL FRONT VIEW



SIDE VIEW

**LEGEND:**

- A - DOOR LOCK
- B - DOOR HANDLE
- C - HINGES
- D - EARTH STUD
- GP - GLAND PLATE
- PS - POWER SOCKET
- TS - TOGGLE SWITCH
- TBS - TERMINAL BLOCKS
- MCB - MINIATURE CIRCUIT BREAKER

**NOTES:**

- 1..JB WILL BE MADE OUT OF 2.0 mm CRCA SHEET.
- 2..PROTECTION CLASS IP-65.
- 3..COLOUR EXT-GREY ISS-631, INTERNAL-BRILLIANT WHITE.
- 4..NUTS FOR MOUNTING THE JUNCTION BOX SHALL BE PROVIDED.
- 5..3 MM THICK CRCA GLAND PLATE (GP) AT BOTTOM SHALL BE PROVIDED.
- 6..SCREWLESS CAGE CLAMP TERMINALS SHALL BE USED.
- 7..EARTH BUS BAR SHALL BE OF 25X6 MM TINNED COPPER.
- 8..INSTRUMENT TAG VIS-A-VIS SERVICE AND TERMINAL DETAILS SHALL BE PRINTED ON PHENOLIC BOARD MOUNTED ON BACK SIDE OF DOOR.
- 9..COLOUR CODE FOR POWER SUPPLY- PHASE-RED, NEUTRAL-BLACK & EARTH-GREEN
- 10..CABLE FOR PANEL LIGHTING SHALL BE 1.5 SQ.MM,1100V GRADE
- 11..SIGNAL WIRING SHALL BE 4 PAIR X 0.5 SQ.MM ANNEALED TINNED COPPER, TWISTED PAIR, OVERALL SHIELDED 500V GRADE, UNARMoured FRILS PVC.

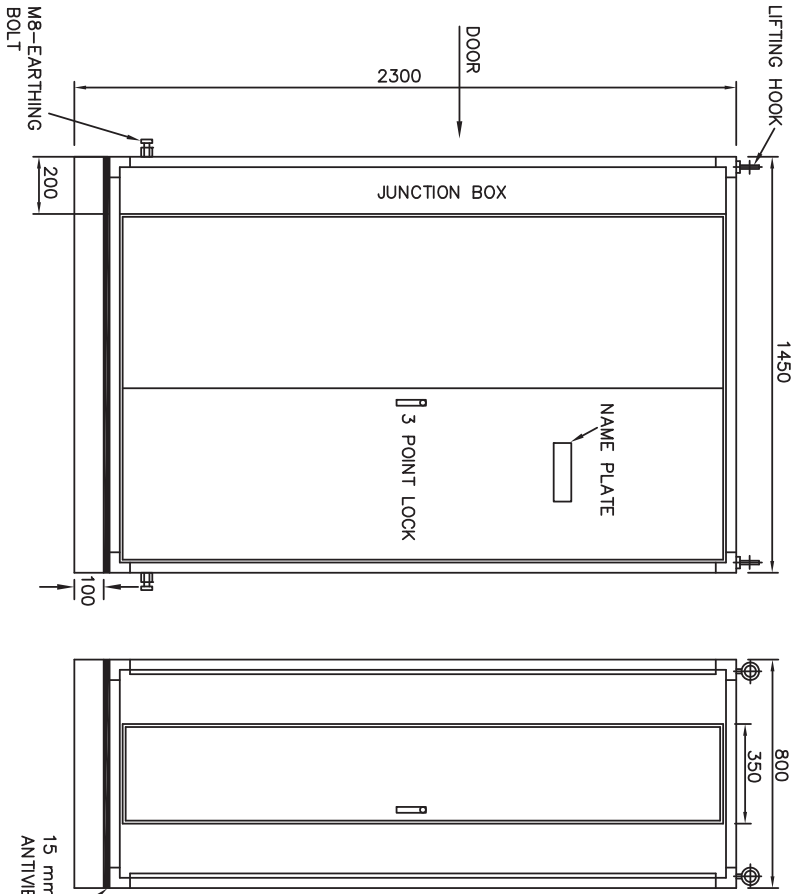
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SR	SR	SD		0	21.04.10

G.A. DRAWING OF JUNCTION BOX FOR LOCAL INSTRUMENT RACK  
 1x800kW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADDARA, GUJARAT

<p>DEVELOPMENT CONSULTANTS PVT. LTD.                  CONSULTING ENGINEERS                  KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>		JOB NO. DGPL-K9213R	SCALE NIL	SHT. 5 OF 10
DWG. NO. K9213R-DWG-I-0200				REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY

LOCAL INSTRUMENT ENCLOSURE



UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

FRONT VIEW

LH SIDE VIEW

NOTES:

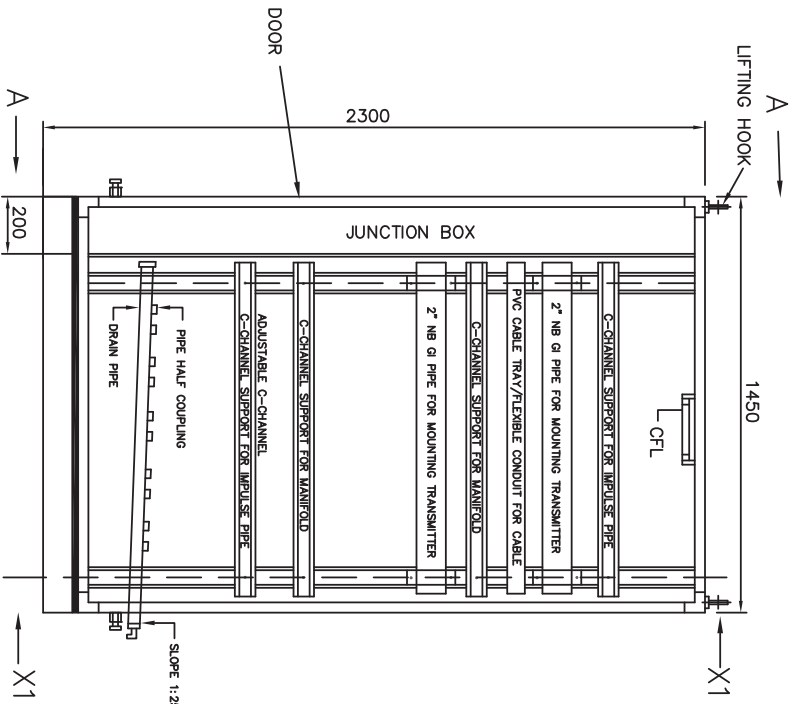
1. DIMENSIONS SHOWN ARE TENTATIVE AND SHALL BE FINALIZED AT DETAILING.
2. ALL SHEETS SHALL BE 3 mm THICK CRCA SHEET.
3. ALL DOORS SHALL BE FLUSH/CONCEALED TYPE.
4. COLOUR :-  
EXTERIOR : GREY ISS-631  
INTERIOR : BRILLIANT WHITE  
OVER ALL THICKNESS WILL BE > 100 MICRONS
5. BASE FRAME WILL BE MADE OUT OF ISMC 100 AND COLOUR WILL BE BLACK PAINT FINISH.
6. BULKHEAD PLATE FOR TOP AND BOTTOM SHALL BE 1150 X 650 X 6 MM.
7. CABLE GLAND PLATE OF THICKNESS 3 mm CRCA SHEET SHALL BE PROVIDED AT BOTTOM OF JUNCTION BOX.
8. ENCLOSURE PROTECTION CLASS SHALL BE IP-65.
9. TERMINALS INSIDE JUNCTION 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 mm TINNED COPPER.
13. DRAIN PIPE SLOPE SHALL BE 1:25 APPROX.
14. COMMON 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 INSTRUMENT.
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.

PRELIMINARY  
TENDER PURPOSE ONLY

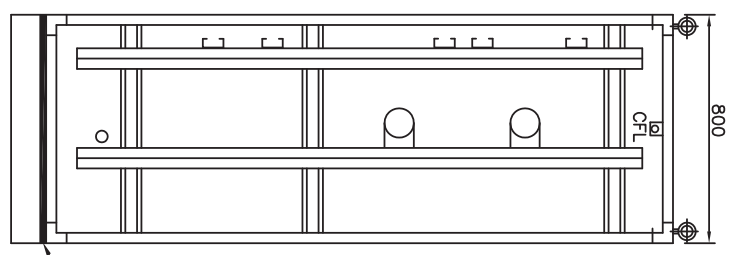
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10

G. A. DRAWING FOR  
LOCAL INSTRUMENT ENCLOSURE  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAQBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADDODARA, GUJARAT

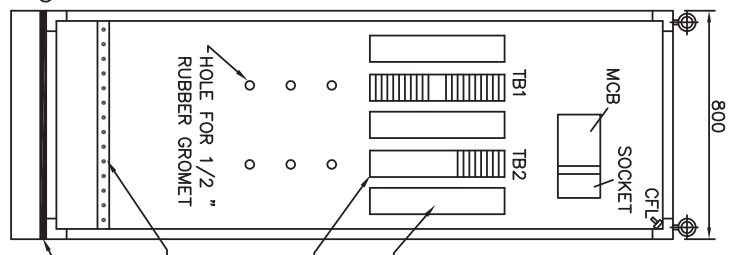
<p>DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA, MUMBAI, CHENNAI, NEW DELHI</p>	JOB NO.	DGPL-K9213R	SCALE	NIL	SHT.	6 OF 10
	DWG. NO.	K9213R-DWG-I-0200				REV.



FRONT INNER VIEW



SIDE VIEW FROM X1-X1

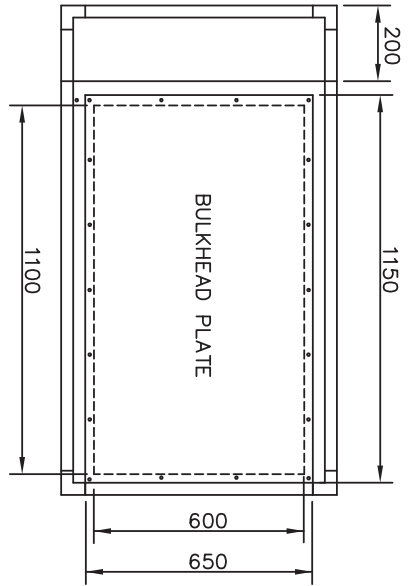


SIDE VIEW FROM A-A

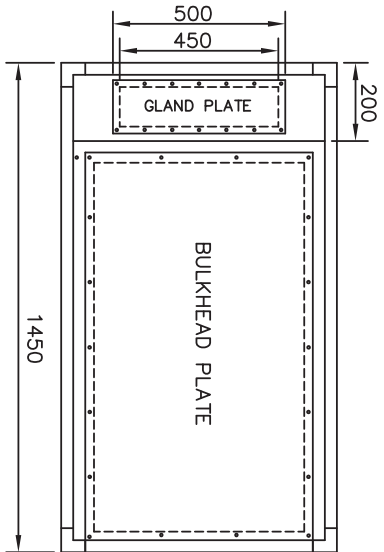
- NOTES: 1..PVC WIRE DUCT WITH COVER SHALL BE PROVIDED.  
 2..FOR ILLUMINATION COMPACT FLUORESCENT LAMP IN LIE AND IN JB SHALL BE PROVIDED.  
 3..DRAIN HEADER IS APPLICABLE FOR STEAM/WATER PROCESS IMPULSE LINES ONLY.  
 4..DRAIN PIPE SHALL BE 2" NB ASTM A106 GRC SCH.80.

PRELIMINARY  
TENDER PURPOSE ONLY

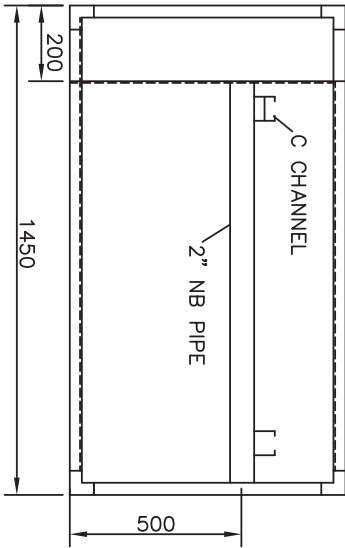
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE	INNER G. A. DRAWING FOR LOCAL INSTRUMENT ENCLOSURE 1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAJOGRI THERMAL POWER STATION, GUJARAT) GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI	JOB NO. DCP1-K9213R SCALE NIL SH. 7 OF 10 DWG. NO. K9213R-DWG-I-0200	REV. 0
SB	SR	SD		0	21.04.10				



TOP VIEW



BOTTOM VIEW



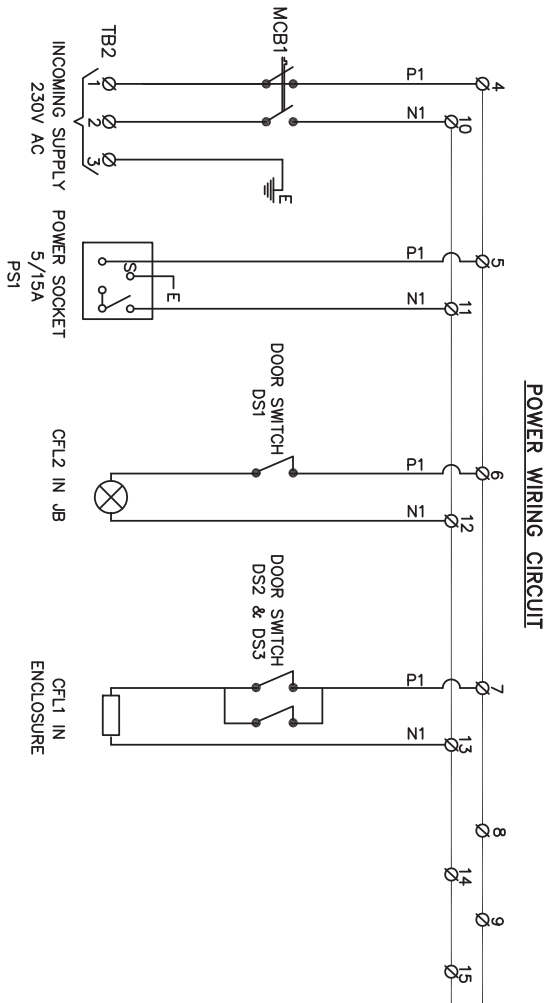
TOP VIEW WITHOUT BULKHEAD PLATE

UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

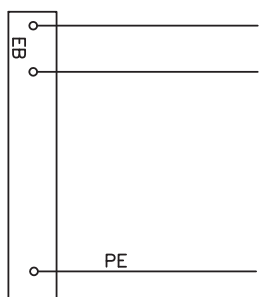
- NOTES:**
- 1..BULK HEAD PLATE DIMENSION ARE AS FOLLOWS: 1150 X 650 X 6 mm.
  - 2..IMPULSE PIPE ENTRY : BOTTOM ENTRY FOR AIR/FLUE GAS APPLICATIONS.
  - 3..IMPULSE ENTRY : TOP ENTRY FOR STEAM/WATER APPLICATIONS.

PRELIMINARY  
TENDER PURPOSE ONLY

						BULKHEAD PLATE DETAILS FOR LOCAL INSTRUMENT ENCLOSURE	
						1x800kW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)	
						GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT	
						DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA · MUMBAI · CHENNAI · NEW DELHI	
JOB NO. DCP1-K9213R		SCALE NIL		SHT. 8 OF 10			
DWG. NO. K9213R-DWG-1-0200							
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE		
SB	SR	SD		0	21.04.10		



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



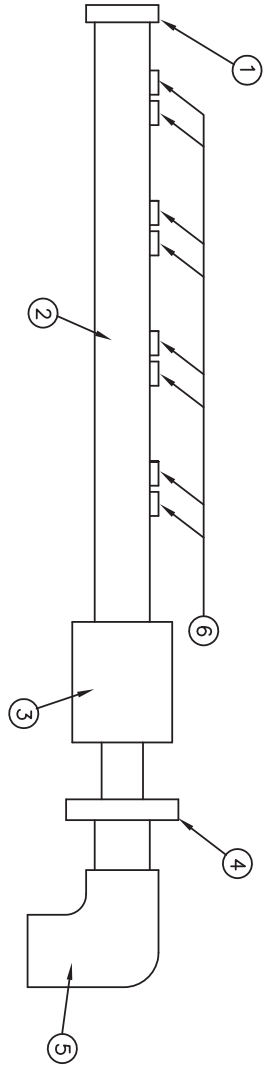
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10

ELECTRICAL WIRING AND TERMINATION DRAWING  
FOR LOCAL INSTRUMENT ENCLOSURE  
1x800Ww SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADDARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SHT. 9 OF 10  
DWG. NO. K9213R-DWG-I-0200

PRELIMINARY  
TENDER PURPOSE ONLY



BILL OF MATERIAL		QTY
SL.NO.	DESCRIPTION	
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

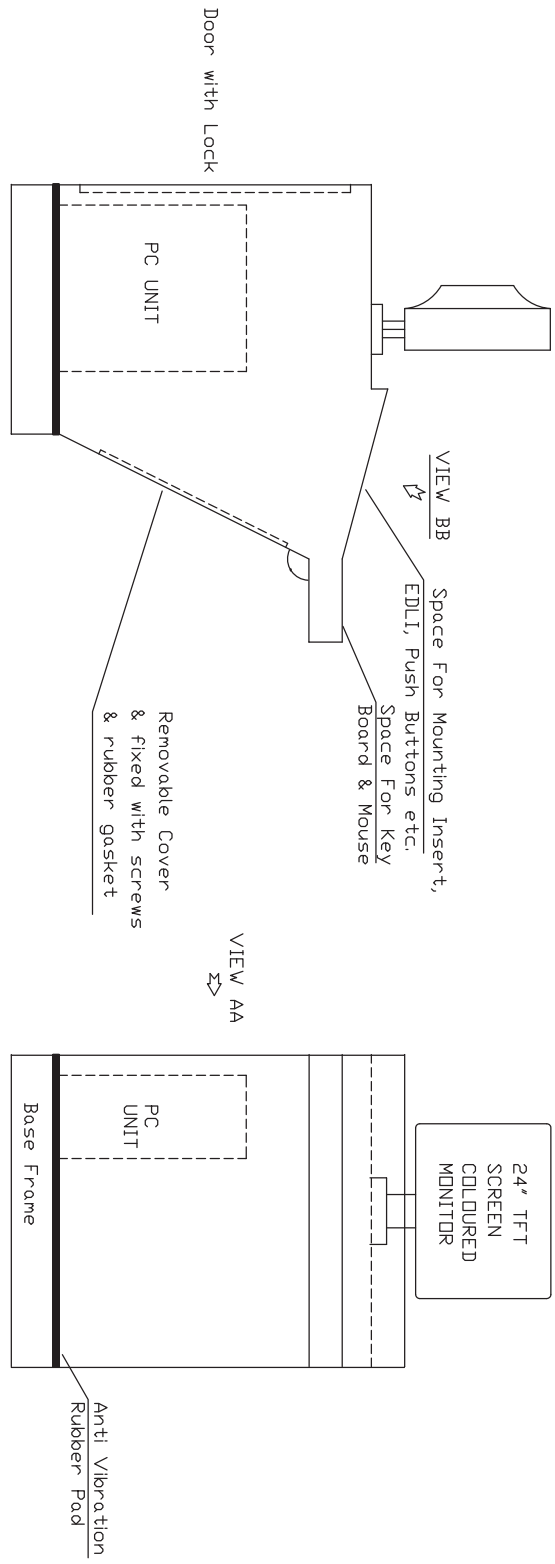
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10

DRAIN HEADER DETAILS FOR  
LOCAL INSTRUMENT ENCLOSURE  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

  
**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SH. 10 OF 10  
 DWG. NO. K9213R-DWG-I-0200 REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY



- NOTES:**
1. THIS DRAWING IS FOR DESIGN CONCEPT AND DETAIL OF FABRICATIONS SHALL BE VENDOR'S RESPONSIBILITY SUBJECT TO USER'S APPROVAL.
  2. DESK PORTION i.e. SPACE FOR KEY BOARD SHALL BE FABRICATED FROM STAINLESS STEEL SHEET. REMAINING PARTS FROM CRCA SHEET STEEL. SHEET THICKNESS SUBJECT TO USER'S APPROVAL.
  3. SUITABLE LOUVERS (WITH WIREMESH REMOVABLE FILTER), GLAND PLATES, DRAWING POCKET (METALLIC WELDED / SCREWED) SHALL BE PROVIDED.
  4. OUTER COLOUR SHADE SHALL BE RAL 7032.
  5. FILLER PANEL AS PER CONTROL ROOM LAYOUT SHALL BE PROVIDED.

REV.	DATE	REV.	RELEASE STATUS	DESCRIPTION	DRAWN	CHECKED	REVIEWED	APPROVED
1								
2								

**TITLE:** OPERATING STATION DESK PROFILE

**PROJECT:** 1x800 MW SUPERCRITICAL THERMAL POWER PLANT (UNIT #8 AT WANDARON THERMAL POWER STATION, GUJARAT)

**FOR TENDERING PURPOSE ONLY**

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
KOLKATA, MUMBAI, CHENNAI, NEW DELHI

**GUJARAT STATE ELECTRICITY CORPORATION LIMITED**  
VAPODARA, GUJARAT


JOB NO. K9213R  
DWG. NO. K9213R-DWG-1-0161

SCALE : NONE  
REV. A

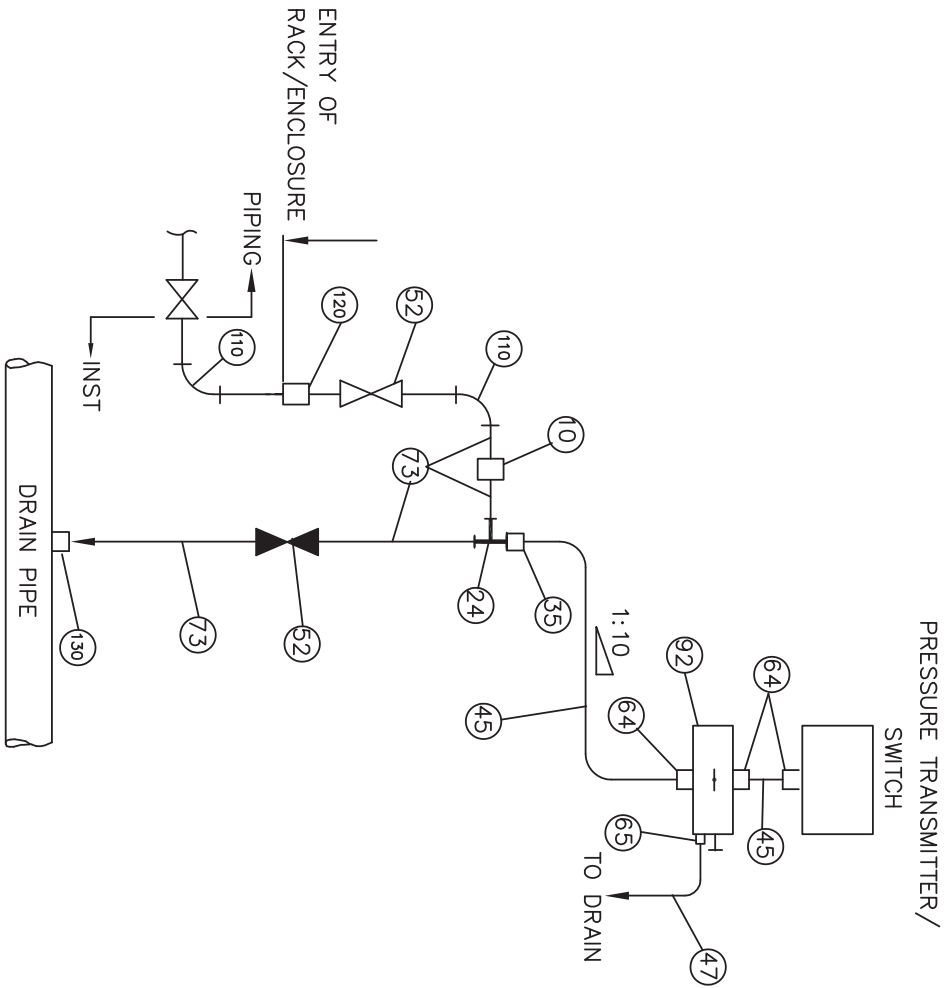
**NOTES :**

- 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 & SPECIFICATION VOL.II-E.
- 3..DRAIN PIPE IN RACK AND ENCLOSURE SHALL BE 2" NB SCH 80.

PRELIMINARY  
TENDER PURPOSE ONLY

						TYPICAL INSTRUMENT INSTALLATION DIAGRAM			
						1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)			
						GUJARAT STATE ELECTRICITY CORPORATION LIMITED			
						VADODARA, GUJARAT			
						 <b>DEVELOPMENT CONSULTANTS PVT. LTD.</b> CONSULTING ENGINEERS KOLKATA - MUMBAI - CHENNAI - NEW DELHI			
						JOB NO. DCPL-K9213R		SCALE NIL	
						DWG. NO. K9213R-DWG-I-0060		SHT. 2 OF 20	
								REV. 0	
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE				
GP	AT	SD		0	21.04.10				

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



**BILL OF MATERIAL**

ITEM NO.	QTY / INST	DESCRIPTION
24	1	EQUAL TEE (FEMALE) 1/2" SW 3000lbs
35	1	MALE CONNECTOR 1/2" PE X 1/2" OD 3000 lbs
52	2	GLOBE VALVE 1/2" SW 600lbs
45	3Mtrs.	TUBE 1/2" OD 2.1 MM THICK
64	3	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000 lbs
73	2Mtrs	IMPULSE PIPE 15 NB SCH 80
92	1	2 VALVES MANIFOLD 1/2" NPT(F)
10	1	FULL COUPLING 1/2" SW 3000lbs
47	0.15Mtrs.	TUBE 8 MM OD 1.0 MM THICK
65	1	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 3000 lbs
110	2	90° ELBOW 1/2" SW 3000lbs
120	1	BULK HEAD UNION/COUPLING C.I.: 3000 LBS/ 1/2" NB-SW/AS PER ANSI B16.11
130	1	HALF COUPLING C.I.: 3000 LBS/ 1/2" NB-SW/ AS PER ANSI B16.11

SERVICE : CONDENSER PRESSURE, INSTRUMENT AIR ETC.

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

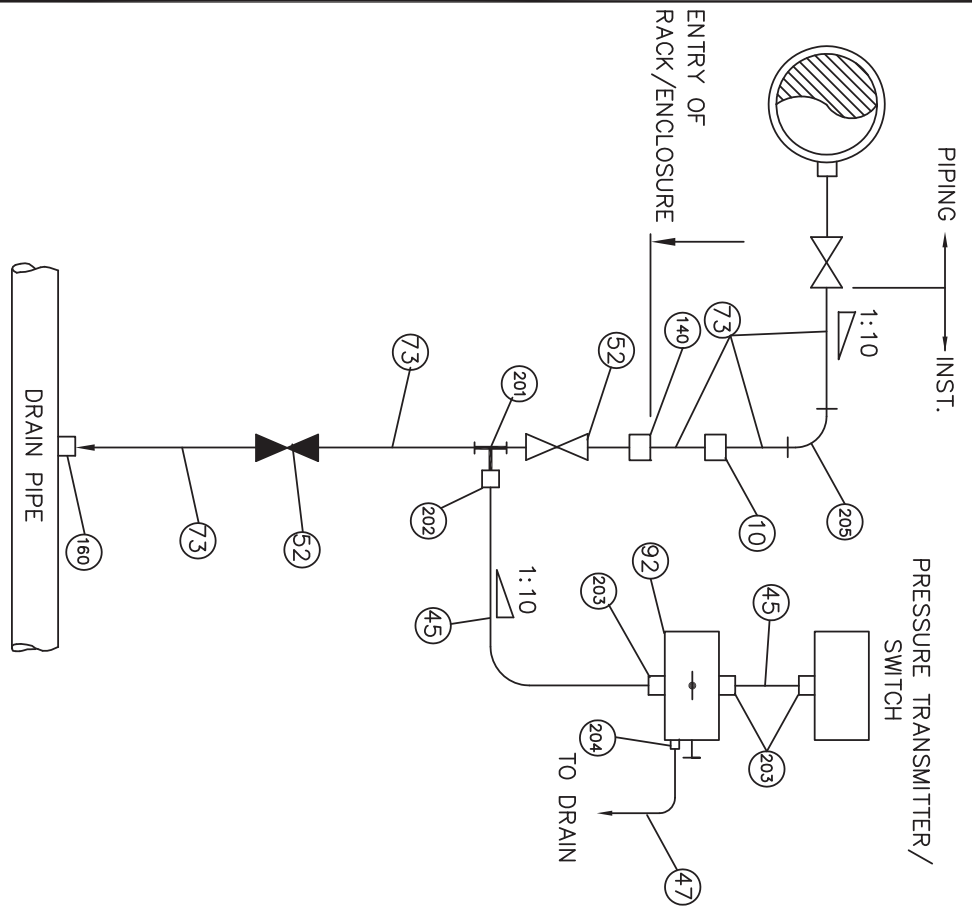
**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAJORE THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

  
**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOKKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 3 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY

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



**BILL OF MATERIAL**

ITEM NO.	QTY./INST.	DESCRIPTION
201	1	EQUAL TEE (FEMALE) 1/2" SW 6000lbs
202	1	MALE CONNECTOR 1/2" PE 1/2" OD 6000 lbs
52	2	GLOBE VALVES 1/2" SW 6000lbs
45	3 Mtrs	TUBE 1/2" OD 2.1 MM THICK
203	3	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs
73	15Mtrs.	IMPULSE PIPE 15 NB GR.B SCH 80
92	1	2 VALVES MANIFOLD 1/2" NPT(F)
10	1	FULL COUPLING 1/2" SW 6000lbs
47	0.15Mtrs.	TUBE 8 MM OD 1.0 MM THICK
204	1	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs
205	1	90° ELBOW 1/2" SW 6000lbs
140	1	BULK HEAD UNION/COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11
160	1	HALF COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

SERVICE : CONDENSATE, FEED WATER ETC.

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
gp	AT	SD		0	21.04.10

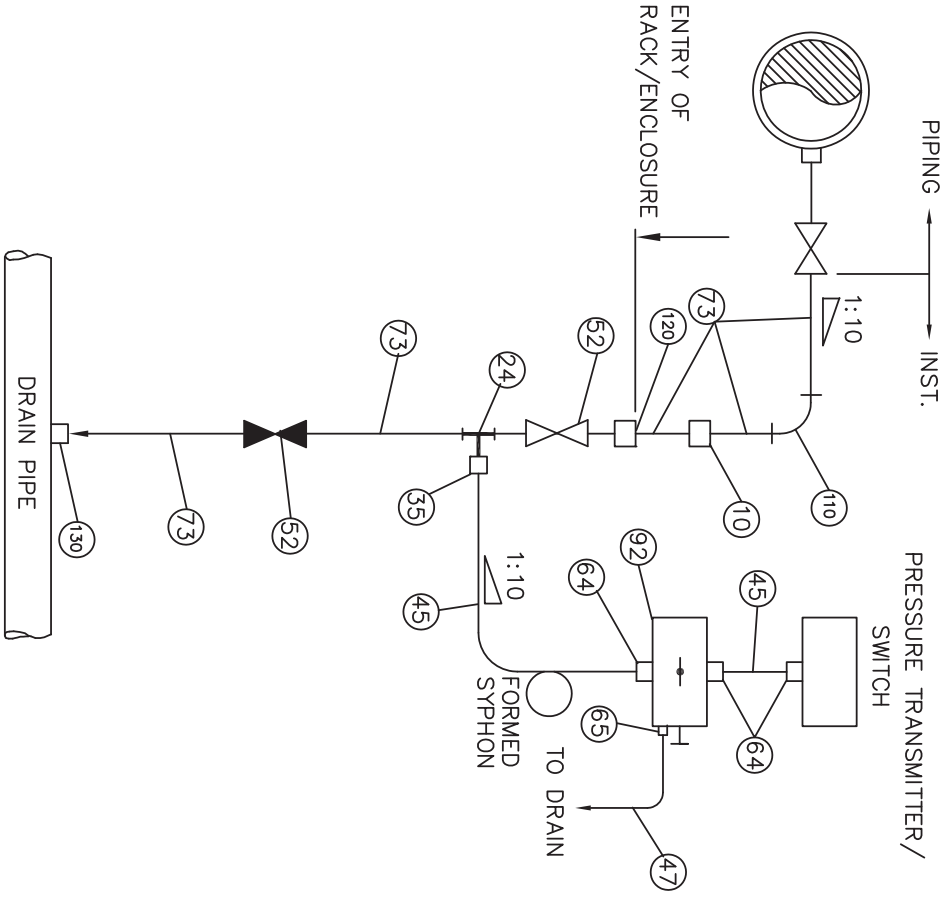
TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAJORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SHF. 4 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY

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



BILL OF MATERIAL		DESCRIPTION
ITEM NO.	QTY / INST	
24	1	EQUAL TEE (FEMALE) 1/2" SW 3000lbs
35	1	MALE CONNECTOR 1/2" PE 1/2" OD 3000 lbs
52	2	GLOBE VALVES 1/2" SW 600lbs
45	3 Mtrs	TUBE 1/2" OD 2.1 MM THICK
64	3	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000 lbs
73	15Mtrs.	IMPULSE PIPE 15 NB SCH 80
92	1	2 VALVES MANIFOLD 1/2" NPT(F)
10	1	FULL COUPLING 1/2" SW 3000lbs
47	0.15Mtrs	TUBE 8 MM OD 1.0 MM THICK
65	1	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 3000 lbs
110	1	90° ELBOW 1/2" SW 3000lbs
120	1	BULK HEAD UNION/COUPLING CI: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11
130	1	HALE COUPLING CI: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

SERVICE : LOW PRESSURE STEAM

PRELIMINARY  
TENDER PURPOSE ONLY

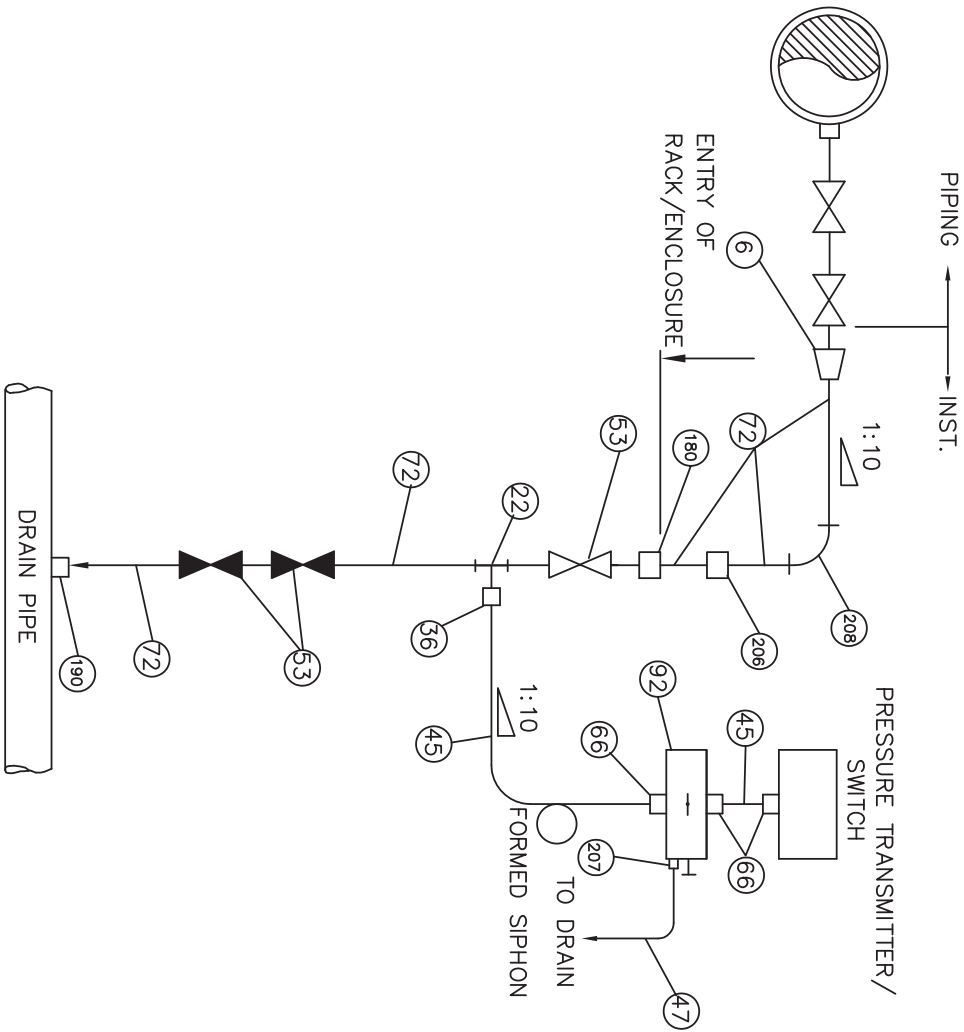
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
gp	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 5 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

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



**BILL OF MATERIAL**

ITEM NO.	QTY./INST.	DESCRIPTION
6	1	REDUCER 1"SW X 1/2"SW 9000lbs
22	1	EQUAL TEE (FEMALE)1/2" SW 9000lbs
36	1	MALE CONNECTOR 1/2" PE X 1/2" OD 9000 lbs
53	3	GLOBE VALVES 1/2" SW 1500 lbs
45	3 Mtrs	TUBE 1/2" OD 2.1 MM THICK
66	3	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 9000 lbs
72	15Mtrs	IMPULSE PIPE 15 NB SCH. 80
92	1	2 VALVES MANIFOLD 1/2" NPT(F)
206	1	FULL COUPLING 1/2" SW 9000lbs
47	0.15Mtrs	TUBE 8 MM OD 1.0 MM THICK
207	1	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 9000 lbs
180	1	BULK HEAD UNION/COUPLING CL: 9000 LBS-AS PER ANSI B16.11/1/2" NB-SW
190	1	HALF COUPLING CL: 9000LBS/ 1/2" NB-SW AS PER ANSI B16.11
208	1	90° ELBOW 1/2" SW CL: 9000 lbs

SERVICE : MEDIUM & HIGH PRESSURE STEAM

PRELIMINARY  
TENDER PURPOSE ONLY

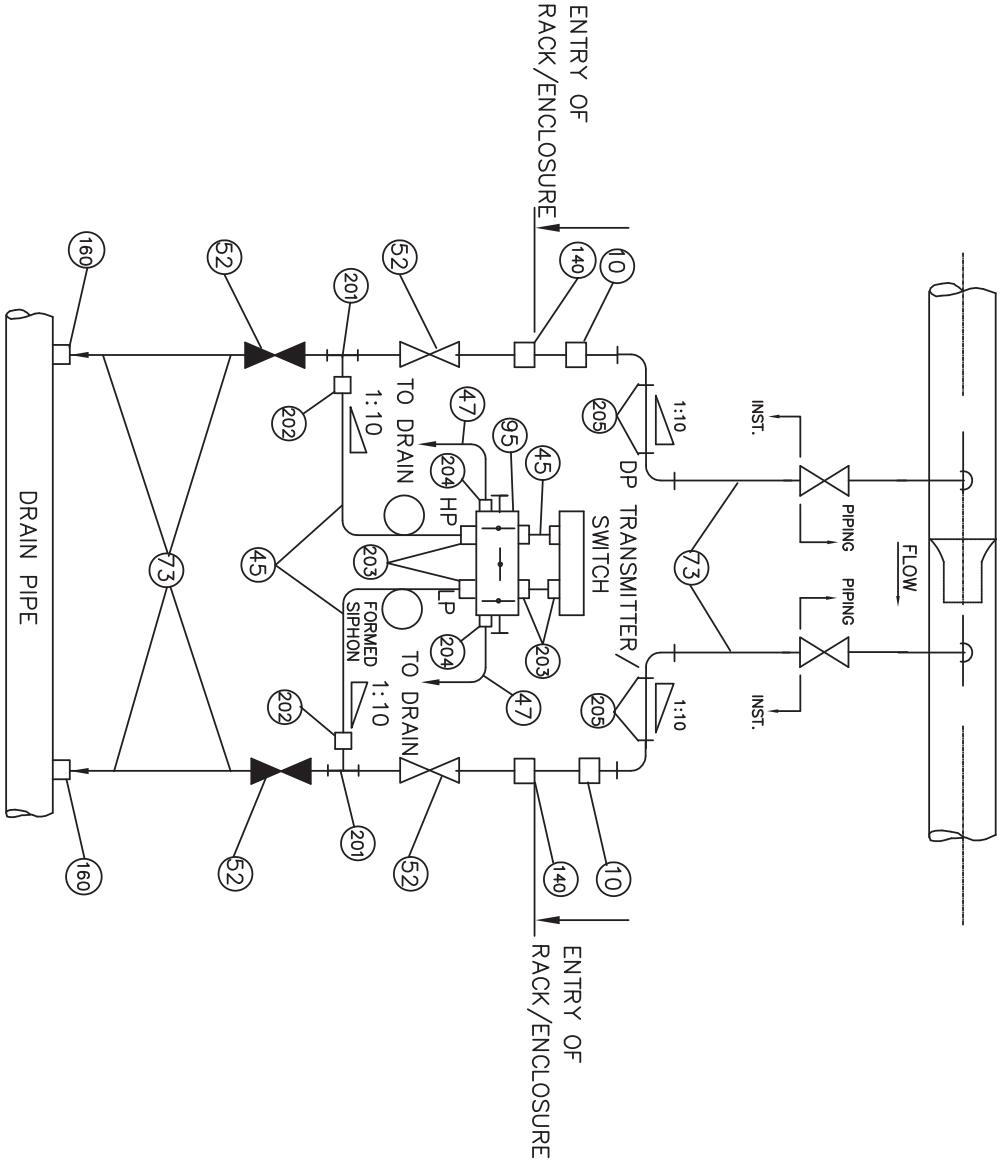
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SHF. 6 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

**DIFF. PRESS. TRANSMITTER/DIFF. PRESS. SWITCH  
MOUNTED BELOW SOURCE POINT**



ITEM NO.	QTY / INST	DESCRIPTION
201	2	EQUAL TEE (FEMALE) 1/2" SW 6000lbs
202	2	MALE CONNECTOR 1/2" PE X 1/2" OD 6000 lbs
52	4	GLOBE VALVES 1/2" SW 6000lbs
45	6 Mtrs	TUBE 1/2" OD 2.1 MM THICK
203	6	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs
73	30Mtrs	IMPULSE PIPE 15 NB GR.B SCH 80
95	1	5 VALVE MANIFOLD 1/2" NPT(F)
10	2	FULL COUPLING 1/2" SW 6000lbs
47	0.3Mtrs	TUBE 8 MM OD 1.0 MM THICK
204	2	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs
205	4	90° ELBOW 1/2" SW 6000lbs
140	2	BULK HEAD UNION/COUPLING CL: 6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11
160	2	HALF COUPLING CL: 6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

SERVICE : CONDENSATE, FEED WATER ETC.

PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

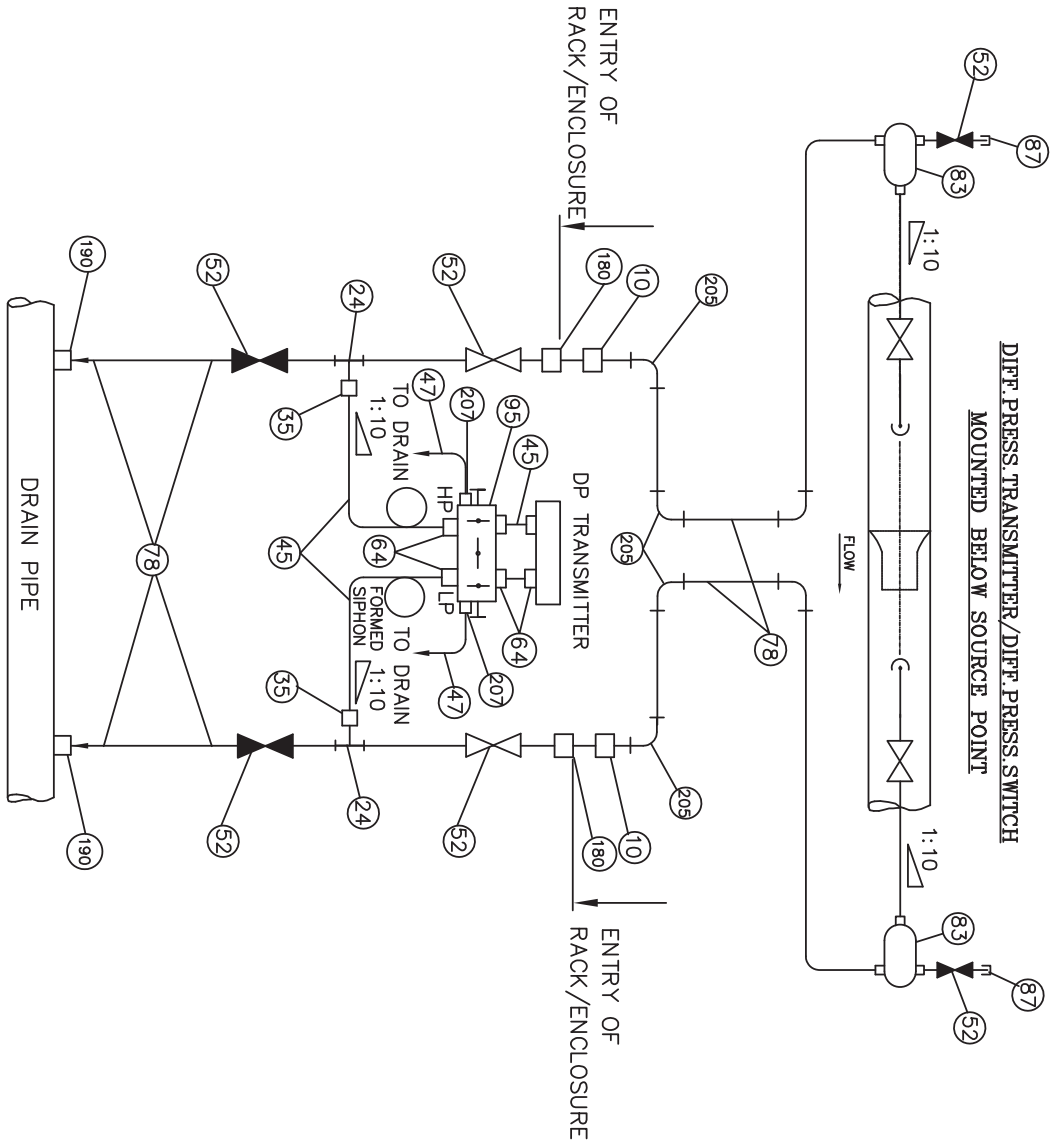
TYPICAL INSTRUMENT INSTALLATION DIAGRAM

1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKABORI THERMAL POWER STATION, GUJARAT)

GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
KOLKATA, MUMBAI, CHENNAI, NEW DELHI

JOB NO. DCP1-K9213R SCALE NIL SH. 7 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0



BILL OF MATERIAL		DESCRIPTION
ITEM NO.	QTY/ INST.	
24	2	EQUAL TEE (FEMALE) 1/2" SW 9000lbs
35	2	MALE CONNECTOR 1/2" PE X 1/2" OD 9000 lbs
52	6	GLOBE VALVES 1/2" SW 600lbs
45	6mtrs.	TUBE 1/2" OD 2.1 MM THICK
64	6	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 9000 lbs
78	30mtrs	IMPULSE PIPE 15 NB SCH 80
95	1	5 VALVES MANIFOLD 1/2" NPT(F)
10	2	FULL COUPLING 1/2" SW 9000lbs
83	2	CONDENSATION POT 1/2" SW NPT(F) 9000 lbs
87	2	PLUG 1/2" NPT(F) 9000lbs
47	0.3mtrs	TUBE 8 MM OD 1.0 MM THICK
207	2	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 9000 lbs
205	6	90° ELBOW 1/2" SW 9000lbs
180	2	BULK HEAD UNION/COUPLING CL: 9000 LBS-AS PER ANSI B16.11, 1/2" NB-SW
190	2	HALF COUPLING CL: 9000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

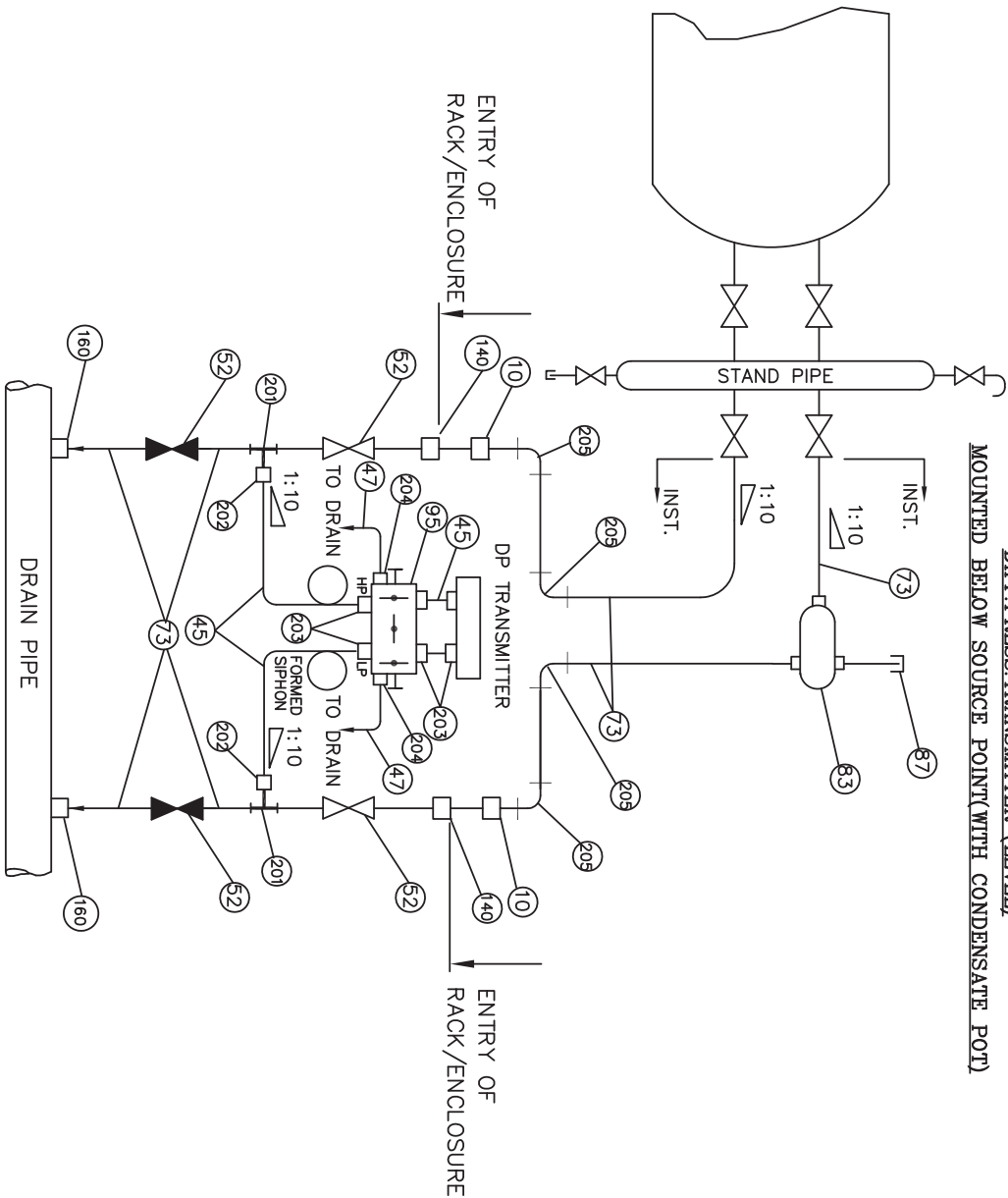
SERVICE : STEAM

PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED		CHECKED		DRAWN		DESCRIPTION		REV.		DATE	
GP	AT	SD						0		21.04.10	
<p style="text-align: center;">TYPICAL INSTRUMENT INSTALLATION DIAGRAM</p> <p style="text-align: center;">1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)</p> <p style="text-align: center;">GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT</p>											
<p style="text-align: center;">DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOKKATA - MUMBAI - CHENNAI - NEW DELHI</p>						<p style="text-align: center;">JOB NO. DGPL-K9213R SCALE NIL SH. 8 OF 20 DWG. NO. K9213R-DWG-I-0060</p>					

**DIFF. PRESS. TRANSMITTER (LEVEL)  
MOUNTED BELOW SOURCE POINT(WITH CONDENSATE POT)**



BILL OF MATERIAL		
ITEM NO.	QTY./INST.	DESCRIPTION
201	2	EQUAL TEE (FEMALE) 1/2" SW 6000lbs
202	2	MALE CONNECTOR 1/2" PE X 1/2" OD 6000 lbs
52	4	GLOBE VALVES 1/2" SW 600lbs
45	6Mtrs.	TUBE 1/2" OD 2.1 MM THICK
203	6	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs
73	30Mtrs	IMPULSE PIPE 15 NB SCH 80
95	1	5 VALVES MANIFOLD 1/2" NPT(F)
10	2	FULL COUPLING 1/2" SW 6000lbs
83	1	CONDENSATE POT 1/2" SW 6000lbs
87	1	PLUG 1/2" NPT(M) 6000lbs
205	4	90° ELBOW 1/2" SW 6000lbs
47	0.3Mtrs	TUBE 8 MM OD 1.0 MM THICK
204	2	MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs
140	2	BULK HEAD UNION/COUPLING CL: 6000 LBS--AS PER ANSI B16.11, 1/2" NB--SW
160	2	HALE COUPLING CL: 6000 LBS/ 1/2" NB--SW AS PER ANSI B16.11

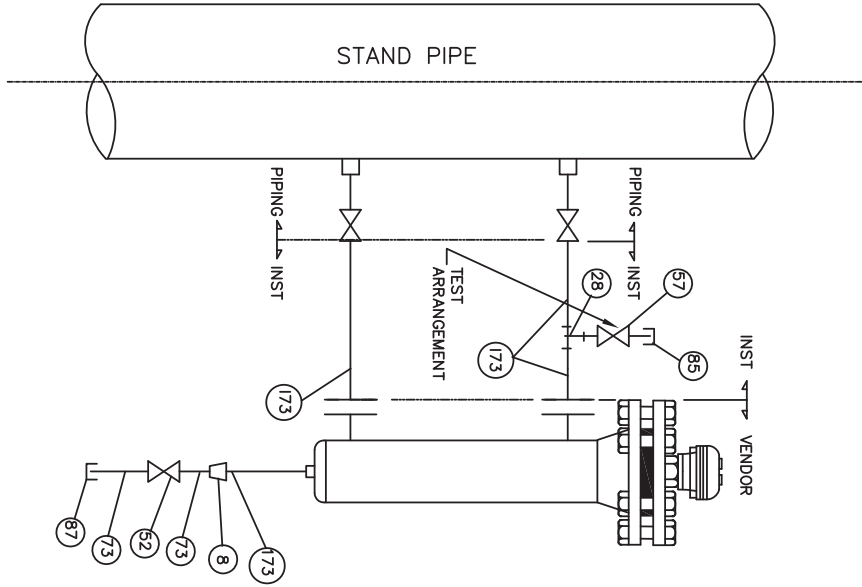
SERVICE : BOILER DRUM, DEAEATOR, HEATERS

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED		CHECKED		DRAWN		DESCRIPTION		REV.		DATE	
gp	AT	SD						0	21.04.10		
<p>1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)</p> <p>GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT</p>											
<p>DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOKKATA - MUMBAI - CHENNAI - NEW DELHI</p>											
JOB NO. DGPL-K9213R		SCALE		NIL		SHT.		9 OF 20		REV.	
DWG. NO. K9213R-DWG-I-0060										0	

**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**

FLOAT OPERATED LEVEL SWITCH



BILL OF MATERIALS	
ITEM NO	DESCRIPTION
52	GLOBE VALVE 1/2" SW 600lbs
73	IMPULSE PIPE 15 NB SCH.80
87	PULG 1/2" NPT(M) 3000lbs
28	EQUAL TEE (FEMALE) 1" SW 3000lbs
173	IMPULSE PIPE 25 NB SCH.80
8	REDUCER 1" SW X 1/2" SW 3000lbs
57	GLOBE VALVE 1" SW 600 lbs
85	PLUG 1" NPT(F) 3000 lbs

SERVICE : CONDENSATE

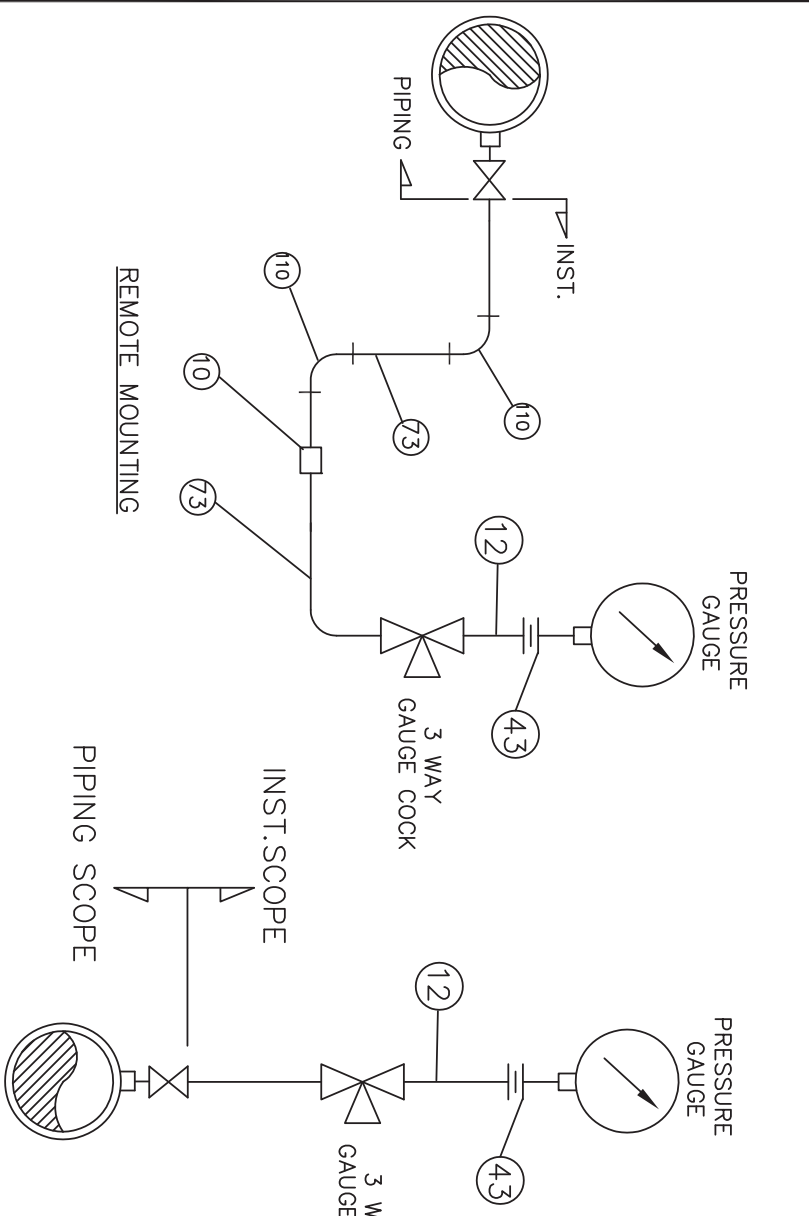
PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
				0	21.04.10
GP	AT	SD			

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SH. 10 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



SERVICE : WATER, CONDENSATE ETC.

BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
73	IMPULSE PIPE 1/2" NB SCH.80
10	FULL COUPLING 1/2" SW 3000lbs
110	90° ELBOW 1/2" SW 3000lbs
12	1/2" NPT(M) X 1/2" PE 4" LONG NIPPLE
43	NUT & TAIL FITTING WITH CU WASHER 1/2" NPT(F) X 1/2" PE

ON TAP MOUNTING

REMOTE MOUNTING

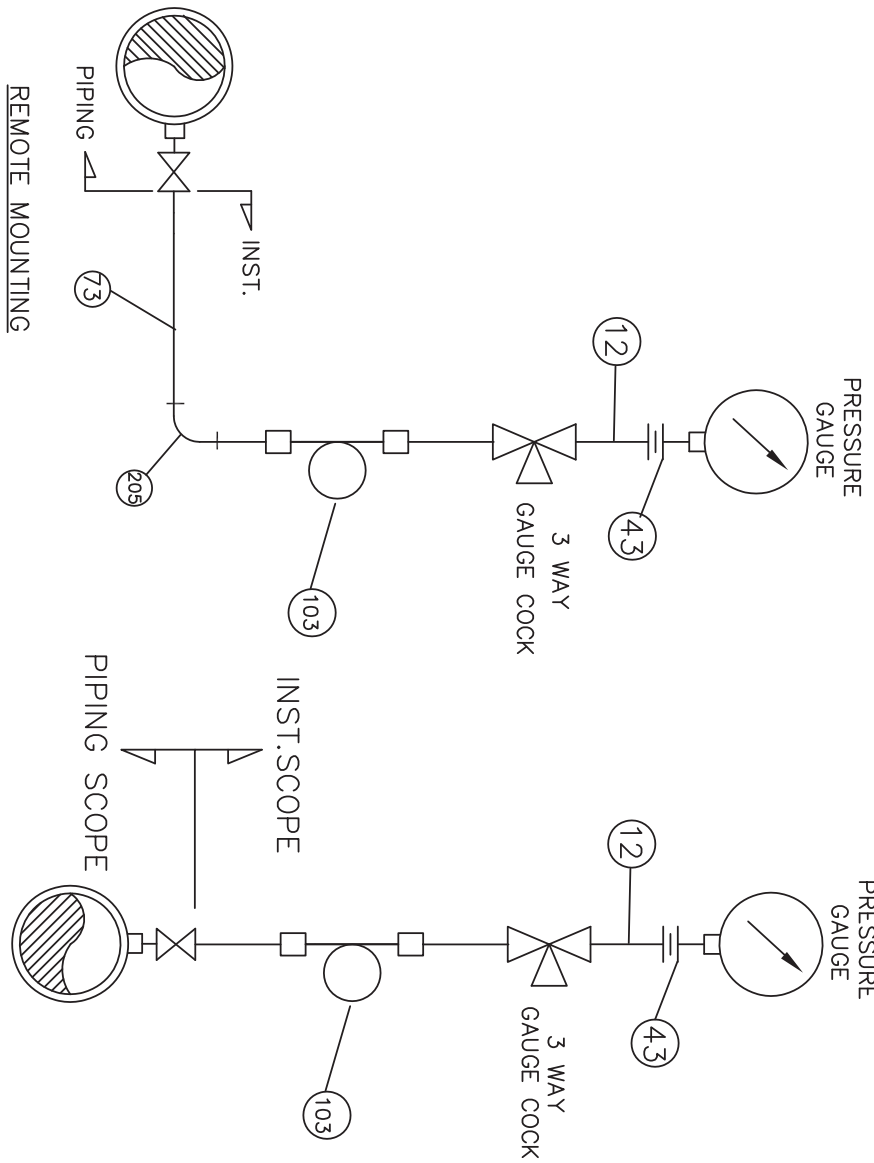
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DCP1-K9213R SCALE NIL SHF. 11 OF 20  
 DWG. NO. K9213R-DWG-1-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY



BILL OF MATERIAL		
ITEM NO.	QTY / INST.	DESCRIPTION
73	15Mtrs	IMPULSE PIPE 15 NB SCH.80
205	2	90° ELBOW 1/2" SW 6000lbs
12	1	1/2" NPT(M) X 1/2" PE 4" LONG NIPPLE
43	1	NUT & TAIL FITTING WITH SS WASHER 1/2"NPT(F) X 1/2" PE
103	1	SYPHON 1/2" OD SCH.80

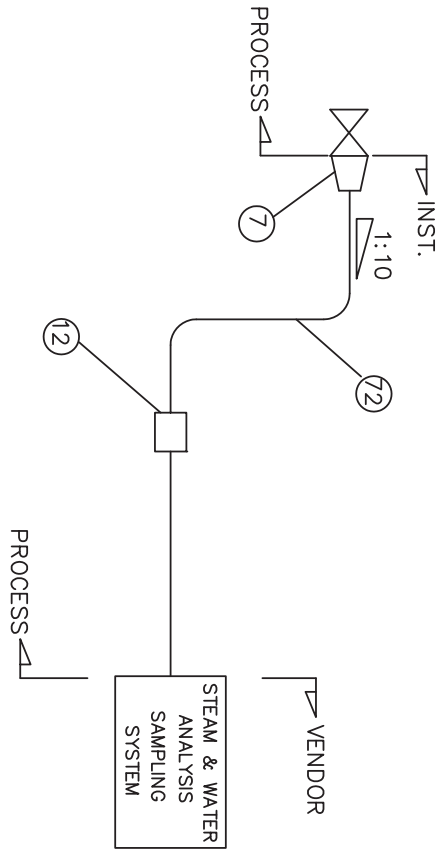
SERVICE : STEAM, FEED WATER

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAQBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI  
 JOB NO. DCPL-K9213R SCALE NIL SH. 12 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



BILL OF MATERIAL		
ITEM NO.	QTY./INST.	DESCRIPTION
12	1	FULL COUPLING 1/2" SW 6000 lbs
7	1	REDUCER 1" SW X 1/2" SW 6000 lbs
72	A/R	IMPULSE PIPE 15 NB SCH 80

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
	AT	SD		0	21.04.10

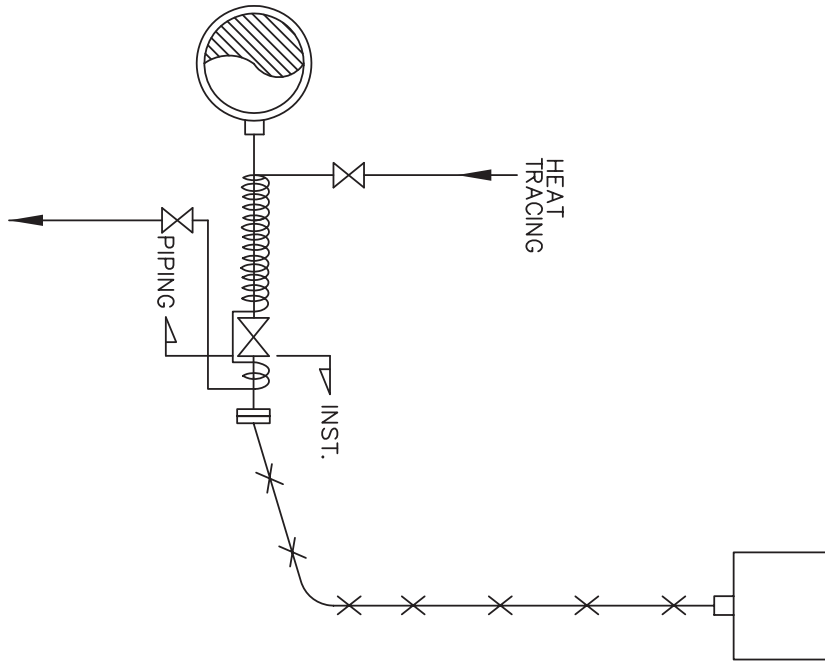
TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 13 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY

**PRESSURE TRANSMITTER/PRESSURE SWITCH  
IN HFO SERVICE**



**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**

1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKARBORI THERMAL POWER STATION, GUJARAT)

GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT



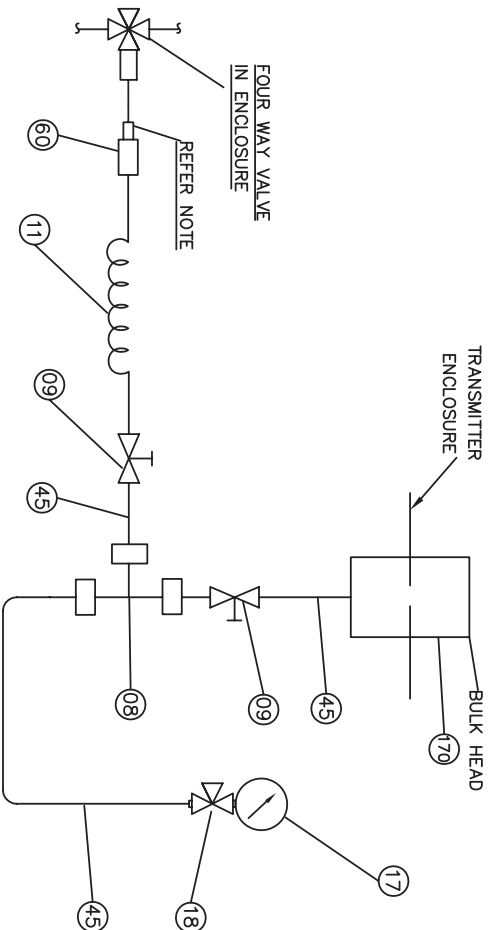
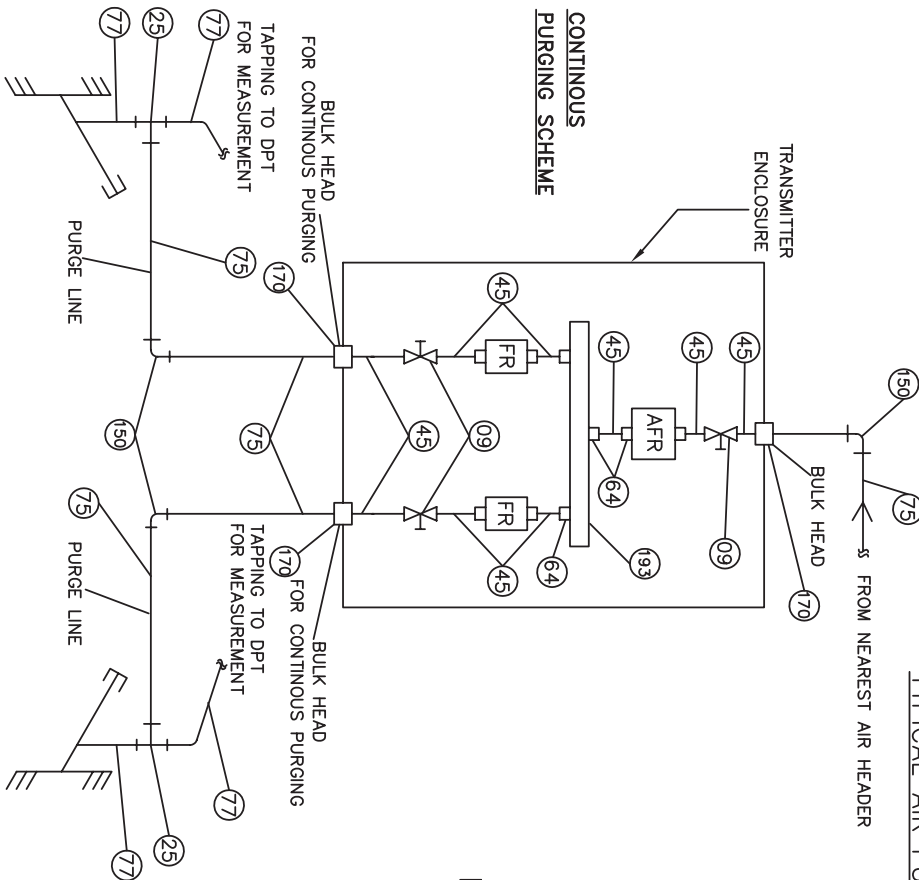
**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SH. 14 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
gp	AT	SD		0	21.04.10

TYPICAL AIR PURGING SCHEMES



**NOTE:**  
 QUICK DISCONNECTING FITTING IS CONNECTED TO  
 FOUR WAY VALVE WHERE INTERMITTENT PURGING  
 IS CALLED IN SCHEME.  
 FR—FLOW REGULATOR

CONTINUE TO SHT. NO. 16/20

PRELIMINARY  
 TENDER PURPOSE ONLY

TYPICAL INSTRUMENT INSTALLATION DIAGRAM		1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)		GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT	
GP	AT	SD	0	21.04.10	
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA, MUMBAI, CHENNAI, NEW DELHI

JOB NO. DCP-1-K9213R SCALE NIL SH. 15 OF 20  
 DWG. NO. K9213R-DWG-1-0060 REV. 0

BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
77	IMPULSE PIPE 3/4" NB
75	GI PIPE/1/2" NB
25	FORGED UNEQUAL TEE/AS PER ANSI B16.11 SIZE: 2 X 3/4" NB SW X 1/2"NPTF/CL 3000
150	GALVANISED ELBOW CL 3000 SIZE: 1/2" NPTF
60	QUICK DISCONNECTING FITTING MALE/END CONN. TO SUIT 1/2" OD CONN.
11	NYLON NOSE TO SUIT 1/2" END CONN./Pr. TESTING 10 Kg/cm <sup>2</sup>
45	SEAMLESS TUBE 1/2" OD TUBE X 2.1 MM THK.
170	BULK HEAD COUPLING TO SUIT 1/2" OD TUBE & 1/2" NB PIPE
09	BALL VALVETO SUIT 1/2" OD TUBE
64	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000lbs
193	INSTRUMENT AIR HEADER 1" NB PIPE
08	EQUAL TEE/SS 316/TO SUIT 1/2" OD TUBE.
17	Pr. GAUGE/4" DIAL SIZE/RANGE 0-10 Kg/cm <sup>2</sup> CONNECTION 1/2" NPTM
18	3 WAY GAUGE 1/2"NPTF X TO SUIT 1/2" TUBE.

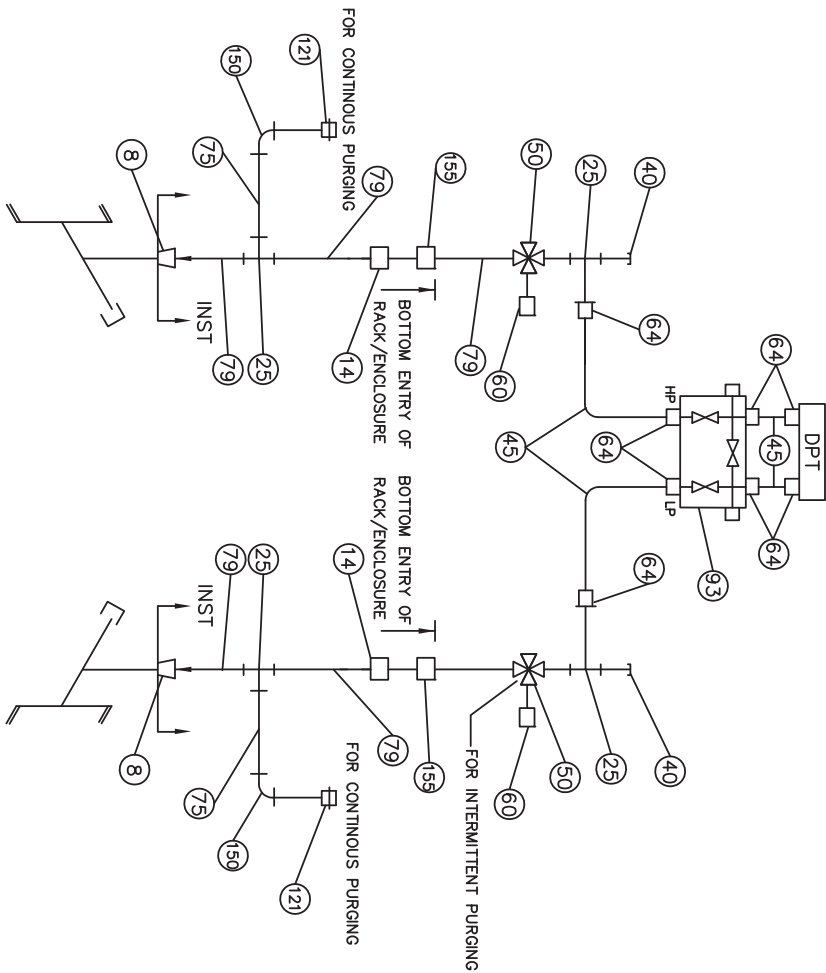
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE	TYPICAL INSTRUMENT INSTALLATION DIAGRAM 1800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT VANDARBORI THERMAL POWER STATION, GUJARAT) GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT
				0	21.04.10	

PRELIMINARY  
TENDER PURPOSE ONLY



**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DCP L - K9213R SCALE NIL SHF. 16 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0



BILL OF MATERIAL

ITEM NO.	QTY./ INST.	DESCRIPTION
8	2	REDUCER 1" BSPF X 3/4" NB-SW CL 3000
14	2	FORGED COUPLING 3/4" SW CL 3000/AS PER ANSI B16.11
25	4	FORGED UNEQUAL TEE AS PER ANSI B16.11 SIZE : 2 X 3/4" NB-SW X 1/2" NPTF/CL3000
40	2	NIPPLE & CAP 3/4" NB-SCH 80/CAP-3/4" NPTF
45	6 Mtrs.	SEAMLESS TUBE 1/2" OD X 2.1 MM THK.
50	2	FOUR WAY VALVE SIZE : (2 X 3/4" NB-SW) X (2 X 1/2"NPTF) CL: 800
60	2	QUICK DISCONNECTING FITTING SIZE: 1/2"NPTM
64	8	MALE CONNECTOR 1/2" NPT(M) X TO SUIT 1/2" OD TUBE
79	30Mtrs	SEAMLESS PIPE/3/4" NB SCH 80
75	A/R	PIPE AS PER IS-1239 SIZE : 1/2" NB-HEAVY GRADE
93	1	3 VALVE MANIFOLD 1/2" NPT(F)
150	2	GALVANISED ELBOW CL 3000 SIZE : 1/2" NPTF
155	2	BULK HEAD COUPLING CL 3000 SIZE : 3/4" NB SW /CL 3000/AS PER ANSI B16.11
121	2	BULK HEAD COUPLING CL 3000 SIZE : 1/2" NPTF /AS PER ANSI B16.11

SERVICE : FLUE GAS, FURNACE ETC.

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
gp	AT	SD		0	21.04.10

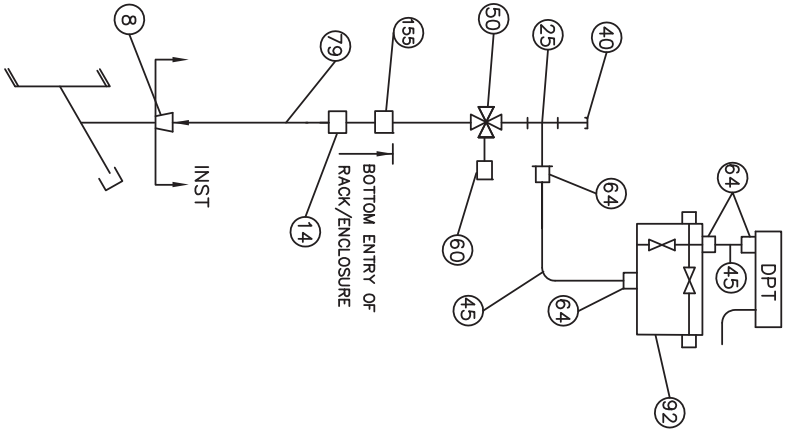
TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADDARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 17 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY

**DIFF. PRESSURE TRANSMITTER  
MOUNTED ABOVE SOURCE POINT**



**BILL OF MATERIAL**

ITEM NO.	QTY./INST	DESCRIPTION
8	1	REDUCER 1" BSPF X 3/4" NB-SW CL 3000
14	1	FORGED COUPLING 3/4" SW CL 3000/AS PER ANSI B16.11
25	1	FORGED UNEQUAL TEE AS PER ANSI B16.11 SIZE : 2 X 3/4" NB-SW X 1/2" NPTF/CL3000
40	1	NIPPLE & CAP 3/4" NB-SCH 80/CAP-3/4" NPTF
45	6 Mtrs.	SEAMLESS TUBE 1/2" OD X 2.1 MM THK.
50	1	FOUR WAY VALVE SIZE : (2 X 3/4" NB-SW) X (2 X 1/2" NPTF) CL: 800
60	1	QUICK DISCONNECTING FITTING SIZE: 1/2" NPTM
64	3	MALE CONNECTOR /SS 316 1/2" NPT(M) X TO SUIT 1/2" OD TUBE
79	30Mtrs	SEAMLESS PIPE/3/4" NB SCH 80
92	1	2 VALVE MANIFOLD 1/2" NPT(F)
155	1	BULK HEAD COUPLING CL 3000 SIZE : 3/4" SW /CL 3000/AS PER ANSI B16.11

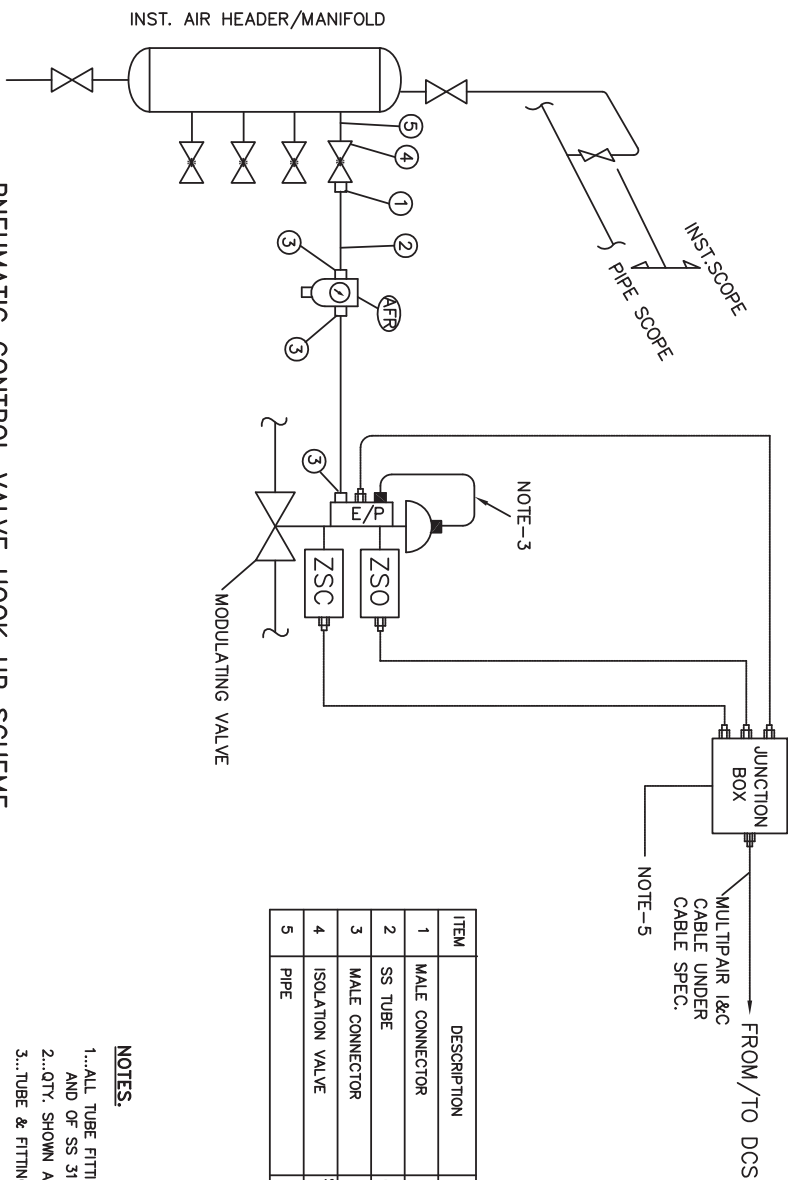
SERVICE : FLUE GAS, PRIMARY AIR, SECONDARY AIR ETC.  
NOTE : AIR PURGING ARRANGEMENT SHALL BE INCLUDED.

APPROVED	CHECKED	DRAWN	REV.	DATE
GP	AT	SD	0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKAGORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

<p>DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA, MUMBAI, CHENNAI, NEW DELHI</p>	JOB NO.	DCPL-K9213R	SCALE	NIL	SHT.	18 OF 20
	DWG. NO.	K9213R-DWG-I-0060			REV.	0

PRELIMINARY  
TENDER PURPOSE ONLY



**PNEUMATIC CONTROL VALVE HOOK UP SCHEME**

ITEM	DESCRIPTION	SPECIFICATION	QTY.	REMARKS
1	MALE CONNECTOR	1/2"NP(TM) X 6 mm OD COMPRN.	1	
2	SS TUBE	6 mm OD X 1 mm THK.	10 MTRS.	
3	MALE CONNECTOR	1/4"NP(TM) X 6 mm OD COMPRN.	3	
4	ISOLATION VALVE	SS BALL TYPE 600LBS 1/2" SW X 1/2" NPT(F)		
5	PIPE	1/2" NB SCH 40S	A/R	

**NOTES.**

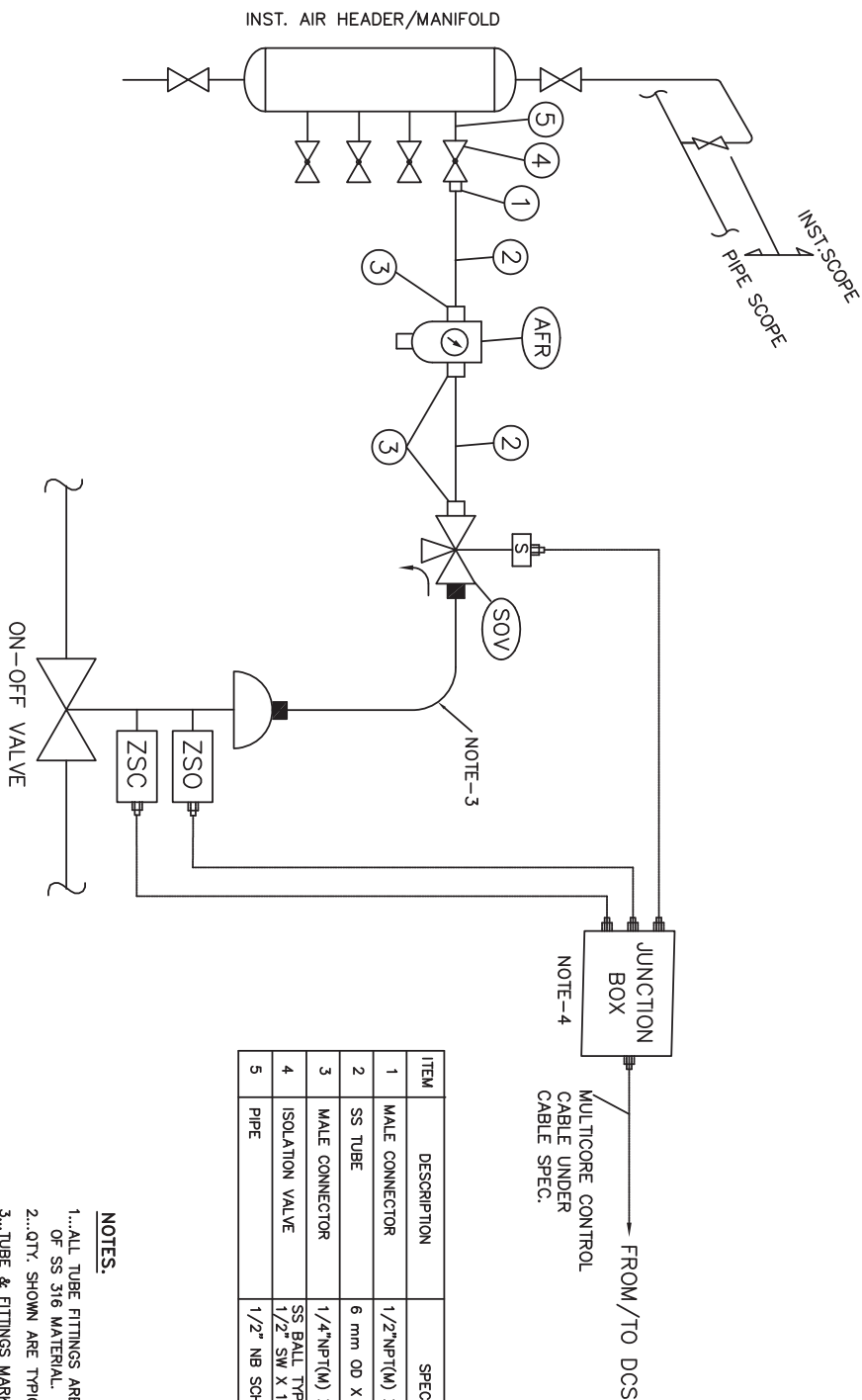
- 1...ALL TUBE FITTINGS ARE OF DOUBLE COMPRESSION TYPE AND OF SS 316 MATERIAL.
- 2...QTY. SHOWN ARE TYPICAL FOR ONE INSTALLATION ONLY.
- 3...TUBE & FITTINGS MARKED ■ ARE INTEGRAL TO THE VALVE.
- 4...LIMIT SWITCHES WILL BE CONNECTED WHEREVER APPLICABLE.
- 5...JUNCTION BOX WILL BE INTEGRAL TO ACTUATOR.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

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
gp	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1:800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA - MUMBAI - CHENNAI - NEW DELHI  
 JOB NO. DCP-1-K9213R SCALE NIL SH. 19 OF 20  
 DWG. NO. K9213R-DWG-1-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY



ITEM	DESCRIPTION	SPECIFICATION	QTY.	REMARKS
1	MALE CONNECTOR	1/2" NPT(M) X 6 mm OD COMPRN.	1	
2	SS TUBE	6 mm OD X 1.0 mm THK.	10 MTRS.	
3	MALE CONNECTOR	1/4" NPT(M) X 6 mm OD COMPRN.	3	
4	ISOLATION VALVE	SS BALL TYPE 600LBS 1/2" SW X 1/2" NPT(F)		
5	PIPE	1/2" NB SCH 40S	A/R	

**NOTES.**

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

**PNEUMATIC SOV HOOK UP SCHEME**

APPROVED				CHECKED				DRAWN				DESCRIPTION				REV.				DATE			
GP				AT				SD								0				21.04.10			
<p style="text-align: center;">TYPICAL INSTRUMENT INSTALLATION DIAGRAM</p> <p style="text-align: center;">1x800kW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANAGORI THERMAL POWER STATION, GUJARAT)</p> <p style="text-align: center;">GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADDARA, GUJARAT</p>																							
<p style="text-align: center;">DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>																							
JOB NO. DGPL-K9213R				SCALE NIL				SHT. 20 OF 20				DWG. NO. K9213R-DWG-I-0060				REV. 0							

PRELIMINARY  
TENDER PURPOSE ONLY



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

**VOLUME – II B**  
**SECTION-D**  
**STANDARD TECHNICAL REQUIREMENTS**



TITLE:  
**TECHNICAL SPECIFICATION FOR  
AIR RECEIVER**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

## 1.0 GENERAL

This standard specification covers the design, material of construction, features, manufacture, inspection & testing at VENDOR'S and/or his sub-vendors' works, suitable painting and packing requirements of air receiver

## 2.0 CODES & STANDARDS

As far as possible, the design, manufacture and performance of air receivers shall be in accordance with the latest applicable Indian/British/American/DIN standards.

The latest editions of the following shall be followed in particular:

IS: 2825 – Code for unfired pressure vessels

ASME – Section-VIII, Division-1

BS – 487-Fusion welded steel air receivers

IS: 7938 – Air receivers for compressed air installation

The materials of the various components shall conform to applicable IS/BS/ASTM/DIN standards.

## 3.0 DESIGN AND CONSTRUCTION

- 3.1 The air receivers shall be vertical self-supporting cylindrical vessels with supporting stands for resting on the civil foundation.
- 3.2 Other design parameters and design internal pressure of the receiver shall be as per the data specification sheet, if any, enclosed. The receiver shall be designed as per IS:7938.
- 3.3 Receivers shall be of welded construction with a minimum number of joints. Longitudinal seams in adjacent section of shell shall not be in the same line.
- 3.4 Receivers shall be provided with gasket inspection openings. Receivers below 500 mm diameter shall have at least two inspection holes. For receivers of larger diameter, manhole of minimum 450 mm diameter shall be provided. These openings shall be placed as far as possible from any welded seam and in no instance shall pierce any seam.
- 3.5 All welding shall be performed in accordance with relevant codes. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. All welding electrodes shall be got approved by the Owner. The electrodes shall be dried in ovens immediately before use to ensure freedom from porosity. All the circumferential and longitudinal butt welds of the air



TITLE:  
**TECHNICAL SPECIFICATION FOR  
AIR RECEIVER**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

receiver shall be subjected to spot radiography. Tee joints and dished welding shall be subjected to 100% radiography.

- 3.6** All other welding on the air receiver, including fillet weld and nozzle connection shall be DP tested as per IS: 2825 (Para 8.7.11).
- 3.7** Each finished receiver complete with all welded attachments shall be hydraulically tested at 150% of the design pressure. The test pressure shall be maintained for at least 30 minutes. All joints shall be gentle hammered during the test.
- 3.8** Receivers shall be provided with relief valve of the capacity and set pressure of the same at least 10% above working pressure. The spring in the relief valve in service for pressure up to and including 250 psi shall not be reset for any pressure more than 10% above or below the design set pressure. For higher pressures, the spring shall not be reset for any pressure more or below 5% design set pressure.
- 3.9** Each air receiver shall be complete with drain connection of 25 mm NB with a trap station consisting of a trap, strainer, isolation and bypass valves.
- 3.10** The receiver shall be provided with necessary number of nozzles. The orientation of the nozzles shall be subjected to the approval of the Owner.
- 3.11** Local instruments like pressure gauge, switch and temp. gauge of suitable range shall be supplied. Please refer specification for conveying air compressor for other instrumentation required.
- 3.12** The vendor will have all welding procedures & welders qualified in accordance with the relevant codes prior to commencing any welding at the works. These tests shall be witnessed by customer/client representative.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CHAIN PULLEY BLOCK & MONORAIL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

## 1.0.0 GENERAL

This specification covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-constructor's works of hand operated chain pulley block.

## 2.0.0 CODES AND STANDARDS

The design, manufacture, inspection and testing and performance of hand operated chain pulley blocks shall confirm to latest editions of the following standards: -

- a) IS: 3832 Specification for hand operated chain pulley block
- b) IS 807: 1976 Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists
- c) IS: 3109(Part II) Calibrated load chain for pulley blocks and other lifting appliances
- d) IS: 2429(Part II) Calibrated hand chain for pulley blocks and other lifting appliances
- e) IS: 4460 Method for rating of machine cut spur and helical gears
- f) Material Specification IS or approved

## 3.0.0 EQUIPMENT

### 3.1.0 CHAIN PULLEY BLOCK

The block shall be so designed that all components shall withstand without failure, an application to the block of a load equal to at least four times the working load limit.

#### 3.1.1 Frame



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CHAIN PULLEY BLOCK & MONORAIL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

Frame shall be robust in design and of welded construction. The frame shall be selected in such a way that head room requirement is minimum. Frame shall maintain alignment under all expected conditions of services.

### **3.1.2 Chain**

The load chain shall be electrically welded, accurately calibrated, and pitched and polished conforming to IS: 6216 Grade 80 as specified in data sheet 'A'.

The hand chain shall also be electrically welded, calibrated, pitched and polished and shall conform to IS: 2429 (Part II) grade 30. The length of chain and link dimension shall be as per IS: 3832.

### **3.1.3 Hook**

The forged hook shall be properly heat-treated and so designed that in loaded condition, it is free to swivel without twisting the load chain. The hook shall conform to IS: 3815.

### **3.1.4 Reduction Gear**

The reduction gear shall be spur or worm/worm wheel type. The spur gear and worm shall be of high-grade carbon steel and heat treated. The worm wheel shall be of bronze. A detachable steel cover shall be provided for total enclosure of the gear train and ample lubrication to be provided.

### **3.1.5 Brakes**

Brakes shall be of screw friction disc type self-actuating or any other approved type as per manufacturer's standard practice. Brake capacity shall be ample and humid atmosphere shall not affect materials used. The brake shall prevent self lowering of load and arrest and sustain load in all working positions. The load brake shall also allow smooth lowering of the load without serious overheating which may impair sufficient working of block

### **3.1.6 Bearing**

Bearing used shall be as per guidelines laid down in IS: 3832.

### **3.1.7 Wheel**

The load chain wheel shall be made of heavy duty malleable casting and shall be designed to ensure, effective operation of the chain. Load chain, wheel shall be mounted on two ball bearings. Hand chain wheel shall be made from malleable casting/pressed sheet steel. The idler wheel shall be so shaped as



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CHAIN PULLEY BLOCK & MONORAIL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

to avoid the twisting of the chain during operation. The P.C.D of idler wheels shall be such that the bending action of the link is avoided. The hand chain wheel shall be provided with flanges and designed to ensure effective operation with hand chain.

### **3.1.8 Other components**

All other components of chain pulley block such as anchorage, guide, pawl, stripper etc. shall be designed and provided as per IS: 3832.

### **3.2.0 MONORAIL TROLLEY**

Monorail trolley shall be provided if called for in the enclosed Data Sheet—A. Monorail trolley frame shall be of heavy section rolled steel, held together by bolts. Wheels shall be of high grade cast iron mounted on ball bearings. Axles and shafts shall be of carbon steel, accurately machined and suitably supported. The trolley shall be suitable for variations in I section beams. The trolley shall be geared travel type.

The hand chain required for trolley travel shall be as per clause 3.1.2 of this specification.

Hand chain wheel shall be as per clause 3.1.7 of this specification.

### **4.0.0 INSPECTION AND TESTING**

The scope of inspection shall include but not limited to the following:

- a) Material identification/co-relation for important items like hook, load chain, hand chain, wheels, nut and pawl etc.
- b) Hardness for pawl and ratchet
- c) Dye penetration test for hooks
- d) Operational test including operational effort, velocity ratio etc,
- e) Proof load test up to 1.5 times of working load limit.
- f) Dimensional check of hook
- g) Marking



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CHAIN PULLEY BLOCK & MONORAIL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

### DATASHEET

S. No.	Parameter	Description
1	Capacity (In Kg)	Suitable for lifting the heaviest load but not less than One (1) ton
2	Service condition	Class II outdoor
3	No. of CPB	1 per bunker
4	Lift (m)	To suit bunker height and equipment on bunker roof top to be handled.
5	Type of suspension	Travelling Trolley
6	Head Room	Minimum permissible
7	Type of gear in CPB	Spur Gear
8	Type of bearing	Ball/Roller
9	Grade of Load Chain	Alloy Steel /Gr 80
10	Grade of Hand Chain	Steel / Gr. 30
11	Factor of Safety	As per Relevant IS

5.01.00 **Conveying Air Compressor:**

5.01.01 The Compressed Air System shall ensure a reliable supply of adequate quantity and quality of oil free air on continuous and intermittent basis for mill rejects removal from mill outlets.

The normal pressure of conveying Air supply at the outlet of conveying compressor shall be decided by the vendor as per system requirement, allowing for pressure drops in system piping, equipment and all other accessories.

The maximum expected pressure in the system should be computed by considering 10% overpressure over and above the rated discharge pressure of each air compressor as computed above.

There will be no separate compressor house for the MRSH conveying compressors. MRHS compressors will be located in the AHP compressor building.

The delivered compressed air at oil filter outlet shall not contain any trace of oil, grease or any other impurities. Size of particles in the delivered air shall not exceed 3 Microns.

Compressed air system equipment requiring cooling water shall be capable of operation at design capacity with cooling water inlet temperature subject to a maximum of 34°C in Auxiliary cooling water (ACW) system. The above equipment shall also be capable to withstand a pressure not less than the shut off head of each ACW pump.

The temperature of air at outlet from after cooler shall not exceed 10°C above the cooling water inlet temperature.

Air Compressors shall be identical and shall be designed for continuous operation with high efficiency to satisfy the performance requirement as specified in the Data Specification Sheet.

The power rating of the driver shall be selected such that a minimum margin of 15% is available over the power required to deliver rated capacity against rated discharge pressure. When the driver is not directly coupled to the compressor, due account should be made for losses in power transmission, in addition to the above margin. However, the power rating of the driver thus selected shall have sufficient margin to run the compressor under relief valve discharge condition considering that the compressor is operating at its rated capacity and discharge pressure corresponding to set pressure of relief valve.

As more than one (1) compressor with drive is specified, satisfactory operation in parallel shall be ensured without any uneven load sharing, undue vibration,

Keeping noise level within permissible limits for a number of compressors working simultaneously.

The Contractor under this specification shall assume full responsibility in the operation of the compressor and the drive as a unit.

Each Air Receiver shall be so sized that even in the event of total stoppage of air inflow to the same, the pressure in the Air Receiver shall not fall below 80% of design pressure kg/cm<sup>2</sup> (g) within two (2) minutes of such stoppage, while maintaining an out flow of air at a rate equal to the rated capacity of a single compressor, during the aforesaid period. In no case, the size of each Air Receiver shall be less than that arrived from IS 7938.

The capacity of each Air Receiver shall be determined in accordance with the following guidelines:

$V_{AR} = (T \times C \times P_A) / (P_{MAX} - P_{MIN})$ , where

$V_{AR}$  = Volume of each Air Receiver in M<sup>3</sup>.

T = Bleed down time in minutes, shall be taken as 2 minutes (minimum)

$P_A$  = Atmospheric pressure, (absolute).

$P_{MAX}$  = Maximum system pressure in Kg/Sq.cm (absolute).

$P_{MIN}$  = Minimum system pressure in Kg/Sq.cm absolute,

C = Free air delivery capacity of each Air compressor for IA system or free air delivery capacity of each SA compressor for SA system, M3.

The water filled volume of each Air Receiver shall be calculated in accordance with the guidelines specified above or 10M<sup>3</sup>, whichever is higher.

#### 5.01.02 Design and Construction

The design shall be such as to ensure trouble free operation with least vibration and noise. Different parts of the compressor and accessories shall be arranged neatly in a compact manner. Due consideration shall be given for easy accessibility and maintenance of the compressors.

Unless inconsistent with this specification equipment from the standard range of manufacture of the bidder shall be preferred.

Compressor components shall be interchangeable as far as possible. Material of construction shall be suitable for the service.

The compressor shall be oil flooded, horizontal, multi-stage, water cooled, electric motor driven screw type, heavy duty, rugged construction. Their speed shall be so selected as to result in low maintenance and trouble-free operation under specified conditions.

Compression chamber wall thickness shall be such that to withstand maximum design pressure.

During maintenance of compressor suitable arrangement for cleaning of the cooling water jackets shall be provided.

Dynamically balanced, one-piece Rotors construction with a symmetric profile to keep leakage loss to a minimum and ensure high efficiency.

Rotor shaft mounted, highly precise timing gears shall be designed to counter the axial forces incurred in compression.

Use of Oil lubricated anti friction type bearings is at least 8000 running hours.

The shaft sealing and retainers shall be free for radial self-adjustment on the rotor shafts.

Minimum design service factor for the integral, oil lubricated type, step up gearbox shall be of 1.5.

AC electric motor will be used for driving the compressor conforming to the relevant Sub Sections of Electrical part (Section-2) of this specification.

The rotor and shaft shall be of single piece construction, made of forged steel with suitable corrosion resistant coated material to minimize leakage and wear (AISI C1141 or equivalent). The stator (casing) shall be of Cast-Iron Construction with corrosion resistant material and with integral jacket cooling.

The seal rings and retainers shall be of stainless steel construction. The seals shall prevent air and oil leakage along the shaft. Air vented from second stage discharge end seals shall provide buffer air to the other seals to prevent migration of oil towards the compression chamber under all operating conditions.

The gaskets shall be of asbestos free material.

For design capacity, outlet pressure and other relevant data, refer Data specification sheet.

#### Lubrication system

The compressor package shall include a lubricant management system which shall lubricate the bearings and seal.

The lubricant pump shall be shaft driven. An auxiliary motor driven pump shall be provided if required by the manufacturer to supply pre-start and shut down system. All lube oil pumps shall be of rotary positive displacement type, having stainless steel rotors and steel casing. A relief valve will protect the pump discharge system.

All instrumentation and accessories in the lubrication circuit, namely discharge pressure gauge, pressure switch, relief valve etc. shall be included in the scope of supply. Suitable time delay relay or equivalent device to bypass low oil pressure switch during start-up shall be provided.

5.01.03 Gear Box

Speed increasing gears between the motor and compressor stages shall consist of a common helical gear driving the pinion of each stage. Helical timing gears shall be mounted on the rotor shafts to maintain accurate relative rotor position. Gears shall have a rating of AGMA-12 or equivalent.

5.01.04 Coolers

The heat exchangers for compressor intercooler, after cooler, and lube oil cooler shall be water cooled. The heat exchangers shall be located within the enclosed compressor skid.

The fouling factor shall be considered as per the recommendation of TEMA.

The intercoolers and after coolers shall be provided with moisture separators and condensate drain arrangement. Necessary safety valves shall be provided on inter and after coolers.

All heat exchangers shall be designed for a heat duty corresponding to the peak power demand of the compressors.

The coolers shall be designed in accordance with the requirement of IS-2825.

After cooler at each compressor discharge shall be designed to bring the outlet temperature of the compressed air within 10°C of the cooling water inlet temperature.

Inter-cooler, after cooler and moisture separator shall be provided with auto trap stations including strainer, bypass and double isolating valves for the traps. A level gauge glass with isolating cocks shall be provided near the bottom of moisture separator.

The intercooler and after cooler, if any, shall be of shell and tube type with removable tube bundle. The shell, tubes, tube sheets and expansion joints with tube sheets particularly at flare portion etc. of the heat exchangers shall be designed to withstand the maximum working pressures encountered. Necessary allowance for corrosion shall be considered.

Inter coolers / after coolers shall be provided with supports which are designed to avoid undue stress or deflection in support or body of the equipment.

Due consideration for the differential expansion of shell and tube shall be given in the design of the coolers.

5.01.05 Installation

The compressor package shall be suitable for simple installation on concrete floor.

5.01.06 Air Receiver

Air receiver(s) shall be in accordance with IS: 2825 & IS: 7938 or approved equivalent.

The design pressure, capacity and other parameters shall be as indicated in Data Specification Sheet.

Receivers shall be of welded construction with minimum number of joints. Longitudinal seams in adjacent sections of shell shall not be in the same line.

Receivers shall be provided with required number of nozzles, the orientations of which shall be subject to approval by the Purchaser. At least two gasketed inspection holes shall be provided for receivers up to 600 mm diameter. For larger diameter, manhole of minimum 450 mm diameter shall be provided. All openings shall be placed as far as possible from welded seams and in no instance shall pierce the seam.

Receivers shall be provided with one or more safety relief valves of proper capacity so that the maximum working pressure of the system is not exceeded under any circumstance. Unless otherwise specified, each receiver shall be provided with at least one pressure gauge and one temperature gauge of proper range and required number of pressure switches for compressor control purpose.

Each air receiver drain connection shall be provided with automatic drain valve for automatic removal of drain consisting of valve, strainer, double isolation and bypass valve. Each air receiver should have air release vents at top to facilitate statutory hydraulic tests.

The air receiver shall be vertical self supporting cylindrical vessel with dished ends and with supporting stand for resting on Civil Foundation in accordance with Air Receiver data sheet enclosed herewith.

All welding shall be performed in accordance with relevant code. Filler material, that will deposit weld metal with a composition and structure as near as that of material being welded, shall be used. The electrodes shall be dried in immediately before use to ensure freedom from porosity.

5.01.07 Intake Air Filter and Silencer

Filters with multiple elements quick removal type for easy cleaning shall be provided at suction of each air compressor and also be of heavy-duty dry type.

Cartridge type filters may also be utilized.

The filters shall be complete with integral silencers. Separate silencers, if specified, shall be provided. The filtering elements shall be easily removable for cleaning.

Maximum pressure drop across filter at design flow rate in new condition shall be 250 mm of water column.

Filtering media shall be of densely packed, replaceable type.

Filter shall be designed to have sound suppressing characteristics.

#### 5.01.08 Interconnecting Piping, Valves and Fittings

Compressed air piping between air compressor and receiver, etc., shall be furnished by the Contractor, complete with valves, fittings, pipe supports as necessary. The piping shall be as per the Codes/Standards mentioned in Data Specification Sheet.

All relief valves shall be provided with hand levers to permit manual operation. Isolation valves shall conform to relevant IS / BS codes. Material of construction shall be suitable for the temperature of fluid & type of fluid it handles. The end connection shall be as mentioned in the datasheets.

Cooling water piping & its fittings shall be as per the data specification sheets.

All lines handling hot air, Reactivating piping / vessel shall be suitably insulated to restrict the exposed surface temperature to 60 °C maximum.

Since a number of compressors will be operating simultaneously in the same room, special attention shall be given for minimising generation and transmission of vibration and noise level during running of the compressors. All piping connections in the compressed air and cooling water lines between the nozzles on the compressors block and the interconnecting piping shall be made by 500 mm of wire reinforced rubber hoses and flexible metallic pressure hoses of suitable size and rating.

Sight flow indicators shall be provided in the cooling water line at the outlet of each piece of equipment and accessories requiring separate cooling water supply. The flow indicators shall be of approved design.

The air discharge piping shall be full size of compressor outlet or larger, short and direct with minimum number of fittings up to air receiver. Only long radius elbows shall be used where bends are unavoidable.

Any pocket in discharge piping shall be provided with drain connection complete with automatic draining arrangement. Long run of vertical piping at compressor discharge shall not be acceptable.

The layout shall be such as to prevent resonance. Provision of thermal expansion of hot pipes shall be made.

All pipe connections with equipment shall be flanged type. All pressure gauges shall be complete with root valves.

All instruments, safety valves etc. as specified and shown in tender drawing shall be furnished on the piping.

Complete piping system shall be provided with adequate supporting arrangement to avoid undue forces and moments at the equipment terminals and vibration.

For water cooled compressors, cooling water shall normally be piped through the intercooler (where applicable) and after cooler in parallel. From the intercooler, the water shall be taken to cylinder jackets. A solenoid valve shall be provided on the water inlet line for interlocked starting of compressors. Where provision for automatic water flow regulation by thermostatic valve has been made, a suitable bypass arrangement to the valve shall be made so that flow is ensured under all circumstances. The velocity in water pipe shall be limited to 2.5 m/sec.

All instruments as specified elsewhere shall be furnished.

All traps shall be of auto drain type to drain out moisture at regular intervals. The body and cover shall be of cast iron/solid steel construction and internals shall be of SS. Isolating valves shall be of stainless steel.

All strainers shall be Y-type with suitable blow-off plugs. The body material shall be cast iron. The screen shall be of stainless steel with 40 mesh openings.

All bolt and nuts shall be of Carbon-steel conforming to IS-1363.

#### 5.01.09 Drive Unit

The compressors shall be driven by A.C electric motor. For determining the output rating of driver general guidelines as indicated in relevant sub-section of the Electrical part (Section-2) of this specification shall be followed.

The driver shall be connected to the compressor either directly or through gear box as per Data Specification Sheet.

For other types of connection between drive unit and compressor, suitable flexible coupling shall be provided.

Necessary guard for all exposed moving parts shall be provided.

Motor speed torque curve shall match with that of the compressor for trouble free start-up.

Motor shall be suitable for eight (8) equally speed starts per hour.

#### 5.01.10 Inspection and Testing

The tenderer shall conduct all tests and inspections required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Purchaser for approval before conducting the tests. The Purchaser's representative shall be given full access to all tests. The Contractor shall intimate the Purchaser well in advance (at least 15 days notice) so that if desired his representative can witness the test.

Where stage inspection is to be witnessed by Purchaser, in addition to above, the bidder shall submit to the Purchaser at the initiation of the contract, the detailed PERT-Chart showing the manufacturing programme and indicating the period where Purchaser or his authorized inspecting agency is required at the shop.

#### Shop Tests

#### Material Test

- i) All materials used for construction shall be of tested quality. Physical and Chemical tests of materials shall be conducted as per the relevant standards and test certificates shall be made available to the Purchaser. If demanded by Purchaser's inspector, proof of use of only tested quality material shall be furnished.
- ii) Where stage inspection is to be witnessed by Purchaser, all material test certificates shall be correlated and verified with the actual material used for construction by Purchaser's inspector who shall stamp the material. In case mill test certificates for the materials are not available, the Contractor shall carry out physical and chemical tests at his own cost from a testing agency, approved by the Purchaser, as per the requirement of specified material standard. The samples for physical and chemical testing shall be drawn up in presence of Purchaser's inspector who shall also witness the testing.
- iii) All castings shall be sound, clean and free from porosity, blow holes, hard spots and other harmful defects.
- iv) If specified in the Data Specification Sheets, the Compressor components shall be subjected to non-destructive testing (NDT). The requirements of NDT shall comply with the relevant standards. The accepted limit shall be as stipulated therein. All components subjected to NDT shall be identified and stamped by Purchaser's inspector on successful completion of testing.

#### Hydraulic Test

All pressure parts shall be hydraulically tested at shop as per relevant code and at 150% of design pressure or 200% of working pressure (whichever is higher) where not specified, prior to painting and lining, if applicable. The pressure parts shall be kept pressurised for at least one (1) hour at this test pressure, unless contradicted by the relevant test code.

#### Dynamic Balancing Test

All rotating components and the assembly of the compressors shall be subjected to dynamic balancing test if asked for in the Data Specification Sheet.

Test for capacity, pressure drop and efficiency of intake filter and silencer shall be made as per manufacturer's standard.

#### Performance Test at shop

Type test/routine test for the compressors shall be done for satisfactory performance in accordance with the relevant IS/BS/ASME or equivalent standard. Test for volumetric and overall efficiency of the machine (and testing of loading & unloading mechanism) shall be included in the routine test if required by the data specification sheet.

Tests shall be conducted with actual driver being furnished.

Reports and test certificates of the above tests shall be submitted to the Purchaser.

All drive motors shall be tested as per procedures detailed in Electrical Sub-sections.

#### Performance Test at Site

After installation, complete system offered may be subjected to testing at field by Purchaser.

#### 5.01.11 Welding and Radiography

All welding shall be performed generally in accordance with IS-2825 - code for unfired pressure vessels and code for pressure piping B31.1. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. Electrodes conforming to AWS-6010 may be used for welding of Carbon steel vessels. The electrodes shall be oven dried before use to ascertain freedom from weld porosity.

The Tenderer shall have all welding procedure qualified in accordance with the relevant codes prior to commencing any welding on the works. Any procedure for the repair of defects in the weldments and all other materials shall be submitted to the Purchaser for his approval prior to any repairing being done.

If asked for in data specification sheet all butt welded joints used for fabrication of the pressure vessel shall be subjected to spot radiography in accordance with relevant standard. Where radiography cannot be easily employed other non-destructive test like dye-penetration tests may be applied. The result of these tests shall be reported as per IS-2825.

#### DATA SPECIFICATION FOR AIR COMPRESSOR AND AUXILIARIES

A.	Performance Specification		
	Air Delivery	:	Bidder to compute and indicate as per guidelines in this section.
	Discharge Pressure	:	- do -
	Duty	:	To be designed for continuous load-unload and On-off mode operation.
	Parallel operation of one or more compressors shall be possible without any undue vibration and noise.		
	Noise level	:	Not to exceed 85 dBA at a distance of 1.0 m. from the equipment surface.
	Compressed air outlet temp.	:	Limited to 10°C above of inlet cooling

		water temperature.
	Location	: Indoor
<b>B.</b>	<b>Construction Features</b>	
	Type of Compressor	: Oil flooded rotary Screw compressor with oil separator at discharge to restrict oil in air to 3 ppm (guaranteed).
	Quantity	: As indicated in the single line flow diagram
	Type of drive	: Electric Motor
	Nos. of starts per Hr.	: 8
	Type of Transmission	: Gear
	Anti vibration Arrangement required	: Yes
	Type of Control	: Dual i.e. both load-unload and auto start/stop
	Type of Annunciation	: Audio-visual
	Flange Standard	: ANSI B16.5
<b>C.</b>	<b>Materials of Construction:</b>	
	Gear casing, Compressor	: Cast Iron, GGG 40, DIN 1693
	Compressor Casing / Rotor housing	: Cast Iron, GGG 40, DIN 1693
	Rotors	: Carbon Steel, Teflon coated, St 50-2, DIN 17100
	Bull gear	: Low Alloy Steel, 18 Cr Ni Mo 7-6 , EN 10084
	Pinion Gear	: Low Alloy Steel, 18 Cr Ni Mo 7-6 EN 10084
	Timing Gears	: Low Alloy Steel, 21 Ni Cr Mo 2-2 EN 10084
	Drive shaft	: Low alloyed steel, 42 Cr Mo S4, EN 10083-1
	Oil pump discharge pressure	: 2 – 2.2 bar
	Oil cooler [ Plate type ]	: Stainless Steel, AISI 316
<b>D.</b>	<b>Supply of Accessories and Service</b>	
	Intake Air Filter with Silencer	: Yes
	Inter Coolers	: Yes
	After Cooler and Moisture Separator	: Yes
	Automatic drain traps	: Yes
	Anti- vibration pads	: Yes.
	All Instruments as specified and as shown in the tender drawing and as required	: Yes
	Coupling guard	: Yes
	Air Receiver	: Yes
	Base Plate	: Yes
	Foundation bolts, nuts, sleeves etc.	: Yes

	Interconnecting pipe work valves & specialties as per scope and as shown in the tender drawing.	:	Yes
	Eye bolts, lifting lugs, tools and tackles	:	Yes
	Jack bolt in each motor base frame for alignment purpose	:	Yes
	Control panel as per specification	:	Yes
	Instrument Gauge Panel	:	Yes
	Shop painting	:	Yes
	Spare parts	:	Yes
	Erection Service	:	Yes
	Shop testing	:	Yes
	Testing at site and commissioning	:	Yes
<b>E.</b>	<b>Testing and Inspection</b>		
	Material Testing and Identification	:	Required
	Radiography Test	:	Yes
	Parts to be Tested	:	All Pressure parts and Vessels
	Dye Penetration Test	:	Yes
	Type of performance test	:	Routine Test
	Volumetric and overall efficiency tests and testing for loading / unloading mechanism included in performance test.	:	Yes
	Hydrostatic test	:	Yes
	Field Performance test	:	Yes
	Performance test and Hydrostatic test at site to be witnessed by the Purchaser	:	Yes
	Non-destructive test of material	:	Yes
	Dynamic balancing test of the rotor	:	Yes
	MPI & UT Tests	:	Yes
<b>G.</b>	<b>Compressor Accessories</b>		
<b>i)</b>	<b>Intake Air Filter and Silencer</b>		
<b>a)</b>	<b>General Information</b>		
	Quantity	:	One (1) no. With each compressor.
	Location	:	Indoor/ at the suction of each compressor
	Type	:	Dry type
	Silencer	:	Yes
<b>b)</b>	<b>Performance Required</b>		
	Air Flow rate, Cu.m/min.	:	To suit compressor rating
	Particle size in micron	:	Maximum 5 micron
	Maximum allowable pressure drop at stated air flow rate in	:	250 mm WC

	new condition of filter		
	Filtering efficiency	:	Minimum 95% for particles 5 microns
c)	<b>Test Requirement</b>	:	
i)	Separate test as per manufacturer's standard practice.		
ii)	<b>Air Receiver</b>		
a)	<b>General Information</b>		
	Quantity	:	As indicated in the single line flow diagram.
	Installation	:	Indoor
	Type	:	Vertical cylindrical with torispherical dished ends
	Design Pressure	:	Bidder to compute and indicate as per guidelines in this section.
	Design temperature	:	50°C
	Hydraulic Test Pressure	:	Bidder to indicate
b)	Design code	:	ASME sec. VIII Div. 1 or IS: 2825
c)	<b>Material of Construction</b>		
	Shell, End plates (dished ends) & flanges	:	IS 2062 or Equivalent
d)	<b>Supply of Accessories and Services</b>		
	Companion flanges with nuts, bolts & gaskets etc.	:	Yes
	Pressure Indicator with snubber	:	Yes
	Pressure Switches	:	Yes
	Temperature Indicators	:	Yes
	Relief Valves	:	Yes, set pressure shall be at least 10% above working pressure
	Trap Stations	:	Yes
	Level Gauges	:	Yes
	Vent valve / plug	:	Yes
	Supporting stand with necessary foundation bolts, nuts, sleeves etc.	:	Yes
	Gasketed inspection manhole	:	Yes, minimum 500 mm diameter
	Eyebolts, lifting lugs, tools and tackles.	:	Yes
e)	<b>Painting</b>		
	i) External	:	Adequate number of shop coats of Polyamide Epoxy primer so as to achieve the required dry film thickness (DFT) of 100-150 microns. Then adequate number of finish coats of <b>Aliphatic Polyester Urethane</b> paint of approved quality shall be applied so as to achieve the required dry film thickness (DFT) of 40-50 microns.  Thickness of each coat shall be 25-50

			microns.
	ii) Internal	:	Shop painted as per manufacturer's standard
f)	Inspection and Testing		
	Material testing and identification	:	Yes
	Bend test as per BS-5169	:	Yes
	Hydraulic test	:	Yes
	Spot radiography of all circumferential & longitudinal Butt welds	:	Yes
	Field Performance test	:	Yes
	D.P. Test where Radiography can not be done	:	Yes
iii)	<b>Intercooler, After-cooler, moisture separator</b>		
a)	After- Cooler		
	Quantity	:	One (1) no. with each compressor.
	Installation	:	Indoor
	Type	:	Shell & Tube
	Design pressure in air side	:	2 kg/cm <sup>2</sup> more than air inlet pressure
	Design pressure in water side	:	Not less than shut off head of ACW Pumps
	Relief Valves	:	Yes
	Internal Baffling	:	Yes
	Moisture Separators	:	Yes
	Trap Stations	:	Yes
	Temperature Indicators	:	Yes
	Level Gauges	:	Yes
b)	Inter-Cooler		
	Quantity	:	One (1) no. With each compressor.
	Installation	:	Indoor
	Type	:	Shell & Tube
	Design pressure in air side	:	2 kg/cm <sup>2</sup> more than air inlet pressure
	Design pressure in water side	:	Not less than shut off head of ACW Pumps.
	Relief Valves	:	Yes
	Internal Baffling	:	Yes
	Trap Stations	:	Yes
	Pressure Indicators	:	Yes
	Temperature Indicators	:	Yes
	Temperature Switches	:	Yes
c)	<b>Supply of Accessories and Services</b>		
	Supporting stands with bolts, nuts & gaskets	:	Yes
	Eye-bolt, lifting lugs, tools and tackles	:	Yes
	Counter flanges at terminal points of supply and return of	:	Yes

	cooling water including gaskets, nuts, bolts etc.		
	Shop painting with two (2) coats of red oxide primer	:	Yes
d)	Material		
	Tube	:	Admiralty brass or Aluminium brass or SS-304
	Shell	:	SA 285 Gr. C or equivalent
	Tube Sheet	:	SA 285 Gr. C or equivalent
	Baffle	:	Carbon Steel
	Flange	:	IS-2002 Grade 2A
e)	Testing and Inspection		
	Material Testing and Identification	:	Yes
	Hydraulic test	:	Yes
	Field performance test	:	Yes
iv)	Interconnecting piping, valves		
	Compressed Air Piping	:	IS-1239 (Heavy Grade) Black ERW, for sizes up to 150 mm NB and as per IS-3589 Gr. 410 for sizes above 150 mm NB
	Cooling Water Piping	:	IS-1239 (Heavy Grade), IS-3589 Gr.-410
	Valves (Air Line)	:	All valves shall be non-lubricated type PTFE Ball Valves with flanged end for sizes 65 mm NB and above. Gunmetal body gate, globe, and check valves with screwed ends for sizes 50 mm NB and below.
	Valves (Water Line)	:	Cast CS body gate, globe, and check valve butt-welded ends for sizes 65 mm NB and above. FCS body gate, globe, and check valves with socket welded end for sizes 50 mm NB and below.
	Fittings (Air Line)	:	Screwed up to 50 mm. Long radius elbows to be used. Flanged above 50 mm (Screwed Flanges).
	Fittings (Water Line)	:	Socket welded up to 50 mm and butt-welded above 50 mm.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CONVEYING VESSEL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

## 1.0 GENERAL

This specification covers the PURCHASER'S general requirement of design, materials, constructional features, manufacture, inspection and testing at VENDOR'S works and/or his sub vendor's works of Conveying Vessel and accessories specified hereinafter.

## 2.0 CODES AND STANDARDS

**2.1 The design, material, construction, manufacture, inspection and performance of the Transporter and accessories, shall comply with all statutory regulations and safety codes currently applicable in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian/British/USA/DIN Standards.**

**2.2** The material of construction and other works of the Transporter and accessories shall in general conform to the following standards/codes but will be subjected to any modification and requirement as specified in Section C of Technical Speciation.

- i) Transporter Vessel – Mild Steel to IS 2062 (Gr. A min); Construction as per IS-2825 / BS5500/ASME SEC-VIII, Div-1
- ii) Material Handling Valve – As indicated in Sec-C of the specification
- iii) Flange – MS as per ANSI B 16.5

**2.3** Where the above standards are in conflict with the stipulations of this specification, this specification supersedes them. In case of any further conflict in this matter, the decision of the Engineer will be final and binding.

## 3.0 DESIGN REQUIREMENTS

**3.1** The dense phase pneumatic conveying system shall be designed for low velocity for conveying of materials as indicated in Section C.

**3.2** The system shall consist of dome shaped vessels made of Carbon Steel complete with pneumatically operated dome/metering valves capable of closing through a solid head of material to make a pressure tight seal.

**3.3** The bottom of vessel shall have transition bend and a control air supply system to the side of the conveying vessel.

**3.4** Airtight seal system shall be provided between the transporter and the feeding point.

**3.5** Transporter shall be equipped with **air strainer** to prevent pipe scale /dirt from causing pressure regulator malfunctioning.

**3.6** Automatic drain filter and oil fog lubricator set shall be fitted into the air line to dome valve/metering valve for use with pneumatic controls.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CONVEYING VESSEL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

**3.7** Any air line stop valve fitted in the air supply line of transporter shall be of ball type to avoid any restriction to air flow, when open.

#### **4.0 CONSTRUCTIONAL FEATURES**

**4.1** The transporter vessel shall be fabricated from mild steel plate to the design of vendor. The vessel shall be of welded structure and shall be provided with necessary supporting structure. The vessel shall be airtight/leak proof in fully assembled condition. Conveying vessel shall be designed and tested as per IS 2825 class-III vessel. Temperature of mill reject coming into the conveying vessel shall be considered as 200 °C. Conveying vessel shall be designed for a pressure 10% above the maximum pressure encountered in the vessel. The conveying vessel shall be constructed with tested quality mild steel plates. They shall withstand the abrasive & hot condition of the mill rejects and operating air pressure. The conveying vessel shall be supported independently on steel columns. The vessel shall have suitably located and adequately numbered air connections for supply of compressed air for conveying mill rejects through pipes to overhead bin.

**4.2** Dome/Metering valve shall be of manufacturer's standard construction and will be easily openable and closeable type. All joints will be flanged with asbestos free or silicon rubber gaskets suitable for 200 °C.

**4.3** All bends will be of long radius cast bends ( $R = 5D$ ). Conveying pipes will be of mild steel heavy duty type.

#### **5.0 TESTING AND INSPECTION**

**5.1** The purchaser shall have free access to those parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded with all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification

**5.2** Should any structure or part of a structure be found not to comply with any of the provision of this specification, it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection/test except in cases where the purchaser or his authorized representative considers the defect as rectifiable defects which may appear during fabrication shall be made with the consent of and according to the procedure laid down by the purchaser, the purchaser may, at his discretion, check the test results obtained at the manufacturer's works by independent tests at the Government test house or elsewhere, and should not be found to be unsatisfactory shall be rejected. The costs of such tests shall be borne by the contractor.

**5.3** Scope of inspection shall include but not limited to the following:



TITLE:  
**TECHNICAL SPECIFICATION FOR  
CONVEYING VESSEL**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

- i) Material used in the fabrication shall be with manufacturer's test certificate with proper correlation for physical properties and chemical analysis. In the absence of correlation actual tests shall be done.
- ii) Welders shall be qualified as per ASME Standard. Only qualified welders shall be employed for the fabrication purpose.
- iii) Electrodes shall be of makes approved by BHEL.
- iv) All fillet welds, root run and trial run of butt welds shall be subjected to visual dye penetrating test with no linear indication. Acceptable norm for dye-penetrating test shall be as per Appendix-8 of ASME SEC. VII Div. 1.
- v) Special tests like NDT as per relevant code will be carried out for fabrication items.
- vi) Chemical analysis and hardness tests of linear plates shall be carried out.
- vii) Dimension shall be maintained as per approved drawings.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT BUNKER AND  
ACCESSORIES**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

## 1.0 GENERAL

1.1 This specification covers the PURCHASER'S general requirement of design, manufacture, fabrication, assembly, inspection, testing and delivery to site or mill reject bunker and accessories specified.

## 2.0 CODES AND STANDARDS

2.1 The design, material, construction, manufacture, inspection, testing and performance of the mill reject bunker shall comply with all statutory regulations and all safety codes currently applicable in the locality where the equipment will be installed.

2.2 The material of construction and other works of the mill reject bunker shall in general conform to the following standards /codes but will be subject to any modification and requirements as specified in the specification.

- |    |  |   |                    |
|----|--|---|--------------------|
| a) | Structural steel   | : | IS-2062 Gr A (min) |
| b) | Rolled Steel Beams, Channels and<br>Angle Sections   | : | IS-808             |
| c) | Scheme of Symbols for Welding  | : | IS-813             |
| d) | Covered Electrodes for Metal Arc<br>Welding of Structural Steel                                  | : | IS-814             |
| e) | Code of practice for use of Metal Arc<br>Welding for general Construction in<br>Mild Steel       | : | IS-816             |
| f) | Code of practice for inspection of Welds   | : | IS-822             |
| g) | Code of practice for use of structural<br>steel in general building construction                 | : | IS-800             |
| h) | Dimension for steel plate, sheet and<br>Strip for structural and general<br>Engineering purposes | : | IS-1730            |
| i) | Recommendation for metal arc welding   | : | IS-9575            |

2.3 Where the above standards are in conflict with the stipulations of this specification, the specification supercedes them. In case of any further conflict in this matter, the decision of the ENGINEER shall be final binding.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT BUNKER AND  
ACCESSORIES**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

### **3.0 DESIGN REQUIREMENT**

- 3.1 The coal mill reject bunker shall be fabricated of mild steel plate with adequate stiffeners welded on. The bunker shall be supported on the concrete foundation provided by the purchaser. Foundation bolts, gratings etc. shall be provided by the bidder.
- 3.2 The reject bunker shall be complete with twin sector discharge gate, stainless steel liners, flanged connections, platforms, gratings/chequered plates, access staircase, hand railings etc. The equipment shall be designed and equipped for outdoor operation, complete with all accessories.

### **4.0 CONSTRUCTIONAL FEATURES**

- 4.1 The bunker shall be of welded structure and shall be provided with necessary supporting structure. Flanged opening shall be provided at the bottom of the bunker for attaching the twin sector gate. The inclined part of the bunker shall be designed with a valley angle of not less than 60 deg. To the horizontal. The design of the bunker shall be such that the problem of formation of arch is eliminated. The inside surface shall be provided with liner MOC as specified elsewhere in the specification. Explosion diaphragm/Pressure relief valve shall be provided to release air from the bunker in case pressure inside the bunker exceeds 1 .0 kg/cm<sup>2</sup>(g)
- 4.2 Vendor shall furnish all steel work required for support and access for operation and maintenance. This shall include platforms, grating/chequered plates, stairways, hand railings, base plates, foundation bolts etc. Purchaser will provide only the foundation with pockets. The bunker shall have shed over it and shall be provided with monorail & hoist for equipment handling.
- 4.3 The storage bunker shall be so arranged that any 10 ton capacity truck can be conveniently loaded under it by an operator standing on the platform.
- 4.4 Access and platform shall be provided with 32 mm thick MS grating & 32 mm MS GI pipe hand railing.
- 4.5 The storage bunker shall be provided with filter bags as specified elsewhere in the specification. Filter bags shall be suitably treated to minimize the chances of filter catching fire. It shall be possible to plug opening for damaged bag filters, if any, to facilitate un-interrupted operation. Suitable explosion vents shall be provided for the bag filter unit. Sequential cleaning cycle shall be initiated with pressure drop signal across the bag filter once sufficient cleaning air pressure is available. Solenoid/pneumatic valves shall be provided for this purpose. Bag cleaning mechanism shall be automatic and shall comprise of solenoid valves. Air nozzles shall be provided just above the filter to facilitate individual cleaning of each bag.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT BUNKER AND  
ACCESSORIES**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

4.6 The terminal boxes for terminating reject conveying pipes shall be of steel construction with necessary deflector or impingement plate to take care of impact and wear due to high velocity reject particles discharging into the bunker.

## 5.0 INSPECTION AND TESTING

5.1 The purchaser shall have a free access at all reasonable times to these parts of manufacturer's works which are concerned with the fabrication of the steel work and shall be afforded all reasonable facilities at all stages of preparation, fabrication and trial assemblies for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this specification.

5.2 Should any structure or part of a structure be found not to comply with any of the provisions of this specification, it shall be liable to rejection. No structure or part of structure, once rejected shall be resubmitted for inspection/ test except in cases where the purchaser or his authorized representative considers the defect as rectifiable. Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the purchaser. The purchaser may, at his discretion, check the test results obtained at the manufacture's works by independent tests at the government test house or elsewhere and should the material so tested be found to be unsatisfactory shall be rejected. The cost of such tests shall be borne by the contractor.

5.3 Examination of material of construction, verification, correlation and identification with material test certificate.

5.4 Ensuring that the relevant weld procedure and welder qualifications tests are in accordance with fabrication code.

5.5 Inspection during fabrication at appropriate stage including fit up. Witness of dye penetrant testing at root and final run for all groove welds and final run for fillet welds as per ASTM E 165. All surfaces examined shall be free of:

- a) Relevant linear indications (Linear indications are those indications in which length is more than three times the width and only indication with major dimension greater than 1.6 mm shall be considered relevant).
- b) Four or more rounded defects in a line separated by 1.6 mm or less (edge to edge). Rounded indications are those where length less than three times the width.

5.6 Any other tests as specified in the fabrication code.

5.7 Dimensional check match marking as per approved drawings.

## 6.0 SCOPE OF INSPECTION FOR RACK AND PINION GATE



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT BUNKER AND  
ACCESSORIES**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

- 6.1 Examination of materials of construction, verification, correlation/testing and identification of material with test certificate for important items like body, drives, warm shaft, rack & pinion, wheel etc.
- 6.2 Dye Penetration check on drive shaft & warm shaft as per IS-3658 and there shall be no surface defects.
- 6.3 Dimensional check
- 6.4 For chain proof load shall be carried out.
- 6.5 Hardness of rubber component
- 6.6 Check for overall dimension, completeness, no load working after assembly.
- 6.7 Clearing, marking and painting.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL DISCHARGE SPOUT & PYRITE  
HOPPER**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

### Mill Discharge Spout and Pyrite Hopper

- Each coal mill has a discharge spout with a pneumatic cylinder operated knife gate valve for discharging rejects into a pyrite hopper of adequate capacity. This hopper shall serve to store the mill rejects between each operating cycle of dense phase system. Minimum effective storage capacity shall be 2-3 times the effective (batch capacity) of the conveying vessel.
- Each pyrite hopper shall be provided with a knife gate valve of approved design at the bottom, adequately sized manhole/inspection door, sizing grid and emergency chute with Knife gate valve and reject quenching arrangement (water spray) shall be provided. Any platform/ structural support (as per IS 2062 Gr A/B) required to maintain the above equipment before transporter vessel's inlet valve. Necessary explosion vent (rupture disc with MOC SS 304/316) of proven design shall be provided in each pyrite hopper.
- Each emergency chute shall be provided with a knife gate valve to transfer mill rejects from pyrite hopper to ground or to Owner's trolley. Necessary access and platform shall be provided. Limit switches shall be provided to indicate the valve position on control panel.
- Each pyrite hopper shall be provided with two level switches – one to start the operating sequence and the other to indicate the hopper above grid chocked condition.
- Open & Close Limit switches shall be provided in all KGVs and these limit switches shall be interlocked with MRS control system. Solenoid box cum local control panel shall be provided. Same shall house system start stop, vessel pressure indication, probe over ride, purge button so that system can be locally optd. It shall be possible to operate individual vessel from local pneumatic panel for few cycles in emergency.
- Following control modes shall be provided
- Remote mode: System shall be controlled through MRS control System.
- Local Mode:
  - a) Energized mode: Manual override shall be selected from MRS control System. System logic shall be executed in MRS control system itself.
  - b) De-energized mode: MRS control system shall be delinked and system (individual stack up assembly) shall be operated manually.
- The sizing grid shall be provided inside the pyrite hopper to prevent oversized mill rejects, tramp iron etc. from entering the conveying vessel. The arrangement for collecting bigger pieces of coal rejects from the grid includes, among others, Knife Gate Valve, chute work etc. Bigger pieces of coal rejects shall roll down from the



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL DISCHARGE SPOUT & PYRITE  
HOPPER**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -D

REV. NO. 00

DATE:

Page

grid and through KGVs, chute work etc. Bigger pieces of coal rejects shall roll down from the grid and can be removed through the over sized seized reject removal gate (to be provided preferably at the bottom of inspection door) be discharged to Owners trolley. The arrangement shall be finalized during detail engineering. The grid shall be made of minimum 10 mm dia.



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**1X800 MW WANAKBORI TPS**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001	
VOLUME <b>II-B</b>	
SECTION -C	
REV. NO. 00	DATE:
Page	

## SECTION – E

**1X800 MW WANAKBORI TPS - MILL REJECT HANDLING SYSTEM**

**ANNEXURE-I**

**PROPOSED SUB-VENDOR LIST (with tentative inspection category)**

Sl. No	ITEM/SERVICE	QAP/ INSP.CAT.	Scope of supply/manufacturer	Place	Remarks by BHEL
<b>I</b>	<b>SELF MFG ITEMS</b>				
1	Pyrite Hopper	I	Self manufacturer		
2	Blow Tank	I	Self manufacturer		
3	Bunker Discharge Gate (Sector Gate)	I	Self manufacturer		
4	Pressure Relief Valve	I	Self manufacturer		
5	Local Control Panel with accessories	I	Self manufacturer		
6	Mill Reject Conveying fittings/Bends	I	Self manufacturer		
7	Swing Valve(Pneumatic operated)	I	Self manufacturer		
<b>II</b>	<b>BOUGHT OUT ITEMS</b>				
<b>A</b>	<b>MECHANICAL</b>				
1	Terminal Box	I	BHEL/Customer Approved Fabricators	INDIA	
2	Air Receiver	I	PARKARE	DELHI	
		I	UNITTED ENGG WORKS	NASIK	
		I	INTEGRATED ENGINEERS	PUNE	
		I	TEMASME VESELLEX	NOIDA	
		I	DIAMOND FABRICATIONS	PUNE	
3	DRAIN TRAP	III	SPIRAX MARSHAL	MUMBAI	
		III	GREAVES COTTON	MUMBAI	
		III	TRIDENT	COIMBOITORE	
4	Gate, Globe, Check valves/ NRV - C.I up to 600NB PN16	III	LEADER	JULLANDHAR	
		III	BANKIM	HOWRAH	
		III	H SARKAR	HOWRAH	
		III	KBL	KONDHAPURI	
		III	AV VALVES	AGRA	
5	Gate, Globe, Check valves/ NRV - G.M	III	LEADER	JULLANDHAR	
		III	BOMBAY METALS & ALLOYS (GG)	MUMBAI	
		III	SANT VALVES	JULLANDHAR	
6	Knife Gate/Plate Valve (H/W Operated & Cylinder Optd)	I	FOURESS	MUMBAI	
		I	VASS	CHENNAI	
		I	ORBINOX	COIMBATORE	
7	Ball Valves	III	Weir BDK	HUBLI	
		III	FLOW CHEM	KALOL	
		III	PRECISION ENGG	MUMBAI	
		III	LEADER	JULLANDHAR	
8	Safety Relief Valve	III	LEADER	JULLANDHAR	
		III	KAYSTONE(TYCO FLOW CONTROL)	HALOL	
		III	BHEL	TRICHY	
9	M.S G.I / ERW PIPES	III	SPIRAX MARSHAL	AGRA	
		I	JINDAL	GHAZIABAD	
		I	SURYA ROBINI	BAHADURGARH	
		II	SAIL	ROURKELA	
		I	WELLSPUN	ANJAR	
		I	INDUS	GB NAGAR	
		II	TISCO	JAMSHEDPUR	
10	Metallic Expansion Bellow(Metallic)	I	MAHARASHTRA SEAMLESS	MAHARASHTRA	
		I	METALLIC BELLOWS	CHENNAI	
		I	SUR INDUSTRIES	KOLKATA	
11	Rupture Disc	I	LONESTAR	CHENNAI	
		II	BS & B SAFETY SYSTEM	CHANNAI	
12	Chain Pulley Block (1 Ton)	II	HERCULES (INDEF)	MUMBAI	
		II	TRACTEL	FARIDABAD	
		II	LIFTING EQUIPMENTS & ACCESSORIES	DELHI	
13	Conveying Air Compressor (Screw Type)	I	ELGI EQUIPMENTS LTD	COIMBATORE	
		I	ATLAS COPCO (INDIA) LTD.	PUNE	
		I	INGERSOLL RAND	NEW DELHI	
14	Sump Pump (Water Service)	II	KSB PUMP	PUNE	
		II	MATHER & PLATT	PUNE	
		II	B & C	CHENNAI	
		II	SAM	COIMBOITORE	
		II	KIRLOSKER	PUNE	
		II	FLOWMORE	GHAZIABAD	
		II	WORTHINGTON	GHAZIABAD	
15	Pneumatic Actuator/Cylinder(Metallic)	III	SCHRADDER	MUMBAI	
		III	NUCON	HYDERABAD	
		III	ROTEX	MUMBAI	
		III	VAAS	CHENNAI	

16	GRATING	III	INDIANA	PUNE	
17	Tools & Trackles	III	BRANDED		
18	Steel Plate/ Structure/ Section/ SS liner	III	SAIL		
		III	JSW STEEL LTD.		
		III	TISCO		
		III	ESSAR STEEL		
		III	IISCO		
		III	LLOYDE STEEL INDUSTRIES LTD.		
		III	JINDAL STEEL & POWER LTD.		
		III	RINL		VIZAG

19	Bag Filter	I	ORIENT FANS (ACCO)	KOLKATA
		I	THERMAX	PUNE
		I	FLAKT	MUMBAI
		I	BATLIBOI	DELHI
<b>B</b>	<b>ELECTRICAL &amp; INSTRUMENTATION</b>			
1	Motor (LT)	I	MARATHON	KOLKATA
		I	SIEMENS	MUMBAI
			NGEF	BANGLORE
		I	KEC	BANGALORE/HUBLI
		I	CGL	AHMED NAGAR
		I	ABB	FARIDABAD/BANGLORE
2	Air Filter/Lubricator/Regulator	I	BBL	MUMBAI
		III	SHAVONORGAN	MUMBAI
3	Level Probes(RF)/Capacitance type	III	PLACKA	CHENNAI
		II	EIP ENVIRO LEVEL CONTROL	NOIDA
		II	NIVO CONTROL	INDORE
4	Annunciator	III	E&H	GERMANY/AURANGABAD
		II	FLOW STAR	FARIDABAD
		III	IIC	MUMBAI
		III	PECON	AHEMDABAD
5	Solenoid Valves	III	PROCON	CHENNAI
		III	NUCON	HYDERABAD
		III	JEFFERSON	ARGENTINA
6	Pressure Switch, DP Switch/ Temp.Switch	III	HARION	GERMANY/AURANGABAD
		III	ASCO(I)	CHANNAI
		III	SCHRADER DUNCAN LTD.	MUMBAI
		III	AVCON CONTROLS	MUMBAI
		III	ROTEX AUTOMATION	BARODA/VV NAGAR
		II	SWITZER	CHENNAI
7	Pressure Gauge & DP Gauge	II	TRAFAG	RANIPETH
		II	GAUGE BOURDON (FOR PRESSURE SWITCH)	PANVEL
		II	ASHCROFT	GANDHINAGAR
		II	ASHCROFT	USA/GERMANY
		III	GAUGE BOURDON	PANVEL
		III	MANOMETER INDIA	MUMBAI
		III	AUXITROL	UK
		III	BUNDENBURG	UK
		III	GOA THERMOSTATIC	GOA
		III	GUCK INDIA	MUMBAI
8	Temperature Gauge	III	WIKA	PUNE
		III	SWITZER(DP INDICATOR)	CHENNAI
		III	AN INSTRUMENTS	KOLKATA
		III	H GURU (SI)	BANGALORE
		III	WAREE	MUMBAI
		III	GIC	MUMBAI/GOA
9	Pulse Jet Valves	III	BUDENBURG	UK
		III	GOA THERMOSTATIC	GOA
		III	H GURU (SI)	BANGALORE
10	Cable Lug	III	WAREE	MUMBAI
		III	ASCO	CHENNAI
		III	MANIK	CHENNAI
11	Limit Switch	III	BILLET (3D)	VALSAD
		III	DOWELLS	MUMBAI
		III	COMETT	NASIK
12	Junction Boxes & Earthing Material ROD, FLAT etc.	III	JAIBALAJI	CHANNAI
		III	SIEMENS	MUMBAI
14	INSTRUMENT CABLE	III	Customer/BHEL APPROVED VENDOR	
		I	DELTON CABLES	BANGLORE
		I	PARAMOUNT CABLES	FARIDABAD
		I	POLYCAB	DAMAN
		I	UNIVERSAL CABLES	SATNA
		I	NICCO	KOLKATTA
		I	CORDS	BHIWADI
15	Cable Tray	I	INCAB	PUNE
		II	MJ ENGG	DELHI/BHIWADI
		II	JAMUNA METALS	DELHI/SONEPAT
		II	INDUSRIAL PERFORATION	KOLKATA
		II	INAR PROFILES	ANAKAPLLI
		II	INDIANA	MUMBAI
16	Cable Gland	II	TECHNO	CHANDIGARH
		III	COMMET	MUMBAI
		III	SUNIL & CO	KOLKATA
		III	ARUN ENGG.	KOLKATA

		III	QUALITY PRECISION	KOLKATA	
17	Local Panel/LPBS	I	CONTROL DEVICES	KOLKATA	
			PYROTECH	UDAIPUR	
			C&S	NOIDA/HARIDWAR	
			INDUS CONTROL AND APPLIANCE	MUMBAI	
			POSITRONICS	BARODA	
			SWITCHING CIRCUITS	KOLKATA	
			JACKSON	GR. NOIDA	
			JOLLY ENGG.	KOLKATA	
18	FRP JUNCTION BOXES	III	Customer/BHEL APPROVED VENDOR	INDIA	
19	LEVEL INDICATOR/GAUGE	III	SBEM PVT. LTD.	PUNE	
		III	PUNE CONTROL	PUNE	
		III	LEVCON	KOLKATA	
		III	SIGMA	MUMBAI	
		III	DK INSTRUMENTS	KOLKATA	

**NOTE: Category of inspection and make shall be subject to customer's approval during detail engineering.**

**LEGENDS**

1. QP/INSPN CATEGORY :

CAT-I : For these items the Quality Plans are approved by Customer and the final acceptance will be on physical inspection witness by Customer.

CAT-II : For these items the Quality Plans approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by Customer shall be on the basis certificate of conformance by the main supplier

UNIT/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.

NOTE-1

For steel following modalities to be adopted **(Rev.-01)**

a) Steel plate, structural steel and section shall be procured from main producers like SAIL/TISCO/ISSCO/RINL/JINDAL/ESSAR/ISPAT/LLOYD'S STEEL/JSW.

b) Material will be delivered directly from manufacturer's plant/stock yard/ godown to Customer project site.

c) Correction of material with MTC will be done by Main Contractor before delivery and Correlated MTC along with delivery challan will be Customer-RIO for issuance of MDCC.

NOTE-2

It that the same Quality Plans as approved for main equipment and identified in the vendor list shall be applicable for the type of control measure i.e. make test/check the procurement of mandatory spares. However, for those spares which are not covered in the approved QP, main supplier shall furnish Certificate of Conformance (COC) along with guarantee and interchangeability certificate duly signed by the main contractor. However, in both cases, the Interchangeability certificate shall be generated by the main item manufacturer, for which the spares are made.

NOTE-3

A) LESS THAN 30 KW:-

Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows:

it is here confirmed that the above mentioned motor/motors was /were manufacture taking care of Customer specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/data sheet

B) 30 KS AND ABOVE & upto 50KW:-

Acceptance of Motor rating between 30 KW & 50 KW is based on Customer review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/were manufactured taking care of Customer specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise , distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing/data sheet



TITLE  
**TECHNICAL SPECIFICATION FOR  
 MILL REJECT HANDLING SYSTEM  
 1X800 MW WANAKBORI TPS**

SPECIFICATION NO. PE-TS-408-160-A001

VOLUME III

SECTION

REV 0

DATE

SHEET 1 OF 1

**ANNEXURE-II**  
**MANDATORY SPARES LIST**

S.No.	Equipment Name	Quantity
1	AIR COMPRESSOR	
1.1	End bush	2 Nos
1.2	Bearing	2 Nos
1.3	Nut & Lock nut	2 Nos
1.4	Sealing ring	2 Nos
1.5	Bearing ring	2 Nos
2	INLET VALVE (Dome type)	
2.1	Cone/ Dome/ Flap/ Disc	5 Nos
2.2	Gasket	10 Nos
2.3	Body	2 Nos
2.4	Cylinder	2 Nos
2.5	Complete Assembly	2 Nos
3	Knife Gate Valve	
3.1	Slide plate	5 Nos
3.2	Body	4 Nos
3.3	Complete assembly	2 Nos
4	415 Volt Motor (Up to 30 Kw rating)	
4.1	Driving end and non-driving end bearing.	1 Set of each type and rating of motor
4.2	Cooling fan	1 Set of each type and rating of motor
4.3	Motor Terminal Block	1 Set of each type and rating of motor
4.4	Complete Set of Coupling	1 set for each application
5	415 Volt Motor (above 30 KW rating up to 160 KW)	
5.1	End Shield Cover Driving & Non-Driving End	1 Set for each type and rating of Motor
5.2	Driving End & Non-Driving End Bearing	1 Set for each type and rating of Motor
5.3	Cooling Fan	1 No. for each type and rating of Motor
5.4	Motor Space Heater	1 No. for each type and rating of Motor
5.5	Motor Terminal Block	1 No. for each type and rating of Motor
5.6	Complete Set of Coupling	1 Set for each Application
6	Field Instruments	
6.1	Transmitters/Temperature elements (TC/RTD)/Gauges/Switches etc. along with relevant accessories	10% of total of each type or at least one (whichever is higher) for each type along with accessories.
7	Control panel/desk mounting panel	
7.1	Push button	
7.1.1	Complete assembly	5 Nos. for each type colour.
7.1.2	Contact element (1 NO + 1 NC) Block	20 Nos
7.2	Selector switch	10 nos. of each type and rating.
7.3	Meter (analog or digital)	
7.3.1	Ammeter	10 % for each type and range or minimum one (1) no. whichever is more.
7.3.2	Voltmeter	10 % for each type and range or minimum one (1) no. whichever is more.
7.3.3	Frequency	10 % for each type and range or minimum one (1) no. whichever is more.
7.3.4	MW	10 % for each type and range or minimum one (1) no. whichever is more.



TITLE  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM  
1X800 MW WANAKBORI TPS**

SPECIFICATION NO. PE-TS-408-160-A001

VOLUME III

SECTION

REV 0

DATE

SHEET 2 OF 1

7.3.5	MVAR	10 % for each type and range or minimum one (1) no. whichever is more.
7.3.6	Power factor	10 % for each type and range or minimum one (1) no. whichever is more.
7.3.7	Synchro scope	10 % for each type and range or minimum one (1) no. whichever is more.
7.4	Indicating lamps complete assembly	10 nos. for each colour and type.
7.5	Mimic lamp	10 nos. for each colour and type.
7.6	MCB	2 nos. for each type and rating.
7.7	Door limit switch	2 nos.
7.8	Annuciation system	
7.8.1	Lamp box with facia & lamp (LED TYPE)	25 nos.
7.8.2	Hooter	1 no.
7.8.3	Each type of PCB (for non- PLC driven system).	1 no. (part of DCS)
8	Actuator	
8.1	Complete set actuator	1 nos. for each type and rating.
8.2	Limit switch	2 nos. for each type and rating.
8.3	Torque switch	2 nos. for each type and rating.
8.4	Auxiliary contact	1 nos. for each type and rating.
8.5	Motor	1 nos. for each type and rating.
8.6	Complete seal of kit	1 set for each type and rating.
8.7	Complete o ring set	1 set.

**NOTES:**

a)	Unless stated otherwise, a 'set' means item or sub-items required for each type/ size, range of assembly/ sub- assembly required for complete replacement in one equipment system; it is further intended that the assembly/ sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in marinating two different sets of spares to be used for subject assembly/ sub assembly, these shall be considered as different type of assembly/ sub assembly.
b)	Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by the vendor shall be the specified percentage (%) of total population required to meet the specification requirements. In case the quantity of mandatory spares so calculated happens to be in fraction, the same shall be rounded off to next higher whole number.
c)	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all the items supplied and installed and the breakup of these shall be furnished by the vendor during detail engineering.
d)	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to the offered design with quantities generally in line with the approach followed in the above list.
e)	Wherever bidder has indicated an item as not applicable, the same will have to be supplied free of cost, in case it is found applicable during detail engineering.

1X800 MW WANAKBORI TPS - Mill Reject Handling System		
ANNEXURE-III		
LIST OF TOOLS & TACKLES		
S.No.	Details of Works or Equipment/System	Total Quantity
1	Spur geared chain pulley block of 2.0 tonnes capacity, 3 mtr	1 No.
2	2 lbs ball pen hammers	2 Nos.
3	Cold Chisel 8"	2 Nos.
4	6" Outside and insider caliperse	2 Nos.
5	Double end spanners and ring spanners upto 1" size	2 Sets
6	6" ft long measuring tape	1 No.
7	a) Hacksaw frames ½" x 12	4 Nos.
	b) HSS Blade 12 x ½"	6 Nos.
	c) Hacksaw blades	6 Nos.
8	Allen Key Set	2 Sets
9	Pipe Wrenches 18"	2 Nos.
10	10" right angle	1 No.
11	12" Aluminium Spirit Levels	2 Nos.
12	Filter Gauges 8" & 12"	2 Sets
13	10" Slide wrenches	2 Nos.
14	6", 8", 10", 12" screw drivers	1 Set
15	Insulated Pliers 8"	1 No.
16	Tommy Bars 6"	2 Nos.
17	a) Cotton Hand Gloves	2 Pair
	b) Lather Hand Gloves	2 Pair
18	Lifting wire rope slings 8 ft. with eye at each end ½" size	2 Pair
19	Wrachet and sockets set for hexagonal head screws & bolts size M-16 to M-24	1 Set
20	Flaring tools with disc	1 Set
21	Grease Gun	01 No.
22	Oil Gun	1 No.
23	Screw Pitch Gauge	1 Nos.
24	a) JK Flat file 12" smooth	2 Nos.
	b) JK Half round file 12" rough	2 Nos.
	c) JK Half round file 12" fine	2 Nos.



TITLE

**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM  
1X800 MW WANAKBORI TPS**

SPECIFICATION NO. PE-TS-408-160-A001

VOLUME III

SECTION

REV 0

DATE

SHEET 1 OF 4

**DRAWINGS/DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT (ANNEXURE-IV)**

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

S. No.	BHEL DRAWING NO.	DRAWING TITLE	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI	CATEGORY
1	PE-V0-408-160-A002	GA OF WATER AND AIR LINE VALVES	12	A-BHEL
2	PE-V0-408-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR	10	A-CUST
3	PE-V0-408-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM	4	A-CUST
4	PE-V0-408-160-A005	INSTRUMENT SCHEDULE	10	A-BHEL
5	PE-V0-408-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM	4	A-CUST
6	PE-V0-408-160-A007	DETAILED BOM	20	I-BHEL
7	PE-V0-408-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BUNKER DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)	6	A-CUST
8	PE-V0-408-160-A009	DEMONSTRATION TEST PROCEDURE	20	I-CUST
9	PE-V0-408-160-A010	P & I DIAGRAM OF MRS COMPRESSOR	10	A-CUST
10	PE-V0-408-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY.	4	A-CUST
11	PE-V0-408-160-A012	WELDING PROCEDURE SPECIFICATION	6	I-CUST
12	PE-V0-408-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE	8	A-CUST
13	PE-V0-408-160-A014	LAYOUT OF COMPRESSOR HOUSE	10	A-CUST
14	PE-V0-408-160-A015	QAP OF MS STRUCTURAL STEEL/ PLATES	6	A-BHEL
15	PE-V0-408-160-A016	EARTHING LAYOUT	10	A-CUST
16	PE-V0-408-160-A017	QAP OF SELF MANUFACTURED- CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL	8	A-CUST



<b>TITLE</b> <b>TECHNICAL SPECIFICATION FOR</b> <b>MILL REJECT HANDLING SYSTEM</b> <b>1X800 MW WANAKBORI TPS</b>	SPECIFICATION NO. PE-TS-408-160-A001	
	VOLUME III	
	SECTION	
	REV 0	DATE
	SHEET 2 OF 4	

17	PE-V0-408-160-A019	G.A OF MRS BUNKER	6	A-CUST
18	PE-V0-408-160-A020	QAP OF MS ERW PIPE	10	A-BHEL
19	PE-V0-408-160-A021	QP FOR COMPRESSOR	10	A-CUST
20	PE-V0-408-160-A022	TRENCH AND INSERT DETAIL OF MRS	8	A-CUST
21	PE-V0-408-160-A023	QP FOR KNIFE GATE/PLATE VALVE	10	A-BHEL
22	PE-V0-408-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER	10	A-CUST
23	PE-V0-408-160-A025	GA OF KNIFE GATE/PLATE VALVE	8	A-BHEL
24	PE-V0-408-160-A026	QP FOR BAG FILTER	10	A-BHEL
25	PE-V0-408-160-A027	G.A OF BAG FILTER	8	A-BHEL
26	PE-V0-408-160-A028	QP FOR METALLIC EXPANSION BELLOW	10	A-BHEL
27	PE-V0-408-160-A030	QP FOR RUPTURE DISC	10	A-BHEL
28	PE-V0-408-160-A031	QP FOR CHAIN PULLEY BLOCK	10	A-BHEL
29	PE-V0-408-160-A032	QP FOR WATER AND AIR LINE VALVES	10	A-BHEL
30	PE-V0-408-160-A033	QP FOR COMPRESSOR MOTOR	10	A-CUST
31	PE-V0-408-160-A034	G.A OF METALLIC EXPANSION BELLOW	8	A-BHEL
32	PE-V0-408-160-A035	G.A. OF RUPTURE DISC.	8	A-BHEL
33	PE-V0-408-160-A036	QAP of INSTRUMENTS (PG/PS/PT/TS/TG/SV)	12	A-BHEL
34	PE-V0-408-160-A037	GA OF CHAIN PULLEY BLOCK	8	A-BHEL
35	PE-V0-408-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR	10	A-CUST
36	PE-V0-408-160-A044	QP FOR SUMP PUMP WITH MOTOR	12	A-BHEL
37	PE-V0-408-160-A045	GA, TECHNICAL DATA SHEET AND WIRING DIAGRAM OF SUMP PUMP	10	A-BHEL
38	PE-V0-408-160-A046	ELECTRICAL LOAD LIST	6	I-BHEL
39	PE-V0-408-160-A047	TECHNICAL DATA SHEET OF TEMPERATURE SWITCH, TEMPERATURE GAUGE, PRESSURE SWITCH, PRESSURE GAUGE, SOLENOID VALVE , LEVEL SWITCH , AIR FILTER REGULATOR	10	A-BHEL



<b>TITLE</b>  <b>TECHNICAL SPECIFICATION FOR</b> <b>MILL REJECT HANDLING SYSTEM</b>  <b>1X800 MW WANAKBORI TPS</b>	SPECIFICATION NO. PE-TS-408-160-A001	
	VOLUME III	
	SECTION	
	REV 0	DATE
	SHEET 3 OF 4	

40	PE-V0-408-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O LIST	10	A-CUST
41	PE-V0-408-160-A051	CABLE INTERCONNECTION DIAGRAM	14	I-CUST
42	PE-V0-408-160-A052	PAINTING SCHEDULE	8	I-CUST
43	PE-V0-408-160-A053	PIPING AND VALVE SCHEDULE	8	I-CUST
44	PE-V0-408-160-A054	CABLE SCHEDULE -SIGNAL AND CONTROL	12	I-CUST
45	PE-V0-408-160-A055	OPERATION AND MAINTENANCE MANUAL	24	I-CUST

**Notes:**

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
5. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
  - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
  - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.
  - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade name.
  - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
  - e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ....etc.



<b>TITLE</b>  <b>TECHNICAL SPECIFICATION FOR</b> <b>MILL REJECT HANDLING SYSTEM</b>  <b>1X800 MW WANAKBORI TPS</b>	SPECIFICATION NO. PE-TS-408-160-A001	
	VOLUME III	
	SECTION	
	REV 0	DATE
	SHEET 4 OF 4	

6. Drawings and documents not covered above but required to check safety of machines/system, shall be submitted during detailed engineering stage without any commercial implication.
7. All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
8. All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No.
9. Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
10. Bidder to follow the following the drawing submission schedule:
  - 1st submission of drawings from date of LOI as per the submission schedule.
  - Every revised submission incorporating comments – within 10 days.
  - BHEL/Customer shall furnish their approval/comments within 21 days of submission
  - Bidder to submit revised drawings complete in all respects 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.



<b>TITLE</b> <b>TECHNICAL SPECIFICATION FOR</b> <b>MILL REJECT HANDLING SYSTEM</b> <b>1X800 MW WANAKBORI TPS</b>	SPECIFICATION NO. PE-TS-408-160-A001	
	VOLUME III	
	SECTION	
	REV 0	DATE
	SHEET 1 OF 1	

### LIST OF BASIC DRAWINGS

BHEL DRAWING NO.	DRAWING TITLE
PE-V0-408-160-A002	GA OF WATER AND AIR LINE VALVES
PE-V0-408-160-A003	G.A., TECHNICAL DATA SHEET OF AIRCOMPRESSOR MOTOR
PE-V0-408-160-A004	DESIGN PHILOSOPHY AND SYSTEM SIZING CALCULATION OF MILL REJECT SYSTEM
PE-V0-408-160-A006	P & I DIAGRAM OF MILL REJECT HANDLING SYSTEM
PE-V0-408-160-A008	GA & DS OF SELF MFG. ITEMS (DENSVEYOR, HOPPER, BNKR DIS. GATE, PRV, ACI BEND, PNEU. PANEL, AIR RECVR, TER. BOX, ETC.)
PE-V0-408-160-A011	SUB VENDOR LIST WITH INSPECTION CATEGORY
PE-V0-408-160-A013	EQPT AND PIPING LAYOUT OF MILL REJECT SYSTEM AND PIPING LAYOUT FROM COMPRESSOR HOUSE
PE-V0-408-160-A014	LAYOUT OF COMPRESSOR HOUSE
PE-V0-408-160-A017	QAP OF SELF MANUFACTURED-CONVEYING VESSEL , PYRITE HOPPER, BUNKER DISCHARGE GATE, PRESSURE RELIEF VALVE, TERMINAL BOX , ACI BEND, AIR RECEIVER , PNEUMATIC PANEL
PE-V0-408-160-A019	G.A OF MRS BUNKER
PE-V0-408-160-A022	TRENCH AND INSERT DETAIL OF MRS
PE-V0-408-160-A024	DESIGN CALCULATION AND STRUCTURAL ARRANGEMENT OF BUNKER AND LOAD DATA OF BUNKER
PE-V0-408-160-A043	G.A., TECHNICAL DATA SHEET AND FOUNDATION DETAILS OF AIRCOMPRESSOR, GA AND WIRING DIAGRAM FOR LOCAL PANEL OF CONVEYING AIR COMPRESSOR
PE-V0-408-160-A048	CONTROL WRITE-UP & INTERLOCK & PNEUMATIC CIRCUIT OF CONVEYING VESSEL, BLOCK LOGIC DIAGRAM/CONTROL SCHEME WITH HMI SCREEN & I/O LIST

**Note:** Drawings listed above have been identified as basic drawings. During contract engineering stage, approval of these drawings from BHEL/Customer shall be treated as clearance to milestone payment for against design & engineering.



<b>TITLE</b> <b>TECHNICAL SPECIFICATION FOR</b> <b>MILL REJECT HANDLING SYSTEM</b> <b>1X800 MW WANAKBORI TPS</b>	SPECIFICATION NO. PE-TS-408-160-A001	
	VOLUME III	
	SECTION	
	REV 0	DATE
	SHEET 1 OF 4	

## ANNEXURE-V

### DRAWING/DOCUMENT SUBMISSION PROCEDURE:

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System (DMS). Bidder would be provided access to DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)”
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor section. For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

## ANNEXURE-VI

### Check List for Operation & Maintenance Manual

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

Sl.no. & Sections	Description	Tick ( <input type="checkbox"/> )if included in Manual			Remarks
		Yes	No	Not Applicable	
<b>1.</b>	<b>Cover page</b>				
<b>1.1</b>	Project Name				
<b>1.2</b>	Customer/consultant Name				
<b>1.3</b>	Name of Package				
<b>1.4</b>	Supplier details with phone, FAX ,email address , Emergency Contact number				
<b>1.5</b>	Name and sign of prepared by , checked by & approved by				
<b>1.6</b>	Revision history with approval Details				
<b>2.0</b>	<b>Index</b>				
<b>2.1</b>	showing the sections & related page nos All the pages should be numbered section wise				
<b>3.0</b>	<b>Description of Plant/System</b>				
<b>3.1</b>	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
<b>3.2</b>	Equipment list and basic parameter with Tag numbers				
<b>3.3</b>	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
<b>3.4</b>	Associated other packages and Interface /terminal points				
<b>3.5</b>	P&ID & Process Diagrams				
<b>3.6</b>	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
<b>3.7</b>	Single line/wiring diagrams				
<b>3.8</b>	Control philosophy /control write-ups				

<b>4.0</b>	<b>Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)</b>				
<b>4.1</b>	Pre-Commissioning Checks				
<b>4.2</b>	handling of items at site				
<b>4.3</b>	Storage at site				
<b>4.4</b>	Unpacking & Installation procedure				
<b>5.0</b>	<b>Operation Guidelines for plant personal/user/operator</b>				
<b>5.1</b>	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
<b>5.2</b>	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
<b>5.3</b>	Do's & Don't of the equipments.				
<b>5.4</b>	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
<b>5.5</b>	Parameters to be monitored with normal values and limiting values				
<b>5.6</b>	Trouble shooting with causes and remedial measures				
<b>5.7</b>	Routine operational checks, recommended logs & records				
<b>5.8</b>	Changeover schedule if more than one auxiliary for the same purpose is given				
<b>5.9</b>	Painting requirement and schedule				
<b>5.10</b>	Inspection, repair , Testing and calibration procedures				
<b>6.0</b>	<b>Maintenance guidelines for plant personal</b>				
<b>6.1</b>	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
<b>6.2</b>	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

<b>6.3</b>	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
<b>6.4</b>	Long term maintenance schedules especially for structural, foundations etc.				
<b>6.5</b>	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
<b>6.6</b>	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
<b>6.7</b>	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
<b>6.8</b>	List of mandatory and recommended spare parts list				
<b>6.9</b>	Tentative Lead time required for ordering of spares from the equipment supplier				
<b>6.10</b>	Guarantee and warranty clauses				
<b>7.0</b>	<b>Statutory and other specific requirements considerations.</b>				
<b>8.0</b>	<b>List of reference documents</b>				
<b>9.0</b>	<b>Binding as per requirement</b>				

Checked by

Dealing Engineer

Key Resource Person

Section Head

# SITE STORAGE AND PRESERVATION GUIDELINES FOR MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR  
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

## **CONTENT**

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
  - a) GENERAL STORAGE REQUIREMENTS
  - b) GENERAL PRESERVATION REQUIREMENTS
  - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

## **1. SCOPE OF THE DOCUMENT**

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

## **2. PURPOSE OF STORAGE & PRESERVATION**

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, lose some of their properties and become unusable due to atmospheric conditions and biological elements.

## **3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION**

### **a) GENERAL STORAGE REQUIREMENTS**

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

**b) GENERAL PRESERVATION REQUIREMENTS**

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
  - a. Rust preventive fluid (RPF)
  - b. Rust protective paints
  - c. Tarpaulin covers, in case of outdoor storage
  - d. De-oxy aluminate for weld-ments

**c) GENERAL INSPECTION REQUIREMENTS**

1. Period inspection of materials with specific reference to –
  - Ingress of moisture and corrosion damages.
  - Damage to protective coating.
  - Open ends in pipes, vessels and equipment -
    - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
  - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
  - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

#### 4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C )**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O )

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
<b>Raw material /mechanical items like pipes, plates, structure sections etc.)</b>				
1.	Steel pipes ( lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
<b>Fabricated mechanical items (pressure vessels, tanks etc.)</b>				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
<b>Mechanical components like valves, fittings, cables glands, spares etc.)</b>				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
<b>Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)</b>				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers( INTERNALS)	S	Damage , packing	
50.	Air conditioners ( split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators( CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
<b>Miscellaneous items like chain pulley blocks, hoists etc.</b>				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
<b>Chemicals and consumables ( acid, alkali, paints, oils, reagents and special chemicals)</b>				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H <sub>2</sub> SO <sub>4</sub> )	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals( powder)	C	Damage, Packing self- life	
77.	Laboratory chemicals( liquid)	C	Damage, Packing self- life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
<b>Electrical and C &amp; I items (motors, cables etc.)</b>				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments( gauges/analysers)	C	Damage	
<b>Special items</b>		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

## 5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

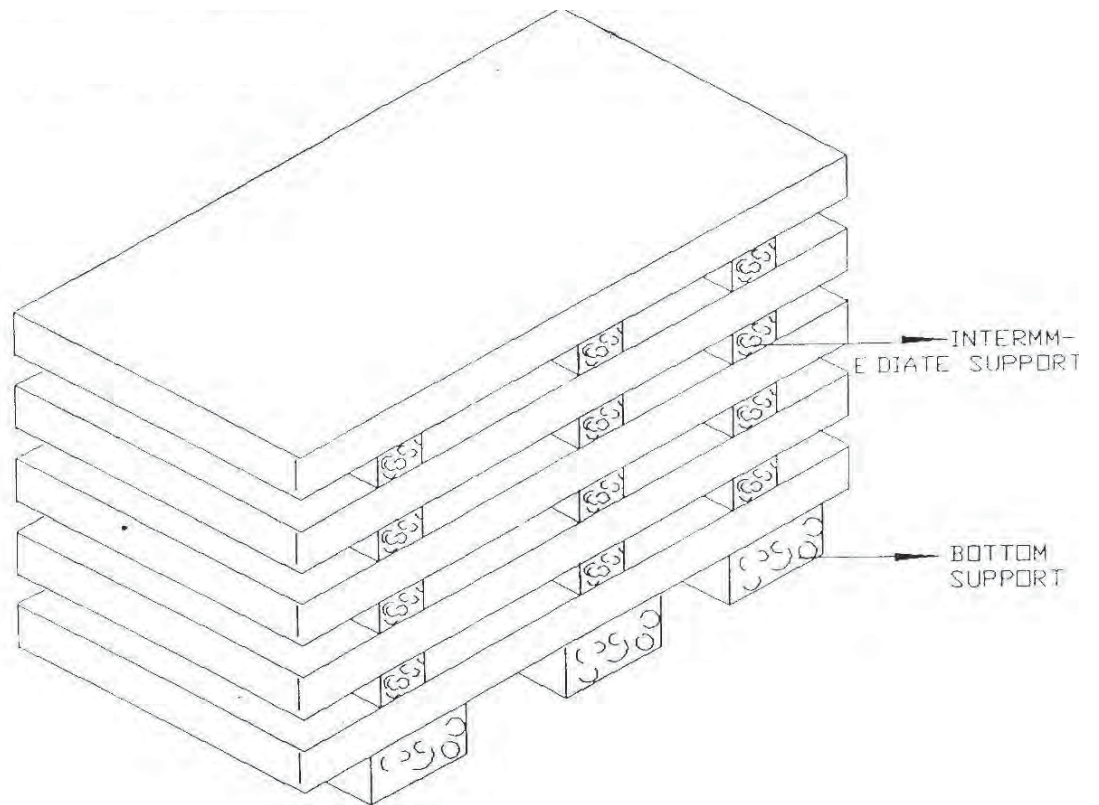


Figure – 1 – PLATE STACKING ARRANGEMENT

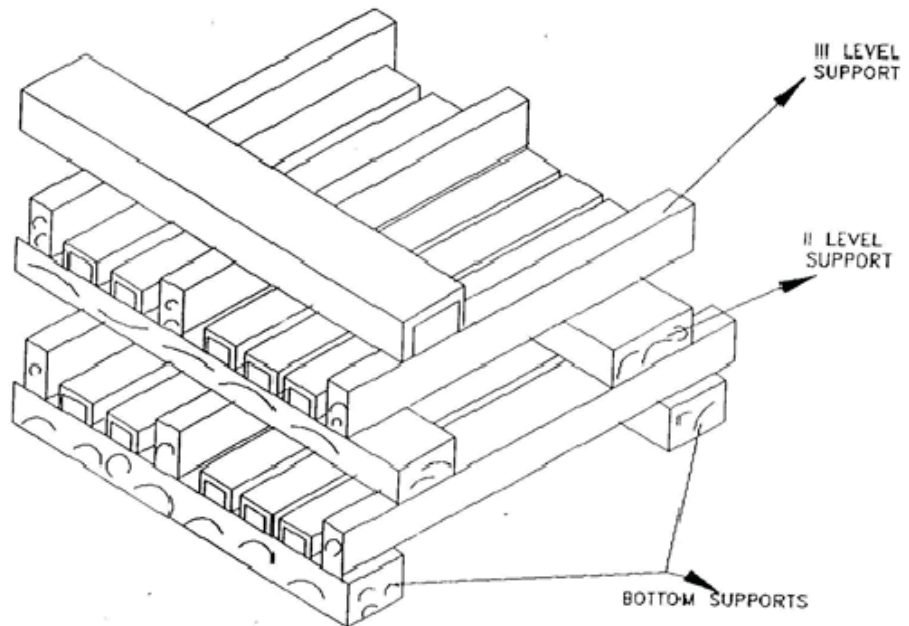


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



TITLE:  
**TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM**  
  
**1X800 MW WANAKBORI TPS**

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **III**

SECTION

REV. NO. 00

DATE:

Page

**VOLUME-III**



TITLE

**TECHNICAL SPECIFICATION FOR**  
**MILL REJECT HANDLING SYSTEM**  
**1X800 MW WANAKBORI TPS**

SPECIFICATION NO. PE-TS-408-160-A001

VOLUME - III

SECTION

REV 0

DATE

SHEET 1 OF 1

## **DRAWINGS/ DOCUMENTS TO BE SUBMITTED WITH THE BID FOR TECHNICAL EVALUATION**

Bidder shall submit the following drawings / documents along with their bid

- a) Copy of pre-bid clarifications, if any, duly signed & stamped.
- b) **Deviation schedule** with reference to specific clauses of the specification along with reason for such deviation and cost-of-withdrawal in the format given with price format.
- c) Signed and stamped copy of Compliance cum Confirmation Certificate (Vol-III)
- d) Un priced copy of price format indicating quoted/ not quoted against each row/column.
- e) Filled electrical load list (Format is enclosed with electrical portion specification- ANNEXURE-II)
- f) Stamped copy of Electrical Scope between BHEL & Vendor (enclosed with electrical portion specification).
- g) Signed and stamped copy of Supply price percentage break-up (enclosed with section C1)
- h) Electrical Equipment Specification for Mill Reject Handling System duly stamped (1 sheet).
- i) Filled format for list of recommended spares (Format is enclosed).

Note: OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.



TITLE: <b>TECHNICAL SPECIFICATION 1X800 MW WANAKBORI TPS COMPLIANCE CUM CONFIRMATION CERTIFICATE</b>	SPEC. NO.: PE-TS-408-160-A001
	VOLUME: III
	SECTION:
	REV. NO. 0      DATE
	SHEET 1      OF 2

**COMPLIANCE CUM CONFIRMATION CERTIFICATE**

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish 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 other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & 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. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.  
  
For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.
- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.



TITLE:  
**TECHNICAL SPECIFICATION  
1X800 MW WANAKBORI TPS  
COMPLIANCE CUM CONFIRMATION  
CERTIFICATE**

SPEC. NO.: PE-TS-408-160-A001

VOLUME: III

SECTION:

REV. NO. 0      DATE

SHEET 2      OF 2

- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Any change arising out of any new government norms, statutory requirements during the course of execution of the project shall be complied by the bidder without any commercial implication.



TITLE  
TECHNICAL SPECIFICATION FOR  
MILL REJECT HANDLING SYSTEM  
1X800 MW WANAKBORI TPS

SPECIFICATION NO. PE-TS-408-160-A001

VOLUME III

SECTION

REV 00

DATE

SHEET 1 OF 2

### PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: \_\_\_\_\_

NAME: \_\_\_\_\_

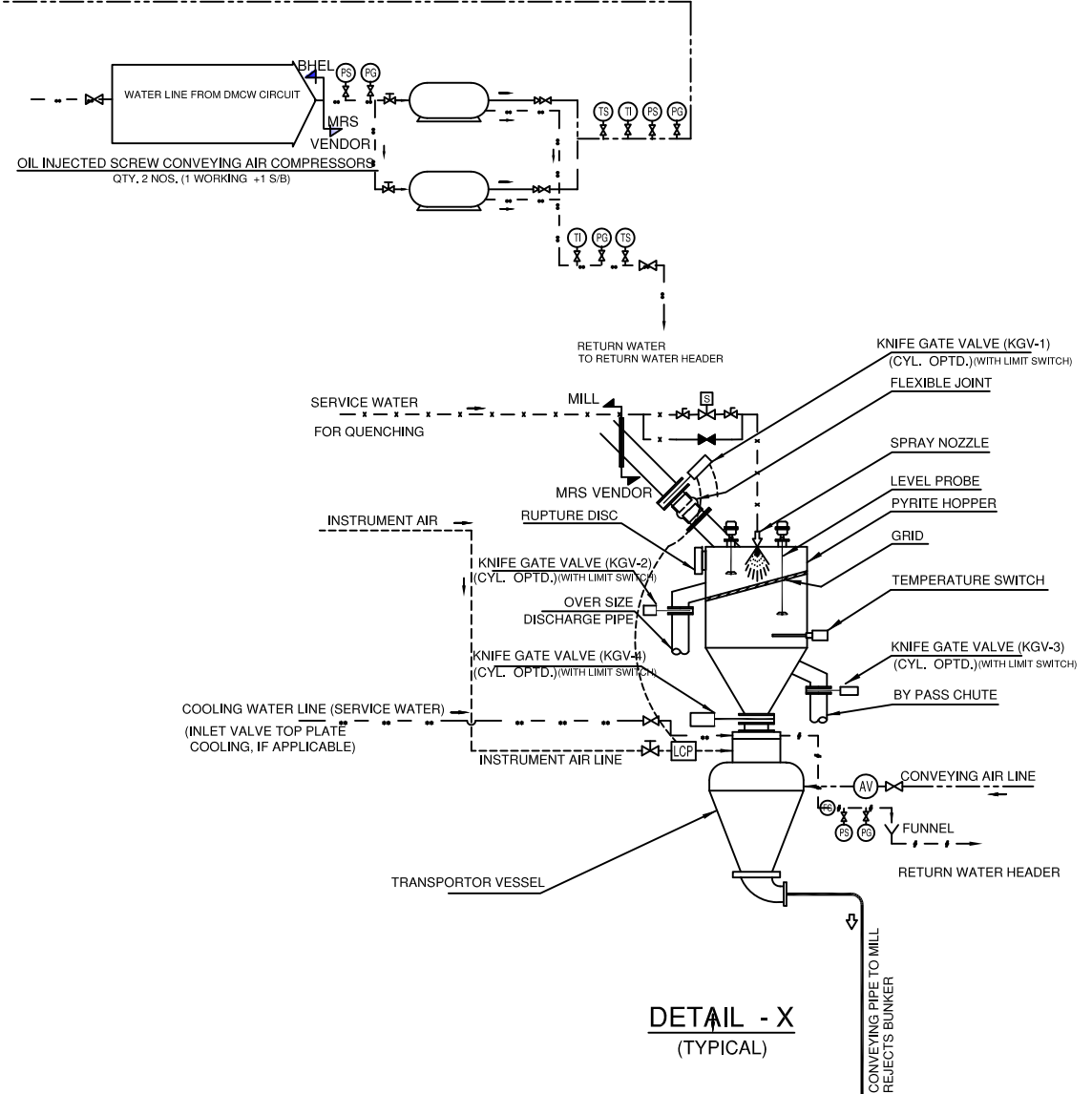
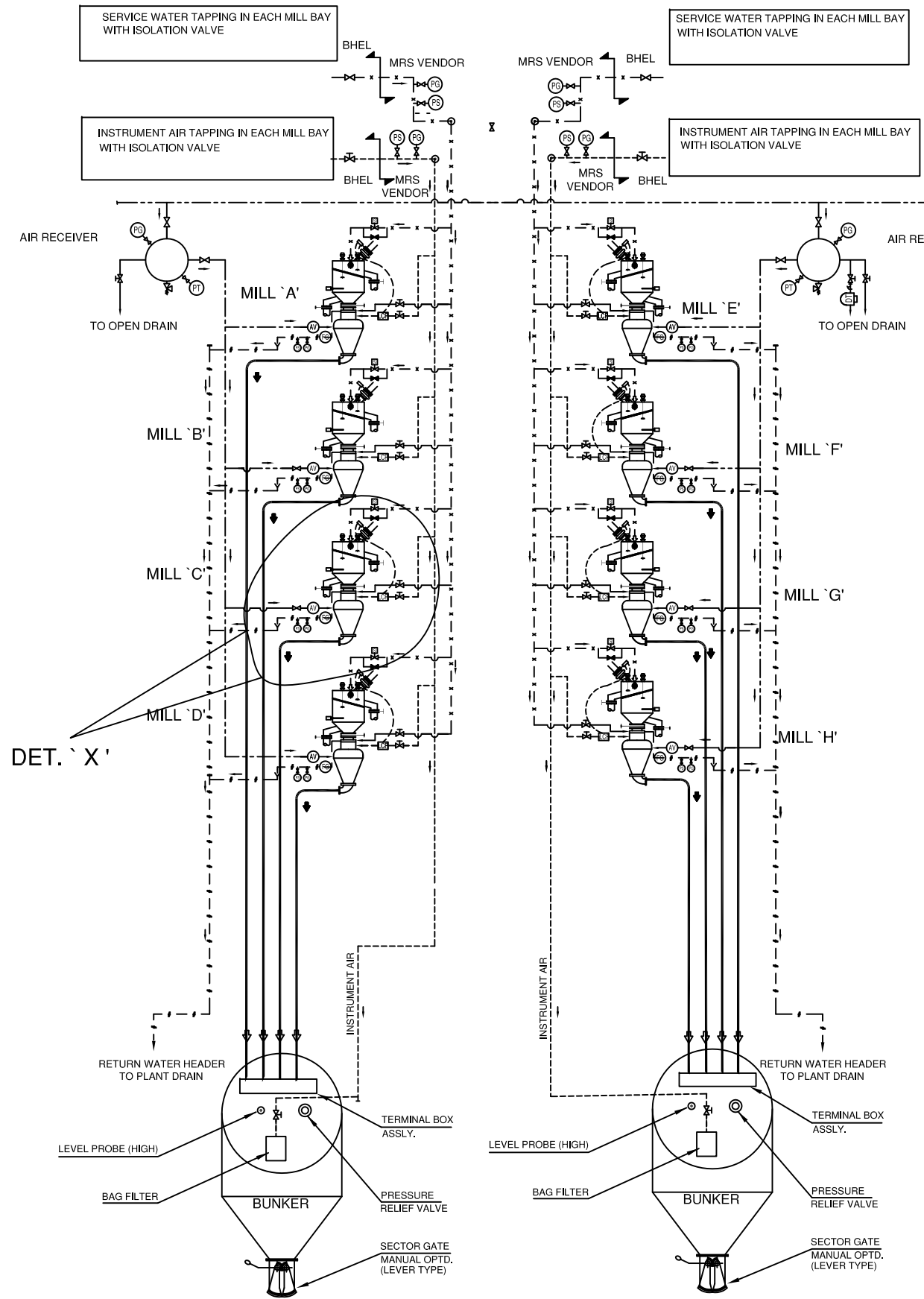
DESIGNATION: \_\_\_\_\_

COMPANY: \_\_\_\_\_

DATE: \_\_\_\_\_

COMPANY SEAL



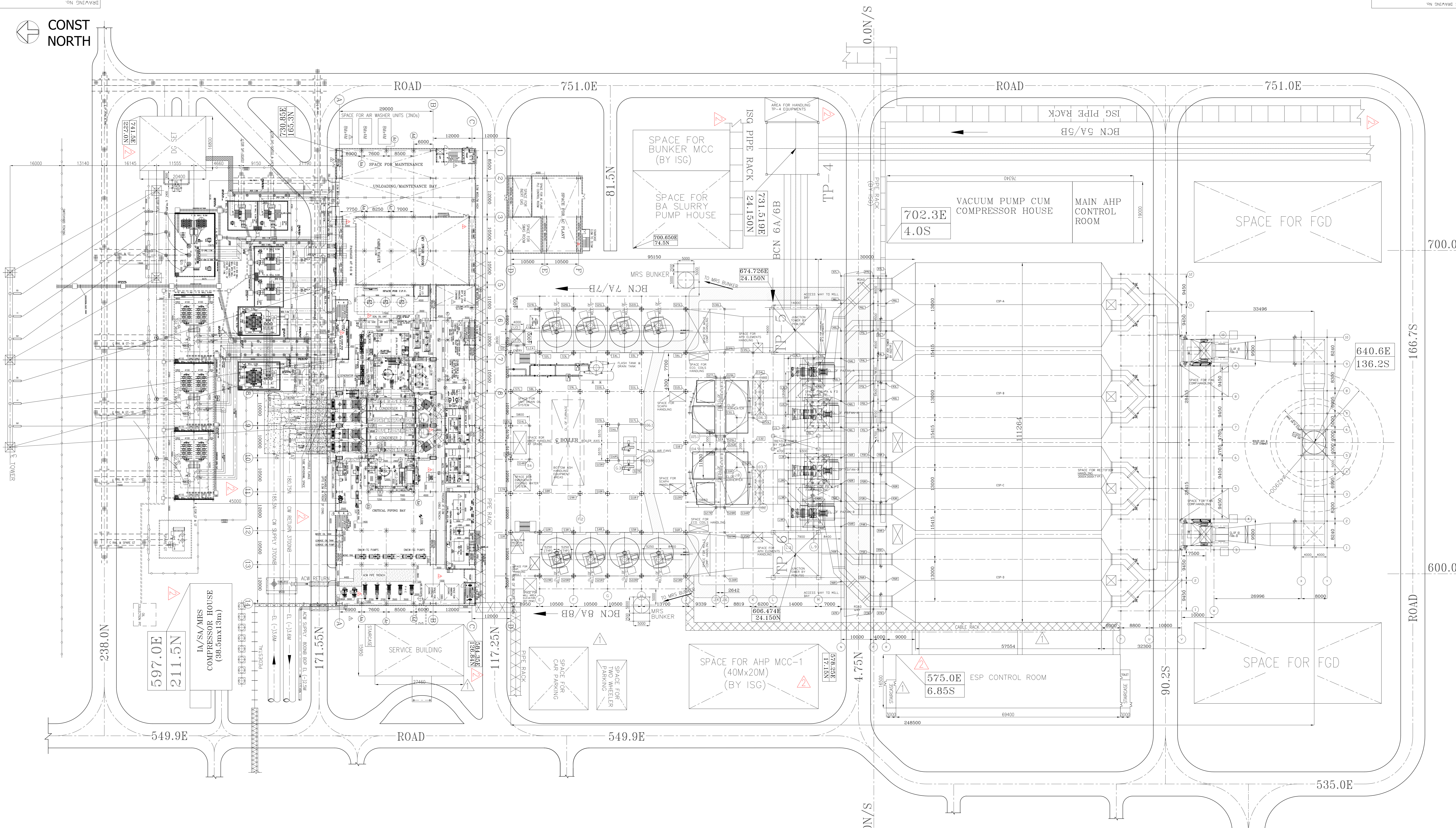


NOTE: THE DRG INDICATES BROAD SCOPE & WORKING PRINCIPAL OF THE SYSTEM. FLOW DIAGRAM OF MILL REJECT HANDLING SYSTEM SHALL BE READ IN CONJUNCTION WITH TECHNICAL SPECIFICATION.

**LEGEND:**

—	MILL REJECTS CONVEYING PIPE	⊗	GATE VALVE	⊙ (AV)	AIR VALVE	⊗ (S)	SOLENOID OPTD. VALVE
- - - - -	CONVEYING AIR	⊗	BALL VALVE	⊙ (LCP)	LOCAL CONTROL PANEL	⊗	STARINER
- · - · - · -	INSTRUMENT AIR	⊗	NORMALLY CLOSED BALL VALVE	⊙ (SV)	SAFETY VALVE	⊗	GLOBE VALVE
- · - · - · -	COOLING WATER	⊗	NON RETURN VALVE	⊙ (PG)	PRESSURE GAUGE		
- · - · - · -	SERVICE WATER	⊗	DRAIN TRAP	⊙ (PT)	PRESSURE TRANSMITTER		
- · - · - · -	RETURN WATER						

CUSTOMER		GSECL	
CONSULTANT		DEVELOPMENT CONSULTANTS PVT LTD	
JOB NO. 408			
STATUS CONTRACT			
DISTRIBUTION			
1X800 MW WANAKBORI STPP UNIT-8			
BHARAT HEAVY ELECTRICALS LTD POWER SECTOR : PROJECTS ENGG MGMT NEW DELHI			
TITLE		SINGLE LINE FLOW DIAGRAM MILL REJECT HANDLING SYSTEM	
DRAWN		NAME GP	
CHECKED		RN	
APPRD		CB	
SIGN		DATE	
NO. OF SHEETS		1	
SHEET NO		1	
Page 443 of 444			



LEGENDS	
	PIPE HATCH
	VERTICAL BRACING
	FIRE PROOF DOOR
	GRATING
	CHEQUERED PLATE
	REMOVABLE
	HAND RAILING
	CABLE TRAY
	FIRE BARRIER WALL
	INDICATES PIPES/CABLE TRESTLE
	ROLLING SHUTTER
	RAIL TRACK
	PIPE TRENCH WITH PCC COVERED SAND FILLED

- NOTES: -**
1. ALL DIMENSION ARE IN MM AND LEVELS ARE IN METRES.
  2. ALL ELEVATION MARKED ARE W.R.T. TG HALL FINISHED FLOOR ELEVATION OF EL 0.00M WHICH CORRESPONDS TO RL 72.3M.
  3. THE FINISHED GRADE LEVEL OF POWER BLOCK AREA IS RL. 72.00M.
  4. THE BOILER & ID SYSTEM AREA FFL IS AT EL.(-)200MM WHICH CORRESPONDS TO RL:72.1M. THE FFL IN MILL BAY & INSIDE CHIMNEY ARE AT EL.0.0. TRANSFORMER AREA FFL IS AT EL.(-)100MM WHICH CORRESPONDS TO RL:72.2M.

- REFERENCE DRGS: -**
1. PLOT PLAN PE-DG-408-100-M001
  2. T.G. EQUIPMENT LAYOUT PLAN AT EL. 0.0M PE-DG-408-100-M003 (PEM)
  3. GA OF BOILER SECTIONAL PLAN SEC-AA 0-00-022-76778 (TRY)
  4. TRANSFORMER YARD LAYOUT PE-DG-408-100-E001 (PEM)

JOB NO.	408
STATUS	CONTRACT
DISTRIBUTION	

<b>CUSTOMER:</b>	GUJARAT STATE ELECTRICITY CORPORATION LTD VADODARA, GUJARAT 1x800 MW Wanakbori Thermal Power Station Extn. Unit-8
<b>CONSULTANT:</b>	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA MUMBAI CHENNAI NEW DELHI
<b>CLIENT:</b>	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA

REV.	DATE	ALT	CHD	APPD	REV.	DATE	ALT	CHD	APPD
1	11.08.2014	MS	HP	MSM	1	01.09.2014	MS	HP	MSM

**TITLE** MAIN EQUIPMENT PLANT LAYOUT

DEPT. SCALE 1:400 DRAWING NO. PE-DG-408-100-M002 SHEET 1 OF 1 REV. 02

COPY RIGHT ARE CONFIDENTIAL. THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE REPRODUCED OR USED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE COMPANY.