



**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.

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 MATERIAL													
1.1	Body & Bonnet casting / forgings, plug, valve stem, seat ring/cage.	1. Physical, Chemical properties 2. Heat Treatment 3. Internal quality of castings 4. Surface Quality	MA MA MA MA	Physical, Chemical tests Review of H.T. Chart RT for Body & UT for Bonnet(NDT) 1. Visual 2. MT/PT	One/ Heat(HT Batch) Each H.T. 100% 100%	Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn. ASME B 16.34 MSS-SP-55 ASME B 16.34	Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn. ASME B 16.34 MSS-SP-55 ASME B 16.34	Test Certificate Test Certificate Test Report / FILM Test Certificate Test Certificate	3 3/2 3/2 3/2	---	2 2 2 2	2,1 1 1,4 2,1 1	IBR Certification (if applicable) to be verified by BHEL Only for rating ANSI 900 and above. Applicable for Body and Bonnet only. For Lower rating only if called for in specification. After Machining on machined surface only

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

RT - Radiographic Test  
 UT - Ultrasonic Test

PT - Dye penetrant Test  
 MT- Magnetic Test

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 W - Agency Witnessing the Test.  
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1 - BHEL  
 2 - Vendor  
 3 - Sub-vendor

4 - Customer/  
 Consultant

01

QUALITY PLAN NO.: PE-QP-408-145-I 006



PEM :: C&I

## QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

VOLUME  
SECTION

REV. NO. 02 DATE: 10.06.15  
SHEET 3 OF 8

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. Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	For Body & Bonnet after machining
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		2. Hardness	MA	Measurement	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		3. Endurance / Life cycle	MA	Cyclic test 10,000 cycles	One / Type	10,000 cycles/ Mfr. standard.	No damage	Test Certificate	3/2		2,1	
1.3	Spring	1. Composition	MA	Chemical- Analysis	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		2. Mech. Properties	MA	Mech. Test	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		3. Performance	MA	1. Stiffness ratio 2. Scragging 3. Cyclic test (Endurance) 4. Dimension (Measurement)	100% 100% One / type One sample/ Lot	Material spec. / Mfr. standard Material spec. / Mfr. standard 10,000 cycles Mfr. standard	Material spec. / Mfr. standard Material spec. / Mfr. standard Appd Drg	Test Certificate Test Certificate Test Certificate Record	3 3 3 3	---	2,1 2,1 2,1 2,1	

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QUALITY PLAN NO.: **PE-QP-408-145-I 006**  
 VOLUME  
 SECTION  
 REV. NO. 02 DATE: 10.06.15  
 SHEET 4 OF 8

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	
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test	MA	HV, IR, Continuity function	100%	Rele. Standards	Rele. Standards	Test Certificate	3	---	2,1	In case TC is not available, Actual test shall be conducted
		2. Degree of protection	MA	IP/NEMA Tests	One sample / type	Approved Data sheet	Approved Data sheet	Test Certificate	3	---	2,1	
1.5	Pressure Gauges	1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2,1	Refer Note-7 
		2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Records	3	---	2,1	
<b>2.0</b>	<b>IN PROCESS INSPECTION</b>											
2.1	After machining, i, Body ii Bonnet iii Plug iv Valve Stem v seat ring/cage	1. Surface flaws	MA	Visual & MT/PT	100% (on accessible surfaces)	ASME B 16.34	ASME B 16.34	Test Records	2	---	1	Butt weld ends shall be included.
		2. Dimensional checks	MA	Measurement	100%	Mfr. Standard	Mfr. Standard	Records	2	---	1	
		3. Hard facing (wherever applicable)	MA	Hardness Measurement	One sample/Lot	Mfr. Standard	Mfr. Standard	Records	2	---	1	
2.2	Lapping	Machining surface contact	MA	Blue Matching	One sample/lot	-----	Proper Physical Contact	---	2	---	---	
<b>3.0</b>	<b>TESTS ON COMPLETED VALVE</b>											

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 MI - Minor characteristics

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## QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.: **PE-QP-408-145-I 006**  
 VOLUME  
 SECTION  
 REV. NO. 02 DATE: 10.06.15  
 SHEET 5 OF 8

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	
3.1	Actuator Chamber	Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	No Leakage	Test Certificate	2	1	1,4 01	Refer Note-4
3.2	Body	Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19	No Leakage	Test Certificate	2	1,4	1 01	Refer Note-4
3.3	Seat leakage test for completed valve	Seat Leakage	MA	Pneumatic Test	100%	FCI-70.2	FCI-70.2	Test Certificate	2	1,4	1	Refer Note-4
4.0 OPERATION TEST ON COMPLETED VALVE (Final inspection)	1.	Valve Travel	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4 01	Refer Note-4
	2.	Opening/Closing time	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
	3.	Linearity/cam characteristic	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4 01	Refer Note-4
	4.	Repeatability	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
	5.	Hysteresis	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4 01	Refer Note-4
	6.	Sensitivity	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4	Refer Note-4
	7.	Accuracy (Overall)	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1,4	1,4 01	Refer Note-4
	8.	Control Valve characteristics / CV Test	MA	◆ Measurement (Press. vs. discharge and discharge vs. opening 0-100% in steps of 10%)	One per type	As per specs/ Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1,4	1,4	◆ Size = Body & port size Or Body size & CV for non std port. Refer Note 1.

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QUALITY PLAN NO.: **PE-QP-408-145-I 006**  
 VOLUME  
 SECTION  
 REV. NO. 02 DATE: 10.06.15  
 SHEET 6 OF 8

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.		Operation of limit switch & solenoids and other accessories	MA	Function	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Report	2	1,4	1,4	On assembled valve Refer Note-4
10.		Overall dimensions	MI	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Records	2	1,4	1,4	Refer Note-4
11.		Pre defined valve position in case of air failure	MA	Visual	100%	As per spec & Appd drg	As per spec & Appd drg	Test Certificate	2	1,4	1,4	
12.		Cleanliness, painting, stamping (for direction of flow), Tag No.	MA	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1,4	1,4	
13.		Manual Opening & Closing (Hand wheel Operation)	MI	Visual	One per type	-----	-----	Test Certificate	2	1,4	1,4	
<b>5.0</b>	<b>AUXILIARY ITEMS (Performance test of auxiliary items shall be performed on the completely assembled valve)</b>											
5.1	Positioner	Overall leakage after assembly including Nozzles leakage	MA	Leak Test (in the steady state input signal)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	Overall leakage including tubing
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	1,4	

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## QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.: PE-QP-408-145-I 006

VOLUME

SECTION

REV. NO. 02 DATE: 10.06.15

SHEET 7 OF 8

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	
5.4	Electronic position transmitter(not applicable if provided integral to smart positioner)	1. Accuracy	MA	Operation	100%	Approved data sheet /	Approved data sheet /	Test Certificate	2	1	1,4	01
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model 2. Degree of Protection 3. Linearity 4. Hysteresis	MA MA CR CR	Visual IP/NEMA test Measurement Measurement	100% Each type 100% 100%	Approved drg. / data sheet Relevant Standard Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet Relevant Standard Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn.	Test Certificate Test Certificate Inspection Report Inspection Report	2 3 2 2	--- --- --- ---	2,1,4 2,1,4 1,4 1,4	  01 01
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model 2. Degree of Protection 3. Linearity 4. Hysteresis 5. Calibration with Hand Held Communicator	MA MA CR CR MA	Visual IP/NEMA test Measurement Measurement Measurement	100% Each type 100% 100% Each type	Approved drg. / data sheet / BHEL specn. Relevant Standard Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn. Approved data sheet / Mfr. Standard	Approved drg. / data sheet / BHEL specn. Relevant Standard Approved drg. / data sheet / BHEL specn. Approved drg. / data sheet / BHEL specn. Approved data sheet / Mfr. Standard	Test Certificate Test Certificate Inspection Report Inspection Report Test Certificate	2 3 2 2 2	--- --- --- --- 1	2,1,4 2,1,4 1,4 1,4 1,4	  01 01 01

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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	
6.0	PAINTING	Soundness of Painting	MA	Visual and Measurement	100%	BHEL specn. / Mfr. Standard	BHEL specn. / Mfr. Standard	Inspection Report	2	---	1,4 01	Refer Note-2
7.0	PACKING	Soundness of Packing against transit damage	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---	Refer Note-3

**NOTES:**

1. In case valid Cv test certificate for a similar control valve (Same type, Same size, Same Cv) is not submitted to BHEL by the vendor, Cv test shall be conducted at FCRI/ Any govt. approved laboratory/ BHEL approved Laboratory. **Validity of the Cv test certificate shall not be more than 3 years.** 01
2. In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
3. Sea worthy packing shall be provided, if applicable.
4. **The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency and Customer.** 02
5. IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
6. Copies of all TC's (Test Certificates) for materials duly correlated with Heat Nos., TC's for electrical items and mechanical tests (Leak/Operation) shall be submitted to BHEL for verification and acceptance.
7. **Calibrator used for calibration shall be approved by government agency & its calibration certificate shall be submitted.** 01

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

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**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.~~



## SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

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### 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

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.



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- 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



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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.

- 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.
- 3.2 Hazardous Area Panel Requirement
- 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.
- 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.
- 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.
- 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 & suitable for area classification.
- 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.
- 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).
- 3.3 Control & Monitoring devices
- 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.
- 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.
- 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 & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.
- 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 & 2 Amp DC as applicable.



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### 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.



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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, corrosion, incidental damage due



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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



## DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PES-145-054A

VOLUME

SECTION

REV. NO. 01

DATE: 22.03.2011

SHEET 1 OF 2

TAG No. .... Qty.....


Data Sheet No.: PES-145A-DS1-0


### Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL  
(TO BE FILLED BY PURCHASER)

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

GENERAL	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"/>	
TECHNICAL	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
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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	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>		
					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
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>	COMPANY SEAL NAME: SIGNATURE: DATE:		
	Shiv Kumar	Anisha B Singhal	Anisha B Singhal			



PEM :: C&I

## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: <b>PE-QP-999-145-I056</b>	
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 <sup>§</sup>			Remarks
									P	W	V	
1.0	<b>INCOMING</b> Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	

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

<sup>§</sup> P - Agency Performing the Test.  
W - Agency Witnessing the Test.  
V - Agency Verifying the Test.

1 - BHEL  
2 - Vendor  
3 - Sub-vendor





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## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: <b>PE-QP-999-145-I056</b>	
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency <sup>§</sup>			Remarks
									P	W	V	
5.0	Misc. Components like <b>Gaskets, Terminal Blocks etc.</b>	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
6.0	<b>IN PROCESS</b> Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	<b>Factory Standard</b>	<b>Factory Standard</b>	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
8.0	<b>ASSEMBLY</b> Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	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

<sup>§</sup> 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.: <b>PE-QP-999-145-I056</b>	
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 <sup>§</sup>			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	

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## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

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

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency <sup>§</sup>			Remarks
									P	W	V	
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
12.	<b>FINAL</b> Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	} At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: <b>PE-QP-999-145-I056</b>	
VOLUME	IIB
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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 <sup>§</sup>			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	

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## STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: <b>PE-QP-999-145-I056</b>	
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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 <sup>§</sup>			Remarks
									P	W	V	
13.	TYPE TEST	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	ROUTINE TEST	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	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

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	<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 16 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**SPECIFICATION FOR QUALITY ASSURANCE & TESTING**

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;

- Heat cycle run test as per the prevailing standards;
- Functional test of a minimum 25 % of all configured points, logic routines, control functions, graphic displays, reports and logs;
- Demonstration of special calculations (e.g. efficiency calculation, performance calculations etc.);
- Testing of redundancy facilities to demonstrate automatic change over to standby data highway, power supply and control processor etc.;
- Demonstration of system diagnostic facilities;

The FAT shall be witnessed by the Owner / Engineer who shall be notified at least three (3) weeks before the commencement of the tests. The system shall have been fully pre-tested by the manufacturer at his works prior to notifying the Owner / Engineer to ensure any component, equipment or system fault have been identified and cleared. The test procedure for the FAT shall be issued to the Engineer and agreed prior to notification. All documents / drawings and test equipment shall be available at the manufacturer's works during the FAT.

The FAT shall include a 72 hour continuous operational run, any equipment fault or failure during this time shall make this part of the test null and void and the test run shall be re-started after rectification of the fault. A test certificate, accompanied by the relevant test results, shall be issued after successful completion of the tests.

**(b) Site Acceptance Test (SAT)**

After installation, connection, integration with other systems and all pre-commissioning checks have been carried out on the complete system, the SAT shall be performed and witnessed by the Engineer. The SAT shall include the following as a minimum:

- a) Complete hardware and installation inspection;
- b) Testing of redundancy facilities by simulating data highway, power supplies and control processor failures. All such units shall be tested to demonstrate of the automatic operation of the standby units and initiation of the relevant system alarms;
- c) Demonstration of system diagnostic facilities; by the simulation of the appropriate fault conditions. The system fault reporting techniques shall also be demonstrated;
- d) Testing of data highway integrity using continuity test equipment based on signal injection / reflection techniques;
- e) Demonstration of data logging, sequence of events and trending system operation.
- f) Pre-commissioning checks shall include the following:

- i) Calibration of all field instruments, analysers and equipment, in the scope of supply of this package, at site;
- ii) Loop checking, for all open and close loops, between source and destination with manual signal injection as well as from Operating Consoles for entire DCS I/Os;
- iii) Logic sequence check with the manual signal injection at signal source as well as checking of feed back signals.

All individual configured data points, logic routines, control functions, graphic displays and reporting facilities shall be verified as part of the loop tests.

The Owner shall be notified at least 2 weeks before the commencement of the test. The procedures shall be issued and agreed before notification.

A test certificate accompanied by the relevant test results shall be issued after successful completion of the calibration and test.

Similar tests shall also be applicable for other control system i.e. plant utility system PLC / Microprocessor based control systems.

	<b>1X800 MW Wanakbori STPP</b>	SECTION: C SUB SECTION : C&I SHEET 17 of 18
	<b>TECHNICAL REQUIREMENTS (C&amp;I)</b>	

**MANDATORY SPARES**

8.1.15	<del>Voltmeter</del>	1 No. for each type and Rating for BTG Area & 1 No. for each type & Rating for BOP Area.	( 0- 500V)-1 No		BAP/ TBG/ EPD
8.1.16	<del>Ammeter</del>	2 No. for each type and Rating for BTG Area & 1 No. for each type & Rating for BOP Area.	( 0-3200 A)-2 No's, ( 0-800A)-2 No's,		BAP/ TBG/ EPD
8.1.17	<del>Auxiliary Control Contactor</del>				BAP/ TBG/ EPD
8.1.17.1	<del>Auxiliary Control Contactor DC complete</del>	25Nos.	Not offered as loose items are not feasible to offer.		BAP/ TBG/ EPD
8.1.17.2	<del>Auxiliary Control Contactor DC spare kits</del>	25Nos.	Not offered as loose items are not feasible to offer.		BAP/ TBG/ EPD
8.1.17.3	<del>Auxiliary Control Contactor DC Coils</del>	25Nos.	Not offered as loose items are not feasible to offer.		<del>BAP/ TBG/ EPD</del>
<b>8.2</b>	<b>PMCC/MCC/ACDB</b>		LOT ( LOT PRICE FOR APPLICABLE ITEMS IN THE LIST OF ITEMS INDICATED BELOW IN SL NO 8.2.1 TO 8.2.15.3)		Trichy/ BAP/ EPD
<b>8.2.1</b>	<b>Contactor</b>				Trichy/ BAP/ EPD
8.2.1.1	Power Contactor (AC)				Trichy/ BAP/ EPD
8.2.1.1.1	Power Contactor Complete Assembly	4 Nos.for each type and rating	4Sets.  (Each set comprises of 8A, 16A, 32A, 63A, 80A, 100A, 125A Contactors)		Trichy/ BAP/ EPD
8.2.1.1.2	Power Contactor spare kits	10Sets for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.1.1.3	Power Contactor AC Coils	10Nos. Coils for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.1.2	Auxiliary Control Contactor (AC)				Trichy/ BAP/ EPD
8.2.1.2.1	Auxiliary Control Contactor Complete Assembly	30 Nos.for each type and rating	30 No's		Trichy/ BAP/ EPD
8.2.1.2.2	Auxiliary Control Contactor spare kits	40 Sets for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.1.2.3	Auxiliary Control Contactor AC Coils	35 Nos.for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.2	MCCB (Power Circuit)	5 Nos. for each type and rating	5Sets  (Each set comprises of 16A, 32A, 63A, 125 A, 315A, 320A, 400A-1No)		Trichy/ BAP/ EPD
8.2.3	MCB (Control Circuit)	25 Nos.for each type and rating	25 Set  (Each set comprises of 2A, 4A, 6A, 8A, 10A-1No)		Trichy/ BAP/ EPD
8.2.4	Switch				Trichy/ BAP/ EPD
8.2.4.1	Local / Remote Selector Switch	10Nos.	10No's.		Trichy/ BAP/ EPD
8.2.4.2	MCCB Status (On/off) Monitoring Switch/Contact	5Nos.		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.4.3	Trial / Normal /MCC Selector Switch	15Nos.		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.4.4	MCC module Service Position Limit Switch	5Nos.	Loose items are not feasible to offer.		Trichy/ BAP/ EPD
8.2.5	Thermal Overload Relay	5Nos. for each type and rating	5Set  (Each set comprises of (1-1.6A)-1 No for Rapping motors & (1-3A)-1No for Opacity Monitor)		Trichy/ BAP/ EPD

8.2.6	Sliding Contact (Fixed & Moving)	25Sets	Loose items are not feasible to offer.		Trichy/ BAP/ EPD
8.2.7	Bus bar to MCC module Lira Contact Assembly ( Bus-end & MCC Module-end)	5Sets for each type and rating	Loose items are not feasible to offer.		Trichy/ BAP/ EPD
8.2.8	Indicating Lamps complete assembly				Trichy/ BAP/ EPD
8.2.8.1	Red	30Sets	30Sets		Trichy/ BAP/ EPD
8.2.8.2	Amber	30Sets	30Sets		Trichy/ BAP/ EPD
8.2.8.3	Green	30Sets	30Sets		Trichy/ BAP/ EPD
8.2.9	Push Button (On/Off) Complete Assembly	20Sets	Loose items are not feasible to offer.	Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.10	CT	1No. for each type and rating	1set 1set consist of (Each 3200/1A, 800/1A,80/1A,50/1A,32/1A for Metering; & Each 2500/1A-2No's, 800/1A-1No for protection. Total 5 Nos. CTs		Trichy/ BAP/ EPD
8.2.11	Ammeter	1No. for each type and rating	1set  (Each Set consist of (0-20A)-1No (0-50A)-1No (0-70A)-1No (0-800A)-1No (0-3200A)-1No)		Trichy/ BAP/ EPD
8.2.12	Control Transformer	1No. for each type and rating	415/240V AC-5KVA---1No		Trichy/ BAP/ EPD
8.2.13	Off Delay/ On Delay Timer	5Nos.for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.14	Switch Fuse Unit	5Nos.for each type and rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.15	Terminal Block				Trichy/ BAP/ EPD
8.2.15.1	Power Terminal Block	10% of total nos. for each type and rating used in the system or minimum one (1) no. whichever is more		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.2.15.2	Control Terminal Block	10% of total nos. for each type and rating used in the system or minimum one (1) no. whichever is more	0.1		Trichy/ BAP/ EPD
8.2.15.3	End Plate for Power & Control Terminal Block	Each type 25Nos.	Loose items are not feasible to offer.	Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
8.3	Energy Meter	1No. For each type & rating		Refer Sno 15 of BH-29 attached herewith.	Trichy/ BAP/ EPD
<del>9.0</del>	<del>DC Starter Panel/DCDB</del>		LOT ( LOT PRICE FOR APPLICABLE ITEMS IN THE LIST OF ITEMS INDICATED BELOW IN SL NO 9.1 TO 9.16.3)		Trichy/ HWR/ HYD/ EPD/ TBG
9.1	DC Power Contactor complete assembly	1No. for each type and Rating			Trichy/ HWR/ HYD/ EPD/ TBG
9.2	Power Contact Spare Kit	2Sets for each type and rating			Trichy/ HWR/ HYD/ EPD/ TBG
9.3	Coil for Power Contactor	2Nos.			Trichy/ HWR/ HYD/ EPD/ TBG

10.2.1.1	Feeder/Transformer Protection	4 Nos.each type and rating	4No's of Numerical relays.  Incomer protection of breakers is applicable. Transformer protection is not applicable.		BAP
10.2.1.2	Motor Protection	5 Nos.each type and rating	Not Applicable		BAP
10.2.2	Conventional (Electromagnetic/Static type) Relay	10% for each type and rating or minimum one (1) no. whichever is more	Not Applicable		BAP
<b>10.3</b>	<b>Generator Protection System</b>				
10.3.1	Numerical microprocessor based Relay	10% for each type and rating or minimum one (1) no. whichever is more	Lot Price for applicable items under Sno 10.3 and Sno 10.4		BPL SCS
<b>10.4</b>	<b>Generator Transformer Protection System</b>				
10.4.1	Numerical microprocessor based Relay	10% for each type and rating or minimum one (1) no. whichever is more	Price for applicable items included at Sno 10.3 above		BPL SCS
<b>11.0</b>	<b>UPS (Main UPS for DCS System)</b>				
11.1	Fuse	3 (Three) times of total quantity of each type of fuses used in the system			EDN
11.2	SCR	10% of total quantity of each type used in the system or minimum 2(two) nos. whichever is more.			
11.3	Diode	10% of total quantity of each type used in the system or minimum 2(two) nos. whichever is more.			EDN
11.4	IGBT	2 (two) nos.			EDN
11.5	Electronic Module/ PCB				
11.5.1	Static Switch	1 (one) no. each type of Electronic Card/PCB/modules used in the system			EDN
11.5.2	Inverter	1 (one) no. each type of Electronic Card/PCB/modules used in the system			EDN
11.5.3	Static voltage Regulator	1 (one) no. each type of Electronic Card/PCB/modules used in the system			EDN
11.5.4	Charger	1 (one) no. each type of Electronic Card/PCB/modules used in the system			EDN
<b>11.6</b>	<b>UPS Battery</b>				
11.6.1	Battery Cell (Uncharged, Dry)	8 nos.			EDN
11.6.2	Inter connecting cell strips	10 nos.			EDN
11.6.3	Vent cap	10 nos.			EDN
11.6.4	Hydrometer	1 no.			EDN
11.6.5	Rubber gloves	1 pair			EDN
11.6.6	Voltmeter for measuring cell voltage (Center zero type)	1 no.			EDN
11.6.7	Funnel	1 no.			EDN
11.6.8	Jug	1 no.			EDN
11.6.9	Aprron & Goggles	1 set			EDN
11.6.10	Cell lifting puller	1 no.			EDN
11.6.11	Insulated socket spanner with handle	1 no.			EDN
11.6.12	Terminal screw with bellaville washer	5% of total quantity used			EDN
11.6.13	Plastic filling bottle	1 no.			EDN
11.6.14	Thermometer	1 no.			EDN
11.7	For other applicable items SI No.12 & 8 of this document shall be followed.		Not quoted as the spec. is not clear		EDN
<b>12.0</b>	<b>Control Panel/Desk Mounted Items</b>				EDN
12.1	Push Button				
12.1.1	Complete assembly	5Nos for each colour			EDN
12.1.2	Contact Element (1NO + 1NC) Block	20Nos.			EDN
12.2	Selector Switch	10Nos. for each type and rating			EDN
<b>12.3</b>	<b>Meter (Analog or Digital)</b>				
12.3.1	Ammeter	10% for each type and range or minimum one (1) no. whichever is more			EDN

12.3.2	Voltmeter	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.3.3	Frequency	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.3.4	MW	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.3.5	MVAR	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.3.6	Power Factor	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.3.7	Synchroscope	10% for each type and range or minimum one (1) no. whichever is more			EDN
12.4	Indicating Lamps complete assembly	10Nos. for each Colour and type			EDN
12.5	Mimic Lamps	10Nos. for each Colour and type			EDN
12.6	MCB	2Nos. for each type and rating			EDN
12.7	Door Limit Switch	2Nos.			EDN
12.8	Annunciation system				EDN
12.8.1	Lamp Box with Facia & Lamps (LED type)	25Nos.			EDN
12.8.2	Hooter	1No.			EDN
12.8.3	Each type of PCB (for non-PLC driven system)	1(one) no.	Part of DCS		EDN
					EDN
13.0	Actuator		( LOT PRICE FOR APPLICABLE ITEMS IN THE LIST OF ITEMS INDICATED BELOW IN SL NO 13.1 TO 13.4, 13.6 & 13.7)		Trichy/ Trichy Valves
13.1	Complete set of Actuator	1No. for each type and rating			Trichy/ Trichy Valves/ BAP
13.2	Limit Switch	2 Nos each type and rating			Trichy/ Trichy Valves
13.3	Torque Switch	2 Nos each type and rating			Trichy/ Trichy Valves
13.4	Auxiliary Contact	1 no each type and rating			Trichy/ Trichy Valves
13.5	Motor	1 no each type and rating	Not envisaged. Hence not offered	Refer Sno 15 of BH-29 attached herewith.	Trichy/ Trichy Valves
13.6	Complete Seal kit	1Set for each type and rating			Trichy/ Trichy Valves
13.7	Complete O-Ring Set	1Set			Trichy/ Trichy Valves
					Trichy/ Trichy Valves
14.0	illumination		LOT PRICE for applicable items under Sno 14.0 Illumination		TBG/PEM
14.1	Comptalux Lamp 100 W	40 nos.			TBG/PEM
14.2	High Pressure Mercury Vapour Lamp 125W	20 nos.			TBG/PEM
14.3	High Pressure Sodium Vapour Lamp 70W	150 nos.			TBG/PEM
14.4	High Pressure Sodium Vapour Lamp 150W	40 nos.			TBG/PEM
14.5	High Pressure Sodium Vapour Lamp 250W	40 nos.			TBG/PEM
14.6	High Pressure Sodium Vapour Lamp 400W	40 nos.			TBG/PEM
14.7	Ignitors (Separate type) for High Pressure Sodium Vapour Lamp	200nos.			TBG/PEM
14.8	Ballast for 1 x 125 W High Pressure Mercury Vapour Lamp	30 nos.			TBG/PEM
					TBG/PEM
14.9	Ballast for 1 x 70 W High Pressure Sodium Vapour Lamp	150 nos.			TBG/PEM
14.10	Ballast for 1 x 150 W High Pressure Sodium Vapour Lamp	100 nos.			TBG/PEM
14.11	Ballast for 1 x 250 W High Pressure Sodium Vapour Lamp	50 nos.			TBG/PEM
14.12	Capacitor for 1 x 125 W High Pressure Mercury Vapour Lamp	50 Nos.			TBG/PEM
					TBG/PEM

GSECL	BHEL		
Equipment/Package Name	Remarks	Remarks as per post-bid resolution dt 9.01.2013 (BH-29)	Name of Unit
<b>General</b>			
The Bidder shall offer mandatory spares of the same make, model and type for items which are offered in the main offer. Further, offered spare parts shall be of the same grade and shall have same performance as the instruments which they are to replace.			
<b>Field Instruments (Transmitters/temperature elements (TC / RTD) / Gauges / Switches etc. along with relevant accessories)</b>			
			Trichy/ HWR/ HYD/ BAP/ PC Chennai/ EDN
<b>10 (ten) percent of total of each type or at least one (whichever is higher) of each type along with accessories.</b>	Lot Price for applicable items		
<b>Steam &amp; Water Analysis System (SWAS)</b>			
2 (two) numbers conductivity / pH transmitter along with probes.			EDN
Electronic modules of each type for conductivity, pH, silica, dissolved oxygen, Hydrazine etc.			EDN
Other items as recommended by Supplier.	No other items offered.	Refer Sno 15 of BH-29 attached herewith.	EDN
<b>Continuous Emissions Monitoring System (CEMS)</b>			EDN
Analyzer spares like transmitter lens & receiver lens, protection windows for transmitter & receiver, integral pressure & temperature sensors, Signal processing unit - one set of each type.	Lot Price for applicable items		EDN
Cooling and purging air blower unit and set of filters -1 (one) number for each type.			
Light source and detector unit for opacity - 1(one) number.			
Other items as recommended by Supplier.	No other items offered.	Refer Sno 15 of BH-29 attached herewith.	
<b>Vibration Monitoring System (TG, TDBFP &amp; HT drives covered in supplied package)</b>	Lot price for applicable items in the list of items indicated below		Trichy/ HYD/ EDN
10 (ten) percent of total of each of velocity coil type, accelerometer type and proximity type vibration transducer (as applicable) or at least one (whichever is higher).			Trichy/ HYD/ EDN
2 (two) numbers of power supply modules.			Trichy/ HYD/ EDN
10 (ten) percent of each type of vibration monitor cards and other electronic cards or 2 (two) nos. of each type, whichever is higher.			Trichy/ HYD/ EDN
<b>Control System (DCS, PLC etc.)</b>	Lot price for applicable items		HWR/ EDN
2 (two) numbers each of keyboard and cursor control devices.			
2 (two) numbers of LCD TFT (24") Monitors.			
10 (ten) sets of spare interface cables with connecting plugs for each type of peripherals & I / O hardware.			
10 (ten) percent of power supply modules of the total qty. offered for each type or 4 (four) numbers, whichever is higher.			
10 (ten) percent of the total qty. offered for each type of electronic modules (I / O) or 5 (five) numbers of each electronic type of module, whichever is higher.			
10 (ten) percent of total bus couplers and communication interface cards of each type or 2 (two) numbers of bus couplers and communication interface cards whichever is higher.	Price Included in electronic modules above		
Controllers for DCS,Control panel ST,Boiler control system,Balance of plant system,PLC system/Sub-systems	For applicable		EDN
10%of each type(at least 1 no. of each type) whichever is higher.	Lot price for applicable items in the list of items indicated below		Trichy/ EDN
<b>CCTV</b>			Trichy/ EDN
2 (two) numbers of cameras and fixing accessories.			Trichy/ EDN

Equipment/Package Name	Remarks	Remarks as per post-bid resolution dt 9.01.2013 (BH-29)	Name of Unit
Other items as recommended by Supplier.	No other items recommended by supplier	Refer Sno 15 of BH-29 attached herewith.	Trichy/ EDN
<b>Large Video Screen (LVS)</b>			EDN
1 (one) number controller module.			EDN
Other items as recommended by Supplier.	No other items recommended by supplier	Refer Sno 15 of BH-29 attached herewith.	EDN
<b>Master Clock System</b>			EDN
10 (ten) percent of the total qty. offered for each type of electronic modules or 1 (one) number whichever is higher.			EDN
<b>Valves, Actuators &amp; Accessories</b>	Lot price for applicable items in the list of items indicated below. For ESP scope Pneumatic actuators only are quoted.		Trichy/ HYD/ BAP/ PC Chennai/ PEM
<b>Control Valves</b>			Trichy/ HYD/ BAP/ PC Chennai/ PEM
2 (two) sets of spare control valve stem packing for each of the control valves, as offered.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
1 (one) set of spare valve trim (including cage, plug, stem, seat rings, guide bushings etc.) for both the units for each of the control valves, as offered.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
<b>Control valve Actuators</b>			Trichy/ HYD/ BAP/ PC Chennai/ PEM
1 (one) set of spare actuators with drive of each type and rating.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
10 (ten) percent of valve positioners of each type.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
10 (ten) percent of position transmitters of each type.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
10 (ten) percent of limit switches/torque switches of each type.			Trichy/ HYD/ BAP/ PC Chennai/ PEM
<b>TOTAL</b>			

	<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

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

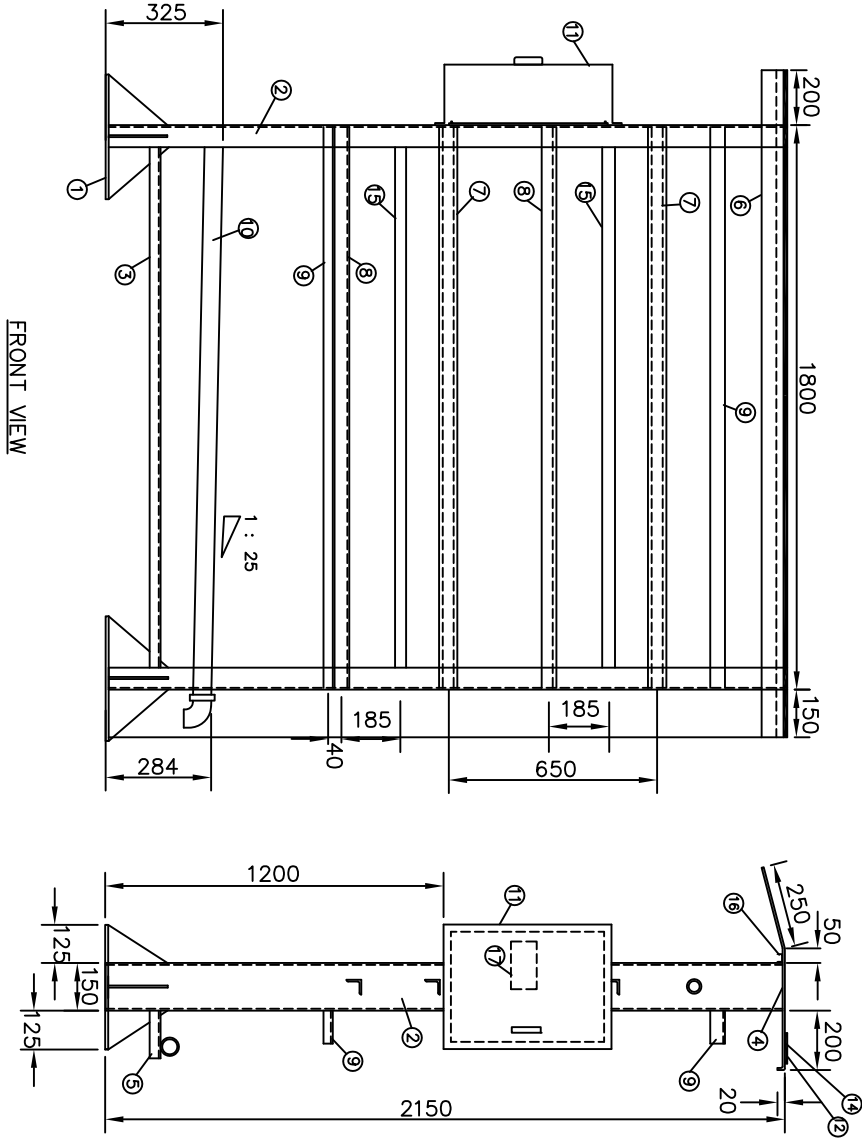
GA DRAWING-TRANSMITTER RACK  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANKARBON THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

PRELIMINARY  
TENDER PURPOSE ONLY



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

JOB NO. DCP1-K9213R SCALE NIL SH. 1 OF 10  
 DWG. NO. K9213R-DWG-1-0200 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:**

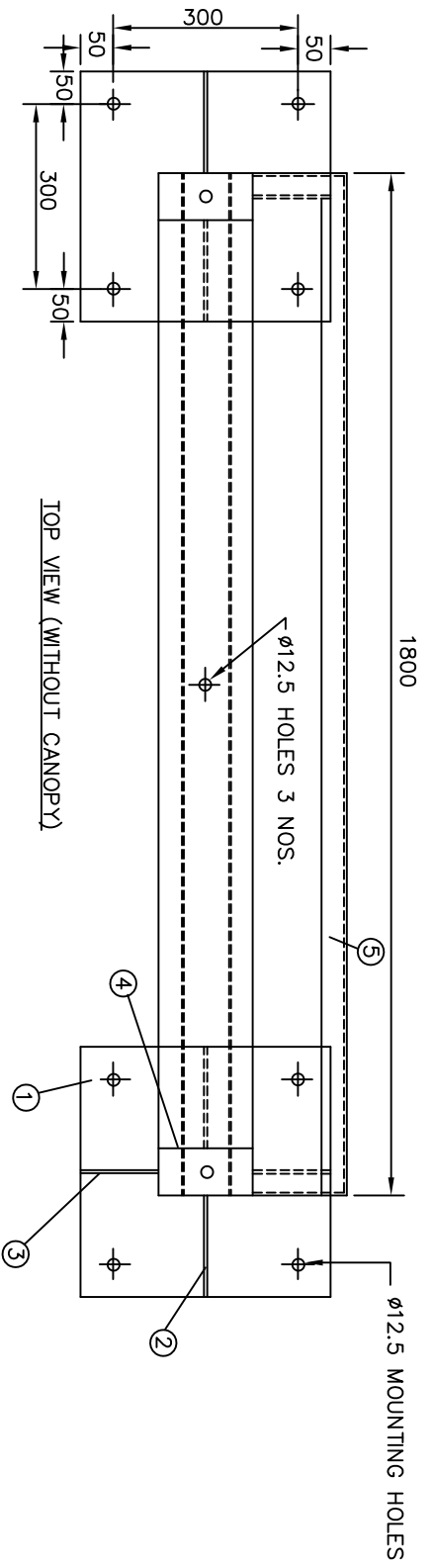
- 1..POWER SOCKET & TB SHALL BE PROVIDED IN JB.
- 2..COLOUR: GREY IS5-631. OVERALL THICKNESS > 100 MICRONS.
- 3..TAG PLATES SHALL BE PROVIDED FOR EACH INSTRUMENT.
- 4..20% TERMINALS SHALL BE PROVIDED AS SPARE.
- 5..ANTIVIBRATION PAD & FOUNDATION BOLTS SHALL BE PROVIDED.
- 6..DIMENSIONS SHOWN ARE TENTATIVE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

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	REV.	DATE
SB	SR	SD	0	21.04.10

G.A.DRAWING FOR LOCAL INSTRUMENT RACK	
1.800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WAMANBORN 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. DCP-1-K9213R SCALE NIL SHEET 2 OF 10
DWG. NO. K9213R-DWG-I-0200		REV. 0




TOP VIEW (WITHOUT CANOPY)

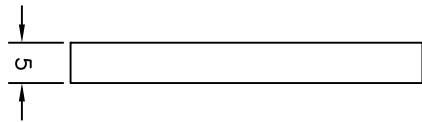
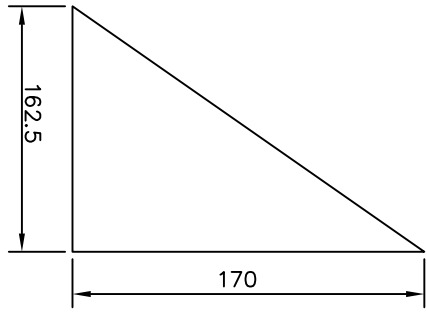
NOTES:

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.

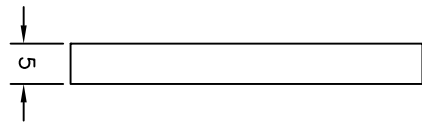
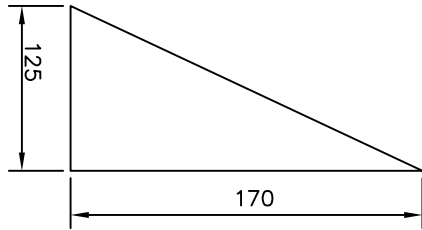
UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

PRELIMINARY  
TENDER PURPOSE ONLY

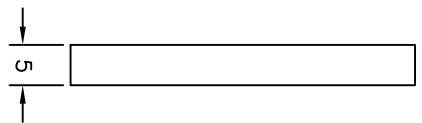
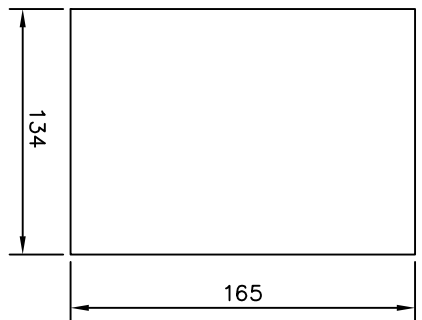
		VIEW OF LOCAL INSTRUMENT RACK W/O CANOPY			
		1.800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANABRON THERMAL POWER STATION, GUJARAT)			
		GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT			
		 DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA · MUMBAI · CHENNAI · NEW DELHI			
JOB NO. DCP-L-K9213R		SCALE NIL		SHT. 3 OF 10	
DWG. NO. K9213R-DWG-I-0200				REV. 0	
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
SB	SR	SD		0	21.04.10



DETAIL OF-1



DETAIL OF-2




DETAIL OF-3

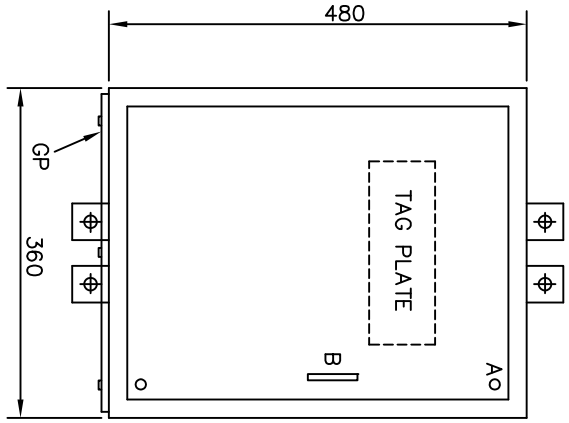
**NOTES:**

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.

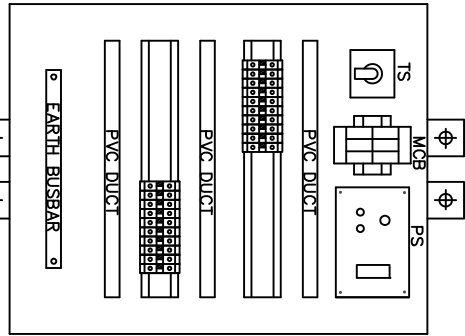
UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

PRELIMINARY  
TENDER PURPOSE ONLY

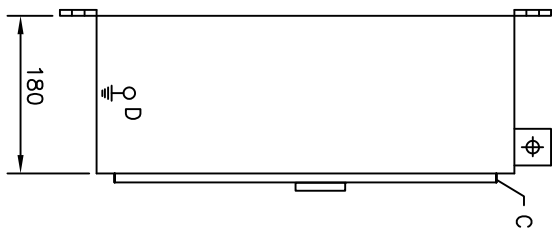
				G. A. DRAWING OF CLEATS FOR LOCAL INSTRUMENT RACK			
				1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANKARBORI THERMAL POWER STATION, GUJARAT)			
				GUJARAT STATE ELECTRICITY CORPORATION LIMITED			
				VADODARA, GUJARAT			
				DEVELOPMENT CONSULTANTS PVT. LTD.			
		KOLKATA · MUMBAI · CHENNAI · NEW DELHI		CONSULTING ENGINEERS			
JOB NO. DGPL-K9213R		SCALE NIL		SHT. 4 OF 10			
DWG. NO. K9213R-DWG-1-0200				REV. 0			
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE		
SB	SR	SD		0	21.04.10		



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..PROTECTON 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 FRLS PVC.

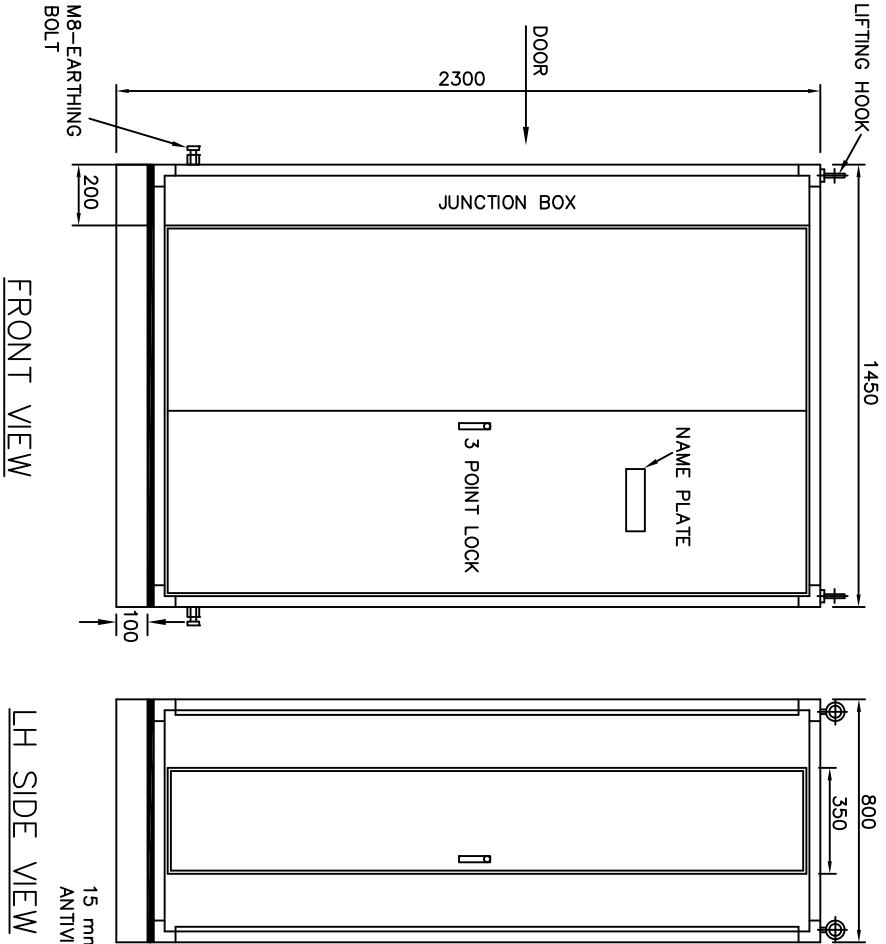
PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	REV.	DATE
SB	SR	SD	0	21.04.10

G. A. DRAWING OF JUNCTION BOX FOR  
LOCAL INSTRUMENT RACK  
1x800MM SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

<p>DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>	JOB NO. DCP-L-K9213R	SCALE NIL	SHT. 5 OF 10
	DWG. NO. K9213R-DWG-1-0200		REV. 0

LOCAL INSTRUMENT ENCLOSURE



UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

NOTES:

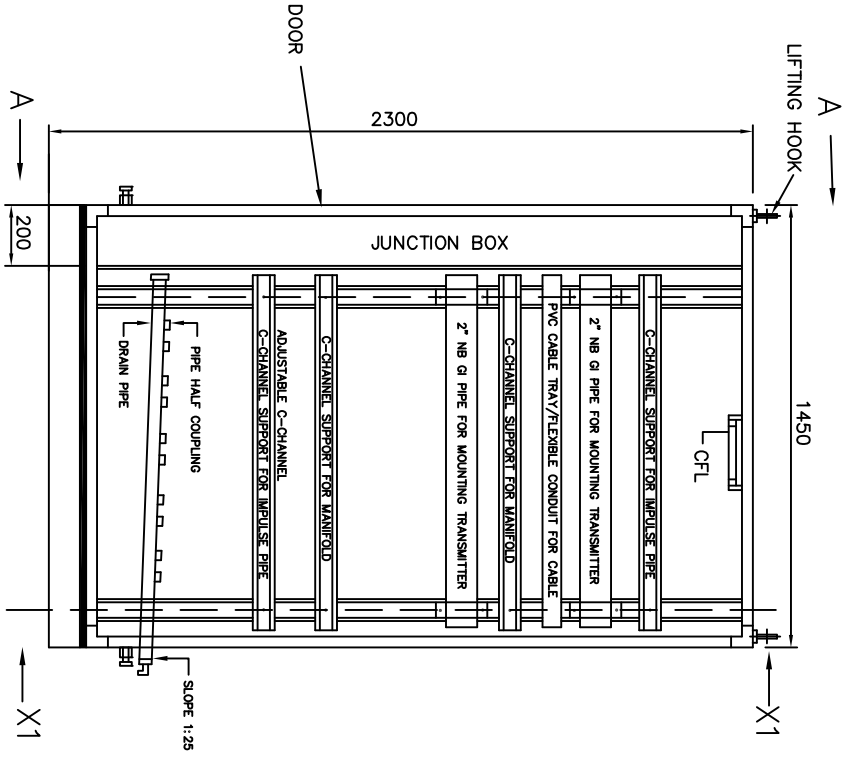
1. DIMENSIONS SHOWN ARE TENTATIVE AND SHALL BE FINALIZED AT DETAILING.
2. ALL SHEETS SHALL BE 3 mm THICK CRCA SHEET.
3. ALL DOORS SHALL BE FLUSH/CONCEALED TYPE.
4. COLOUR :-  
EXTERIOR : GREY IS5-631  
INTERIOR : BRILLIANT WHITE  
OVER ALL THICKNESS WILL BE > 100 MICRONS
5. BASE FRAME WILL BE MADE OUT 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 LIET'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.

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

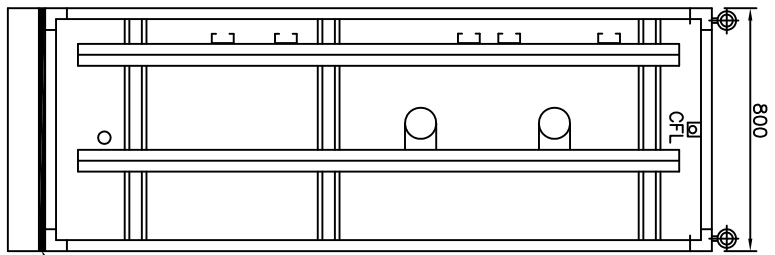
G.A. DRAWING FOR  
LOCAL INSTRUMENT ENCLOSURE  
1.800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANABRON THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

<p>DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA, MUMBAI, CHENNAI, NEW DELHI</p>	JOB NO. DCP-L-K9213R	SCALE NIL	SHT. 6 OF 10
	DWG. NO. K9213R-DWG-I-0200		REV. 0

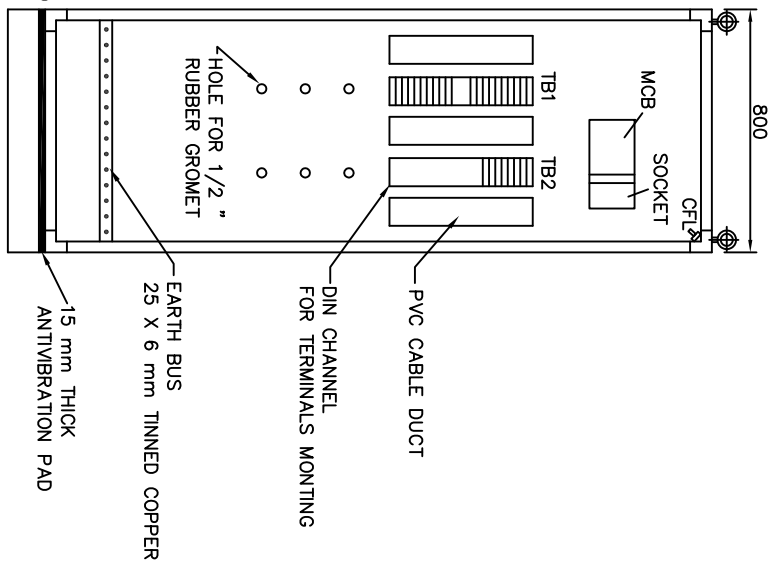
PRELIMINARY  
TENDER PURPOSE ONLY



FRONT INNER VIEW



SIDE VIEW FROM X1-X1



SIDE VIEW FROM A-A

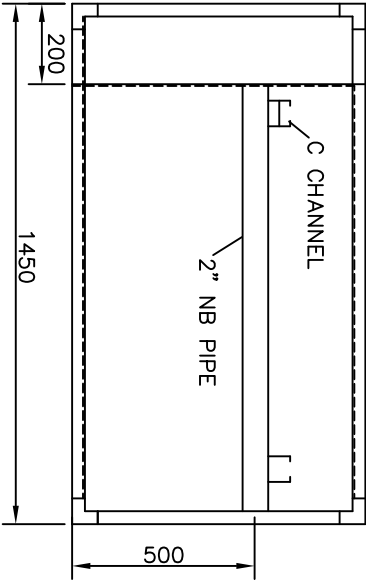
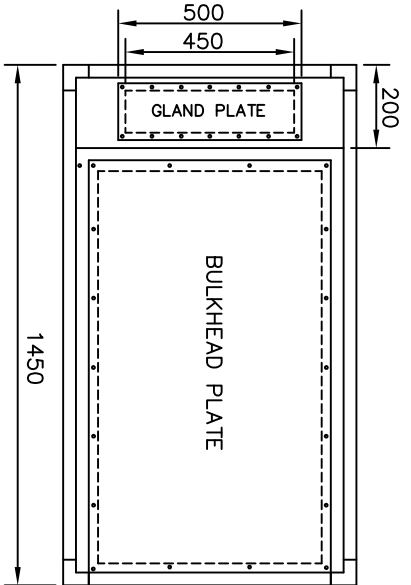
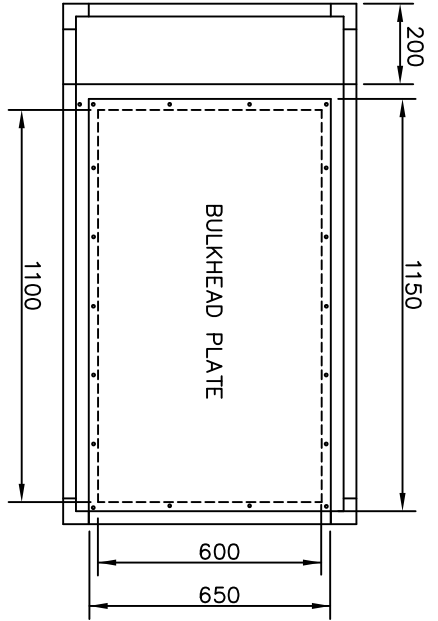
- NOTES:
- 1..PVC WIRE DUCT WITH COVER SHALL BE PROVIDED.
  - 2..FOR ILLUMINATION COMPACT FLUORESCENT LAMP IN LIE AND IN JB SHALL BE PROVIDED.
  - 3..DRAIN HEADER IS APPLICABLE FOR STEAM/WATER PROCESS IMPULSE LINES ONLY.
  - 4..DRAIN PIPE SHALL BE 2" NB ASTM A106 GRC SCH.80.

PRELIMINARY  
TENDER PURPOSE ONLY

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

INNER G.A. DRAWING FOR  
LOCAL INSTRUMENT ENCLOSURE  
1.800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANABRON 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-L-K9213R SCALE NIL SH. 7 OF 10  
DWG. NO. K9213R-DWG-I-0200 REV. 0



UNLESS OTHERWISE SPECIFIED  
ALL DIMENSIONS ARE IN MM

**NOTES:**

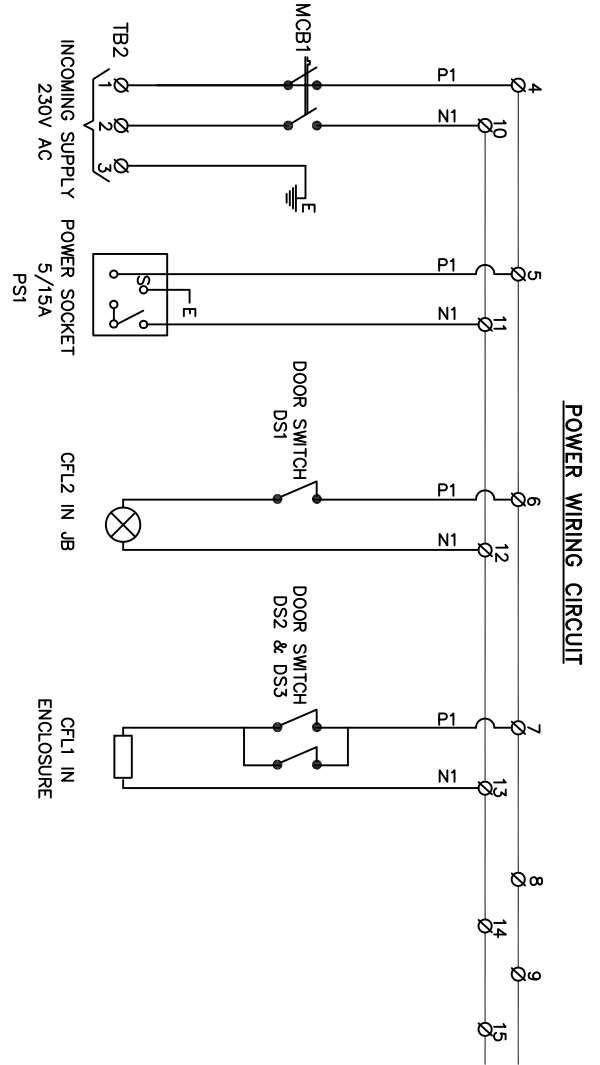
- 1..BULK HEAD PLATE DIMENSION ARE AS FOLLOWS: 1150 X 650 X 6 mm.
- 2..IMPULSE PIPE ENTRY : BOTTOM ENTRY FOR AIR/FLUE GAS APPLICATIONS.
- 3..IMPULSE ENTRY : TOP ENTRY FOR STEAM/WATER APPLICATIONS.

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

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

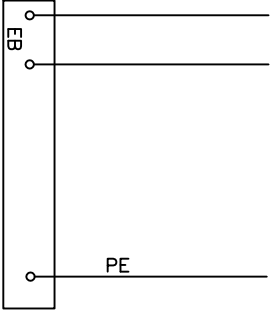
<p>DEVELOPMENT CONSULTANTS PVT. LTD. KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>	JOB NO. DCP-L-K9213R	SCALE NIL	SHT. 8 OF 10
	DWG. NO. K9213R-DWG-I-0200		REV. 0

PRELIMINARY  
TENDER PURPOSE ONLY



**NOTES :**

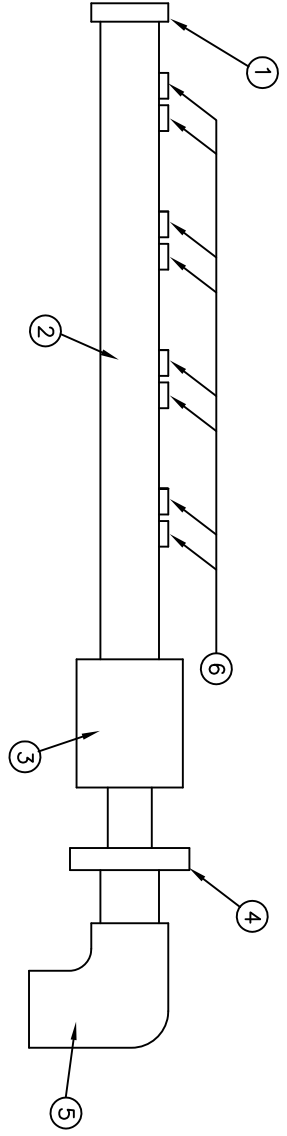
- 1.. COLOUR CODING FOR POWER SUPPLY : PHASE - RED, NEUTRAL - BLACK, EARTH - GREEN
- 2.. CABLE ROUTING FROM TB TO PANEL LIGHT WILL BE 1.5 Sqmm 1100V AC GRADE.
- 3.. SIGNAL WIRING WILL BE DONE BY 4 PAIR X 0.5 Sqmm ANNEALED TINNED COPPER, PAIR TWISTED OVERALL & SHIELDED, VOLTAGE GRADE 1100V, UNARMoured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



APPROVED	CHECKED	DRAWN	REV.	DATE
SB	SR	SD	0	21.04.10

ELECTRICAL WIRING AND TERMINATION DRAWING FOR LOCAL INSTRUMENT ENCLOSURE		1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #8 AT WANABORI 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
DWG. NO.	K9213R-DWG-I-0200	SHT.	9 OF 10
			REV. 0


PRELIMINARY  
TENDER PURPOSE ONLY



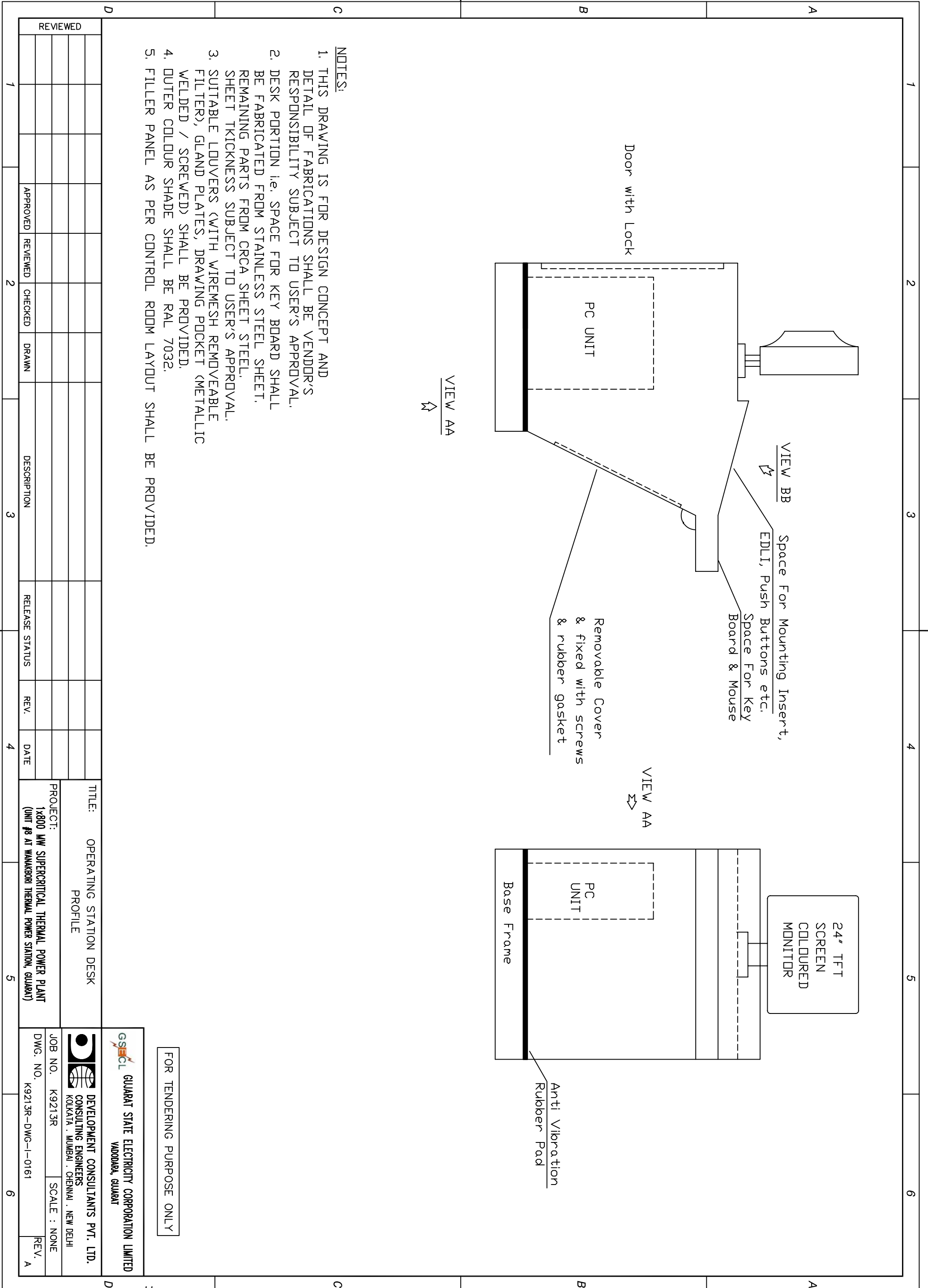
BILL OF MATERIAL		QTY
SL.NO.	DESCRIPTION	
1	2" S.W. CAP, CS	1
2	2" NB, ASTM A-106, SCH 80/Gr. C	1
3	2" SW X 1" NPT(F) COUPLING CS	1
4	1" NPT(M) X 1" BSP(M) HEX. NIPPLE WITH FITTING, CS	1
5	1" BSP(F) ELBOW, CS (BOTH ENDS THREADED)	1
6	HALF COUPLING; SIZE: 1/2" NB SW	AS REQD

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 WANAARBON THERMAL POWER STATION, GUJARAT)  
**GUJARAT STATE ELECTRICITY CORPORATION LIMITED**  
 VADODARA, GUJARAT

  
**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI  
 JOB NO. DCP-L-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.

REVIEWED	APPROVED	REVIEWED	CHECKED	DRAWN	DESCRIPTION	RELEASE STATUS	REV.	DATE
1								
2								
3								

**TITLE:** OPERATING STATION DESK PROFILE

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

**GS&ECL** GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

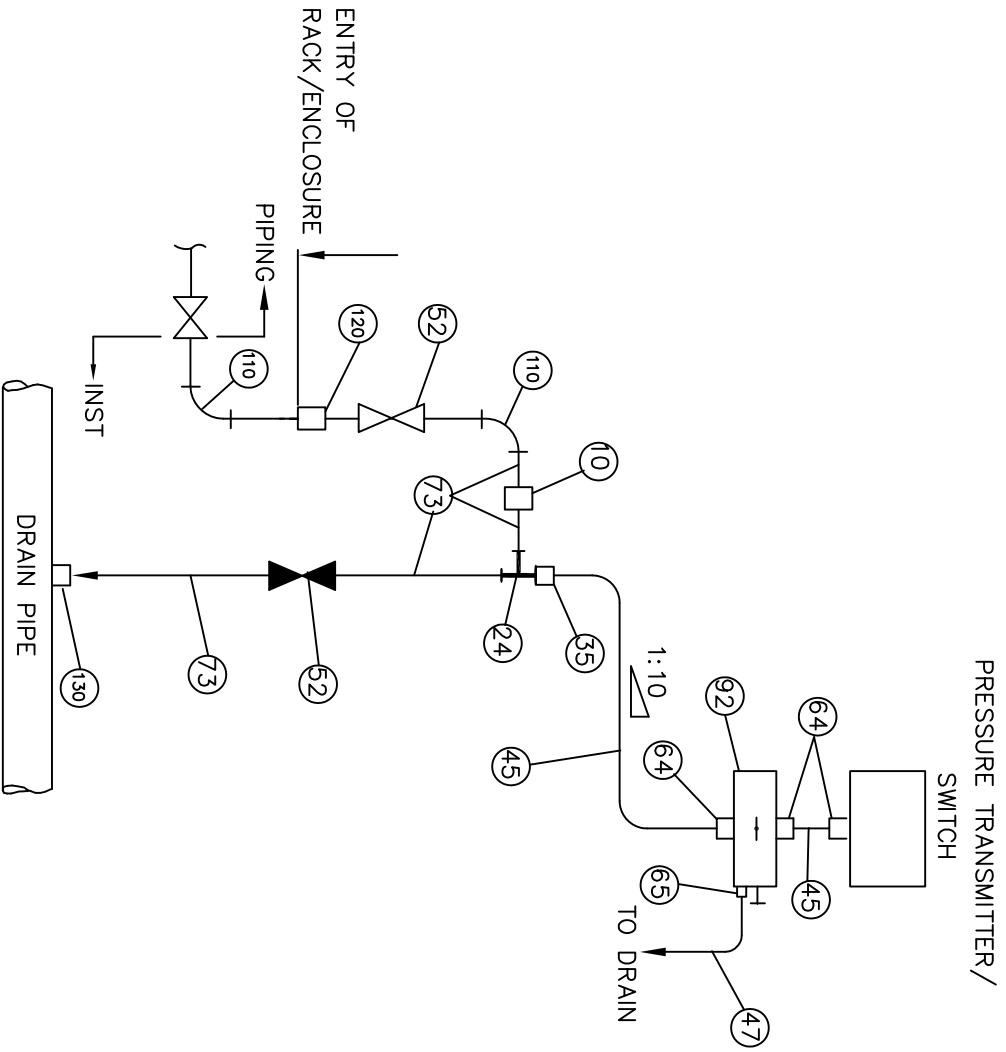
**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 KOLKATA . MUMBAI . CHENNAI . NEW DELHI

JOB NO. K9213R SCALE : NONE  
 DWG. NO. K9213R-DWG-1-0161 REV. A

FOR TENDERING PURPOSE ONLY



**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. CL: 3000 LBS/ 1/2" NB-SW/AS PER ANSI B16.11
130	1	HALE COUPLING. CL: 3000 LBS/ 1/2" NB-SW/ AS PER ANSI B16.11

SERVICE : CONDENSER PRESSURE, INSTRUMENT AIR ETC.

PRELIMINARY  
TENDER PURPOSE ONLY

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

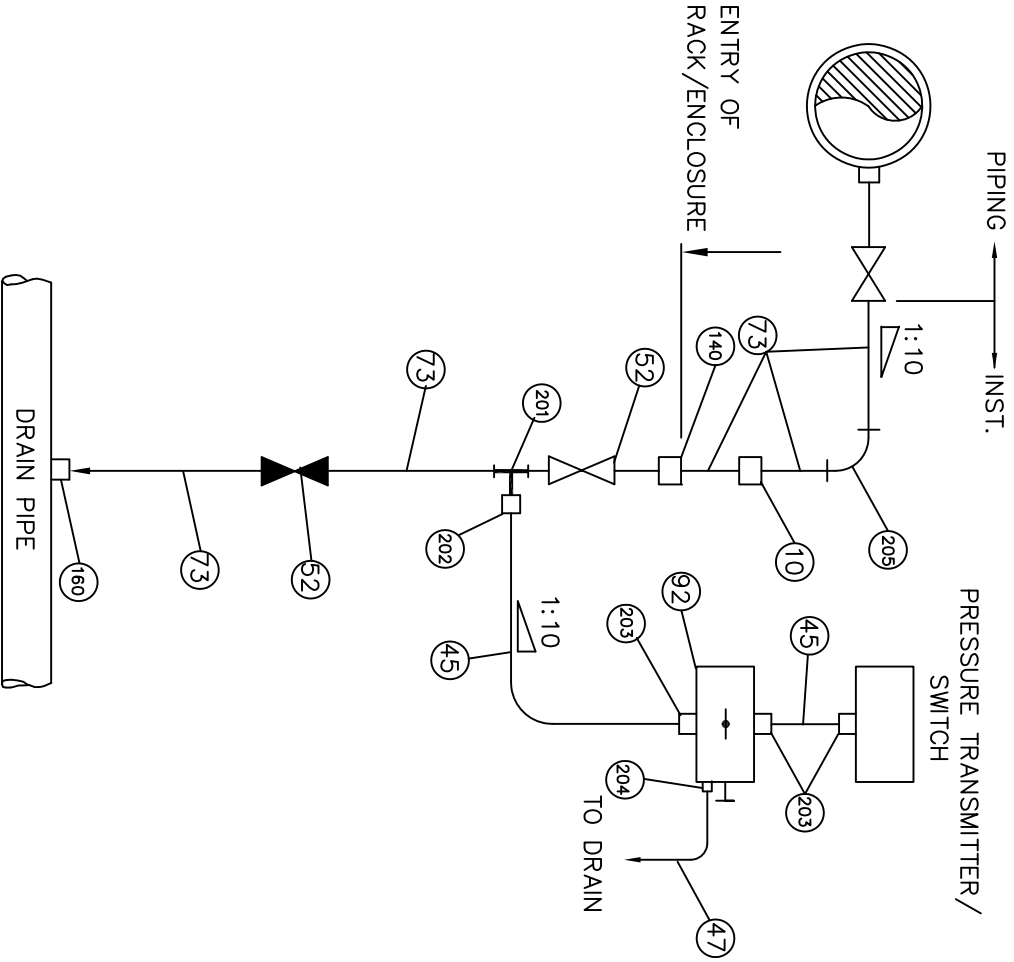
TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKBORI THERMAL POWER STATION, GUJARAT)  
GUJARATI STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT



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

JOB NO. DCP- K9213R SCALE NIL SH. 3 OF 20  
DWG. NO. K9213R-DWG-1-0060 REV. 0

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



**BILL OF MATERIAL**

ITEM NO.	QTY./INST.	DESCRIPTION
201	1	EQUAL TEE (FEMALE)/2" SW 6000lbs
202	1	MALE CONNECTOR 1/2" PE 1/2" OD 6000 lbs
52	2	GLOBE VALVES 1/2" SW 600lbs
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 GRB SCH 80
92	1	2 VALVES MANIFOLD 1/2" NPT(F)
10	1	FULL COUPLING 1/2" SW 6000lbs
47	1	0.15Mtr\$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.

PRELIMINARY  
TENDER PURPOSE ONLY

APPROVED	CHECKED	DRAWN	REV.	DATE
GP	AT	SD	0	21.04.10

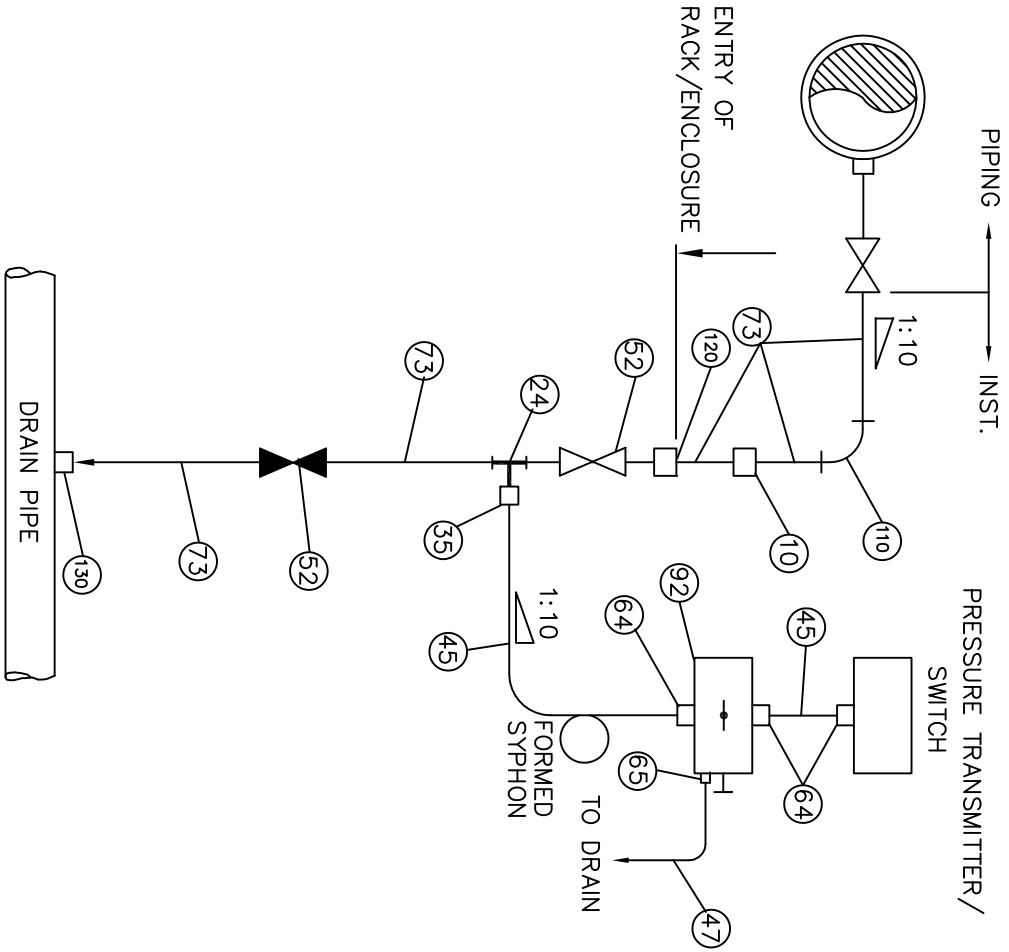
TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKBORI THERMAL POWER STATION, GUJARAT)  
GUJARATI STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT



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

JOB NO. DCPL-K9213R SCALE NIL SH. 4 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

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



**BILL OF MATERIAL**

ITEM NO.	QTY./INST	DESCRIPTION
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 CL: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11
130	1	HALF COUPLING CL: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

SERVICE : LOW PRESSURE STEAM

PRELIMINARY  
TENDER PURPOSE ONLY

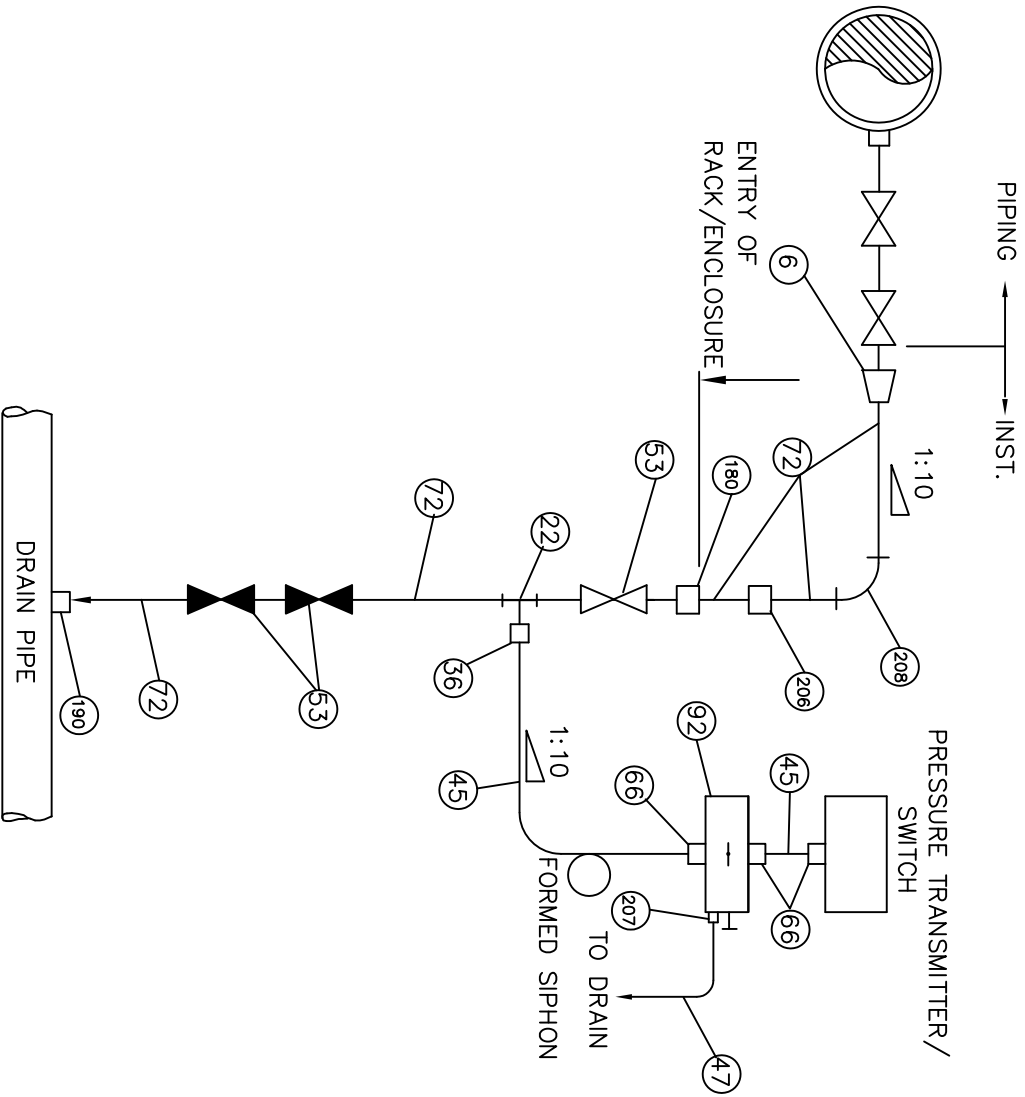
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

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  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCP-L-K9213R SCALE NIL SHT. 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

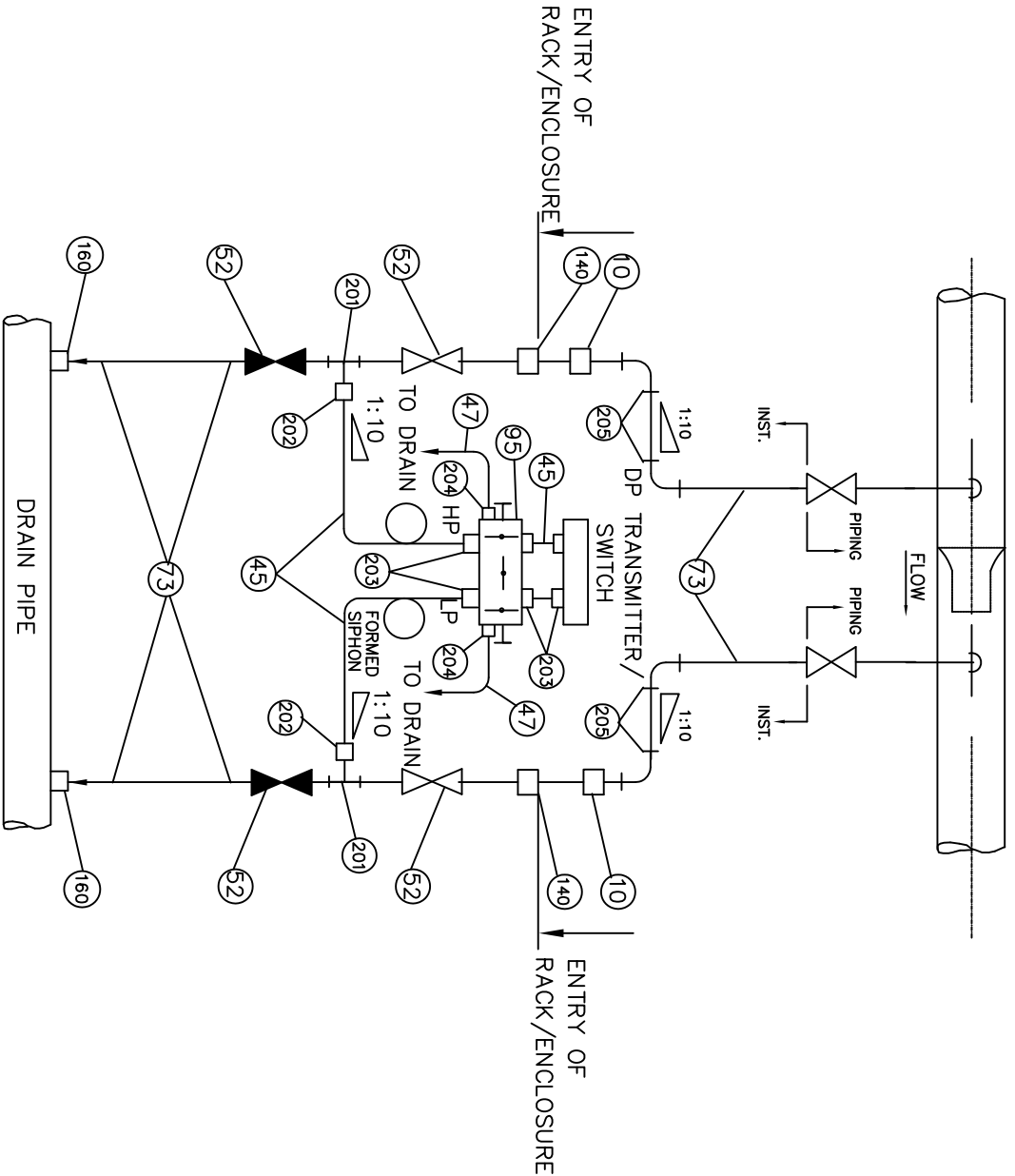
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**

1x800kW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WAMBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

<p align="center"><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b> CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>	JOB NO. DCP L-K9213R	SCALE NIL	SHT. 6 OF 20
	DWG. NO. K9213R-DWG-I-0060		REV. 0

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



BILL OF MATERIAL

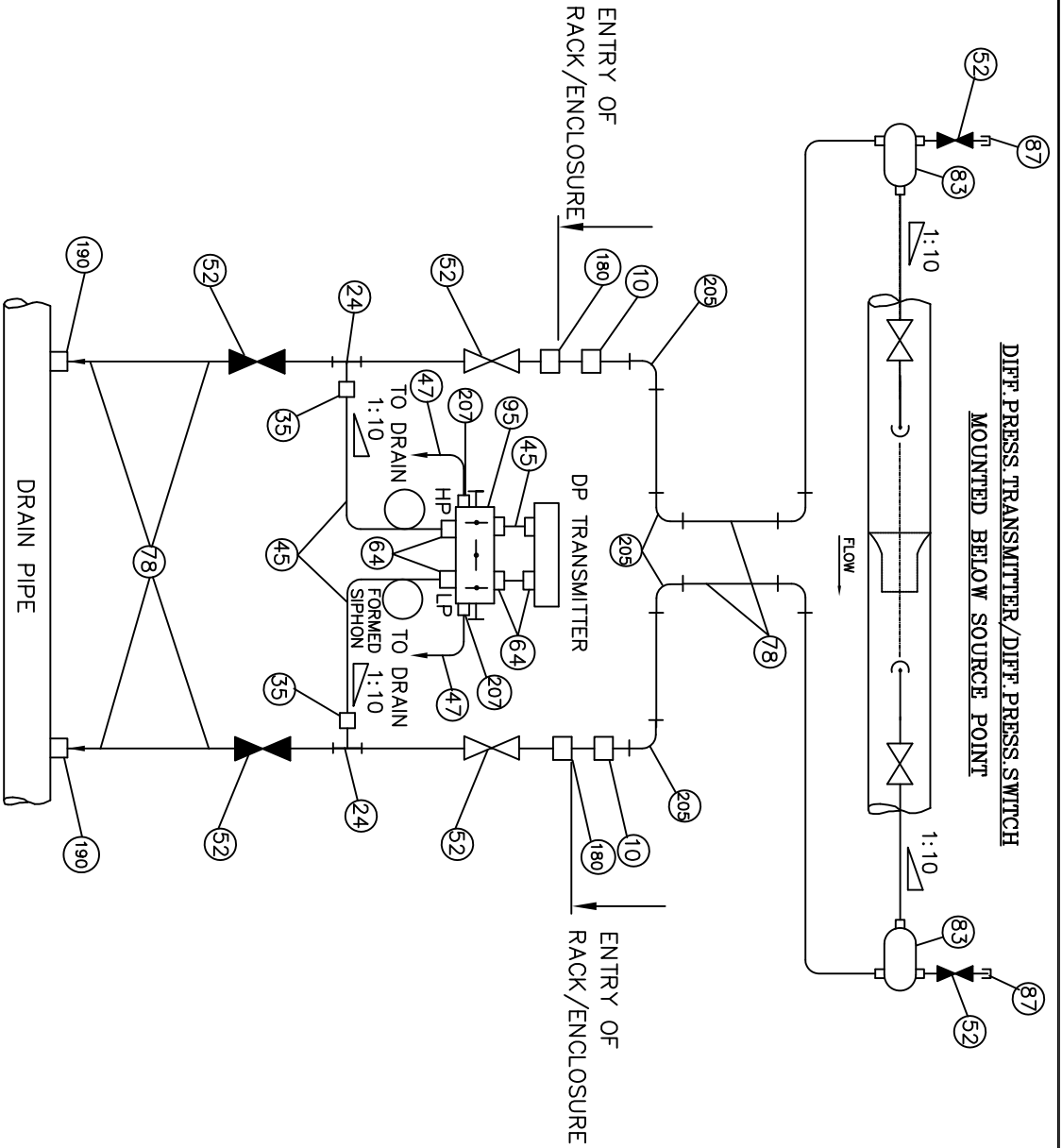
ITEM NO.	QTY./INST.	DESCRIPTION
201	2	EQUAL TEE (FEMALE) 1/2" SW 6000lbs
202	2	MALE CONNECTOR 1/2" PE X 1/2" OD 6000 lbs
52	4	GLOBE VALVES 1/2" SW 600lbs
45	6 Mtrs	TUBE 1/2" OD 2.1 MM THICK
203	6	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs
73	30mtrs	IMPULSE PIPE 15 NB GR.B SCH 80
95	1	5 VALVE MANIFOLD 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	
<p>1:800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #3 AT WANABORI THERMAL POWER STATION, GUJARAT)</p> <p>GUJARAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJARAT</p>											
TYPICAL INSTRUMENT INSTALLATION DIAGRAM						<p>DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>					
JOB NO. DCPL-K9213R			SCALE			NIL			SHT. 7 OF 20		
DWG. NO. K9213R-DWG-I-0060									REV. 0		



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

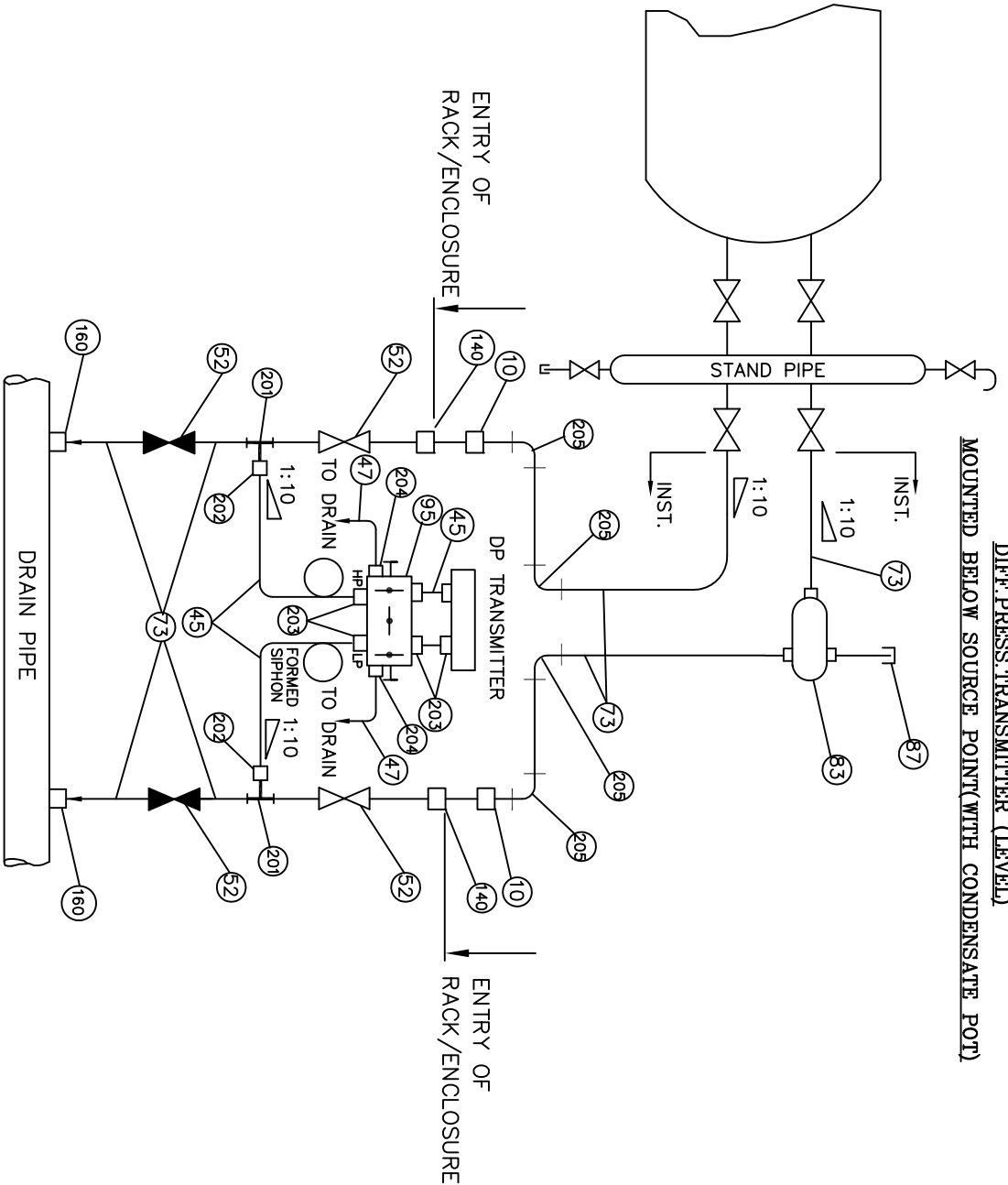
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

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

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

JOB NO. DCP1-K9213R SCALE NIL SH. 8 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

**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 6000lbs
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	HALF COUPLING CL: 6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11

SERVICE : BOILER DRUM, DEAERATOR, HEATERS

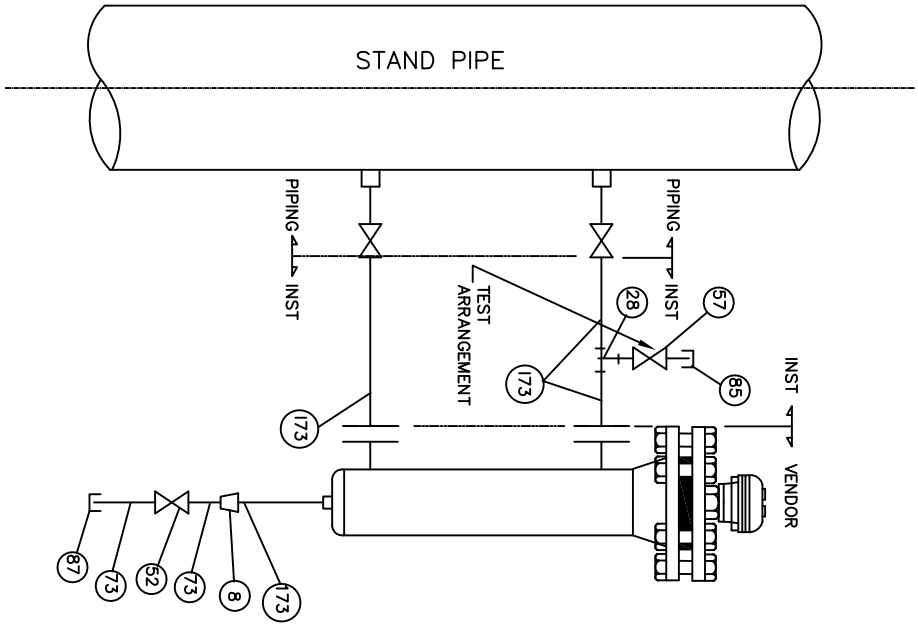
PRELIMINARY  
TENDER PURPOSE ONLY

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 WANKBORI THERMAL POWER STATION, GUJARAT)  
**GUJARAT STATE ELECTRICITY CORPORATION LIMITED**  
VADODARA, GUJARAT

<p><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b> CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>	JOB NO. DCP-1-K9213R SCALE NIL SHEET 9 OF 20 DWG. NO. K9213R-DWG-1-0060 REV. 0
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**FLOAT OPERATED LEVEL SWITCH**



BILL OF MATERIALS	
ITEM NO	QTY / INST / DESCRIPTION
52	1 GLOBE VALVE 1/2" SW 600lbs
73	0.5Mtrs IMPULSE PIPE 15 NB SCH.80
87	1 PLUG 1/2" NPT(M) 3000lbs
28	2 EQUAL TEE (FEMALE) 1" SW 3000lbs
173	1 Mtrs IMPULSE PIPE 25 NB SCH.80
8	1 REDUCER 1" SW X 1/2" SW 3000lbs
57	1 GLOBE VALVE 1" SW 600 lbs
85	1 PLUG 1" NPT(F) 3000 lbs

SERVICE : CONDENSATE

PRELIMINARY  
TENDER PURPOSE ONLY

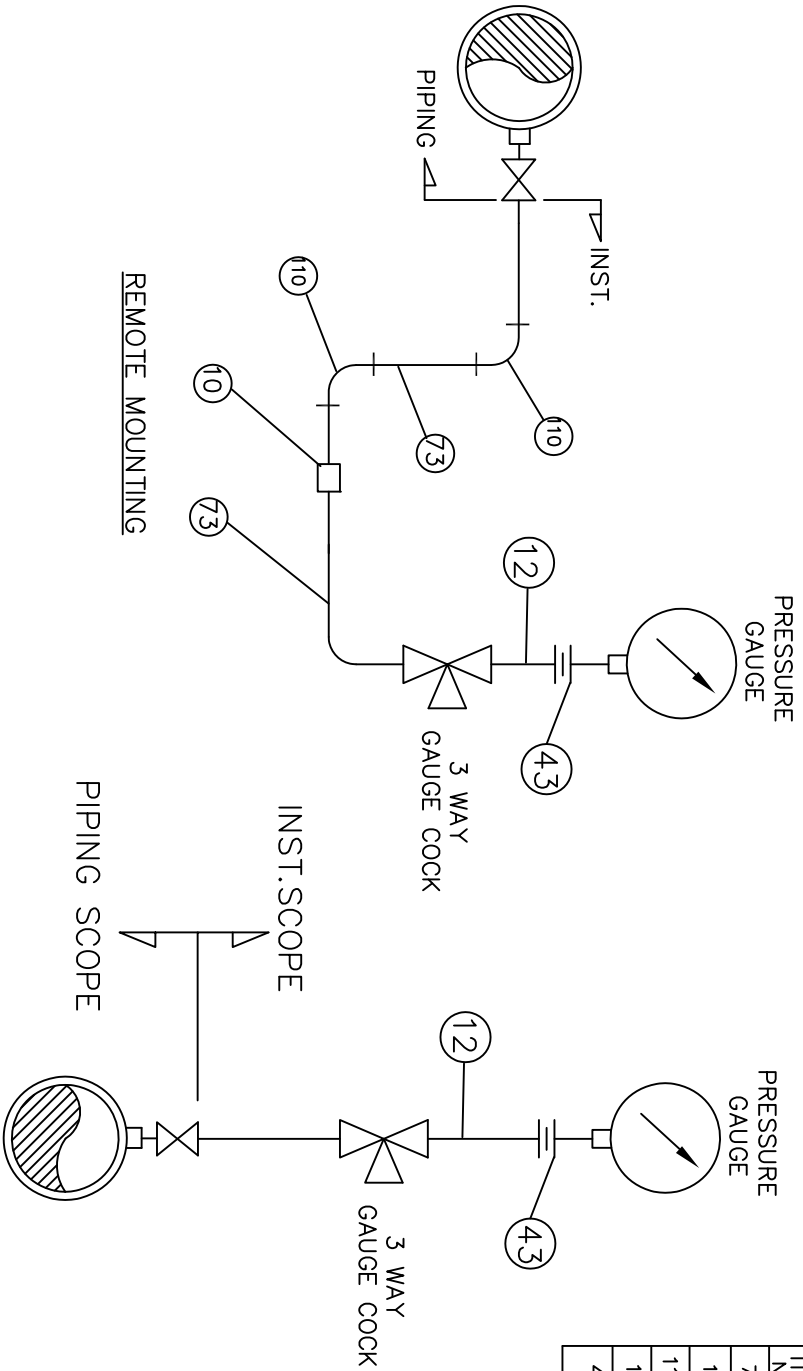
APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE
GP	AT	SD		0	21.04.10

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1.8000MW 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  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

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



BILL OF MATERIAL		
ITEM NO.	QTY./INST.	DESCRIPTION
73	15mtrs	IMPULSE PIPE 15 NB SCH.80
10	1	FULL COUPLING 1/2" SW 3000lbs
110	2	90° ELBOW 1/2" SW 3000lbs
12	1	1/2" NPT(M) X 1/2" PE 4" LONG NIPPLE
43	1	NUT & TAIL FITTING WITH CU WASHER 1/2" NPT(F) X 1/2" PE

SERVICE : WATER, CONDENSATE ETC.

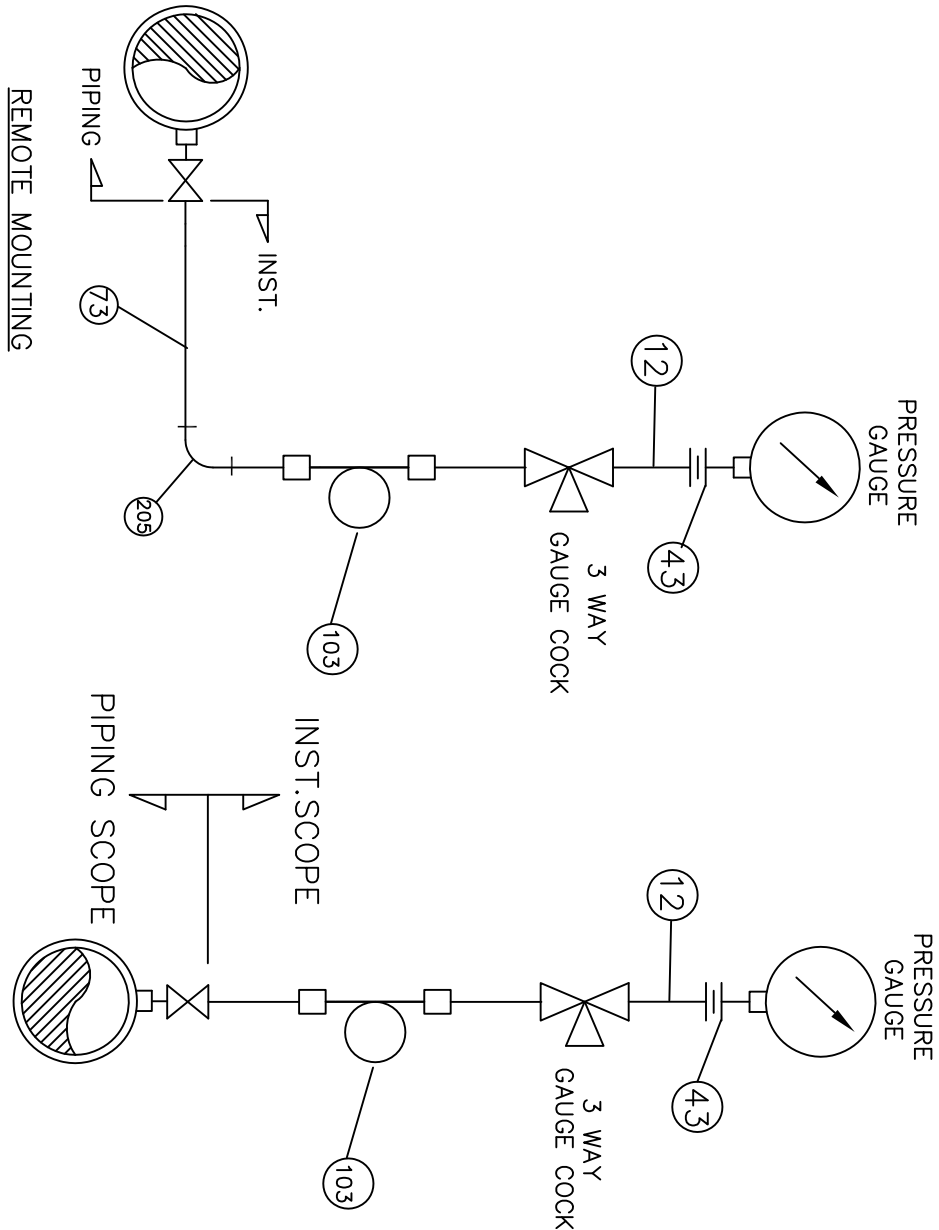
PRELIMINARY  
TENDER PURPOSE ONLY

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 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 SHT. 11 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



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

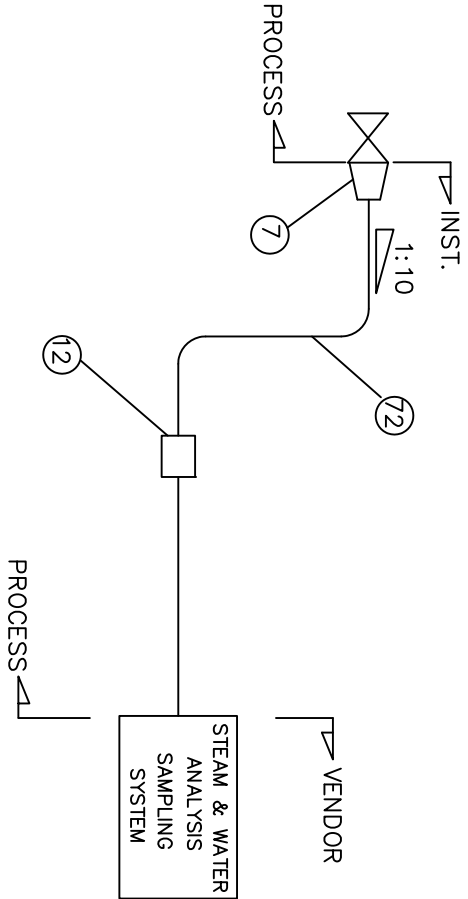
PRELIMINARY  
TENDER PURPOSE ONLY

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

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANKARBON 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-L-K9213R SCALE NIL SH. 12 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



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

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 WAMANBORN THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

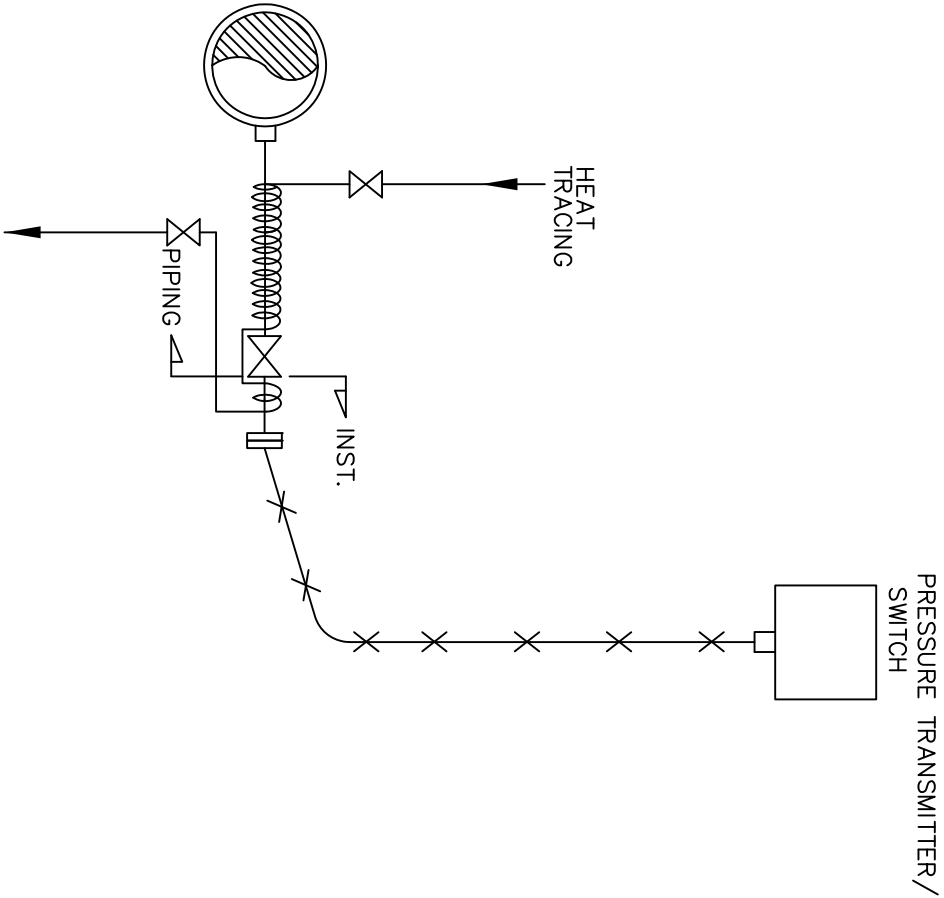


DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

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**




PRELIMINARY  
TENDER PURPOSE ONLY

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

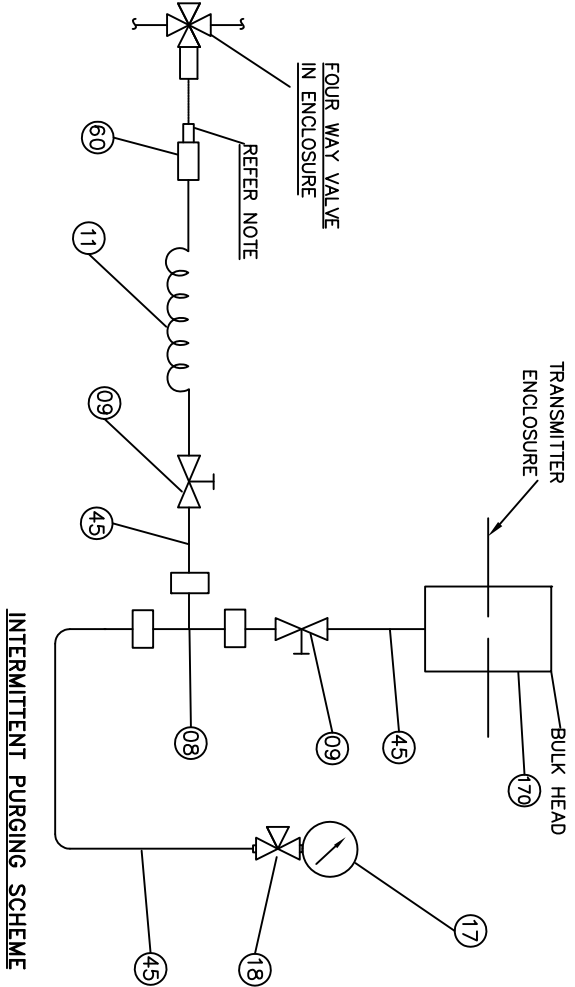
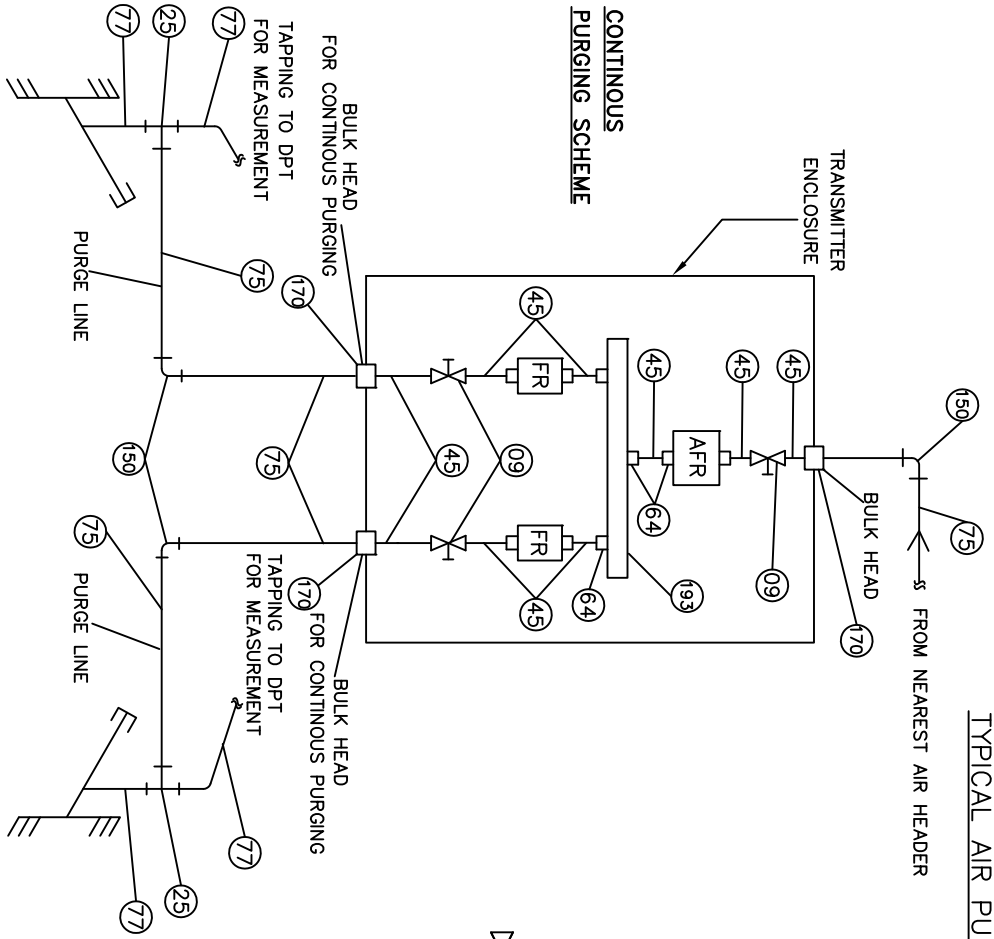
**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**

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

**GUJARAT STATE ELECTRICITY CORPORATION LIMITED**  
VADODARA, GUJARAT

 <p><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b> CONSULTING ENGINEERS KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p>		JOB NO. DCP L-K9213R DWG. NO. K9213R-DWG-I-0060	SCALE NIL SH. 14 OF 20	REV. 0
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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 SH. NO. 16/20

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 #9 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. 15 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

BILL OF MATERIAL		
ITEM NO.	QTY./INST	DESCRIPTION
77	15Mtrs	IMPULSE PIPE 3/4" NB
75	A/R	GI PIPE/1/2" NB
25	2	FORGED UNEQUAL TEE/AS PER ANSI B16.11 SIZE: 2 X 3/4" NB SW X 1/2"NPTF/CL 3000
150	3	GALVANISED ELBOW CL 3000 SIZE: 1/2" NPTF
60	1	QUICK DISCONNECTING FITTING
11	A/R	MALE/END CONN. TO SUIT 1/2" OD CONN. NYLON NOSE TO SUIT 1/2" END CONN./Pr. TESTING 10 Kg/cm <sup>2</sup>
45	A/R	SEAMLESS TUBE 1/2" OD TUBE X 2.1 MM THK.
170	3	BULK HEAD COUPLING TO SUIT 1/2" OD TUBE & 1/2" NB PIPE
09	5	BALL VALVETO SUIT 1/2" OD TUBE
64	9	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000lbs
193	1	INSTRUMENT AIR HEADER 1" NB PIPE
08	1	EQUAL TEE/SS 316/TO SUIT 1/2" OD TUBE.
17	1	Pr. GAUGE/4" DIAL SIZE/RANGE 0-10 Kg/cm <sup>2</sup> CONNECTION 1/2" NPTM
18	1	3 WAY GAUGE 1/2"NPTF X TO SUIT 1/2" TUBE.

APPROVED	CHECKED	DRAWN	DESCRIPTION	REV.	DATE	TYPICAL INSTRUMENT INSTALLATION DIAGRAM 1x800MW SUPER CRITICAL THERMAL POWER PROJECT (UNIT #9 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.	DWG. NO.	SCALE	SHT.	REV.
AT	SD			0	21.04.10			K9213R	K9213R-DWG-I-0060	NIL	16 OF 20	0

PRELIMINARY  
TENDER PURPOSE ONLY