

**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

14. Features :
- i) Noncontact position feedback sensor
 - ii) Integral Electro-Pneumatic convertor
 - ii) Self calibration with tunable response time
 - iii) Online diagnostics
 - iv) Pressure guages to be provided on positioner (I/P & O/P pressure)

1.43.00 MAGNETIC LEVEL INDICATOR

- 01. TYPE : Magnetically coupled level indicator
- 02. Display : Coloured flags
- 03. Chamber material : Stainless steel
- 04. Wetted part material : Stainless steel
- 05. Process connection : Side Side Flanged
- 06. Drain & Vent : Flanged
- 07. Scale : Standard, Stainless steel
- 08. Accessories : Counter flange, gaskets

1.44.00 FLOW SWITCH

- 01. Type : Paddle /Piston/Disk
- 02. Wetted part material : Stainless steel or Hastelloy for acidic application
- 03. End connection Tee :
 - i) Threaded upto 1" line size with integral Tee
 - ii) Flanged for line size > 1 ½"
- 04. Enclosure material : Die cast aluminium
- 05. Enclosure class : IP 65
- 06. Switch configuration : 2 SPDT
- 07. Contact rating : 240V AC 15A
- 08. Repeatability : 2%
- 09. Cable connection : ½"NPTF





WBPDC

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

10. Accessories : Tee, counter flange

1.45.00 ULTRA SONIC TYPE FLOW METER

- a) Ultrasonic Flow meter shall be dual path transit time clamp-on type.
- b) The flow meters shall be of proven reliability, accuracy and repeatability requiring a minimum of maintenance. They shall comply with relevant international standards and shall be subject to approval.
- c) CW flow shall be measured by redundant Ultrasonic Flow meter.
- d) All accessories required for mounting/erection of these instruments shall be furnished, erected and installed as necessary for completeness of the system though not specifically asked for. Also the equipment shall include necessary cables, flexible conduits, junction boxes required for the purpose.
- e) Flow meters shall be provided with suitable environment protection devices / structures such that they shall be suitable for continuous operation in the operating environment of a coal fired utility station without any loss of function or departure from the specification requirements.
- f) Technical Requirements
 01. Type : Transit time Clamp On Ultrasonic meter
 02. Mounting Style : Dual path with two sets of transducers on the same pipe
 03. Flow measurement : Instantaneous Flow rate as well as totalized flow **& velocity**
 04. Power supply : 240V AC, 50Hz with built –in battery back up.
 05. Analog Outputs : Isolated 4-20mA linear outputs for each path **with HART for volumetric flow and velocity**
 06. Binary Output : Contact relay outputs, 2 NO + 2 NC for alarm
 07. Communication ports : RS 232 C digital
Hand held terminal port
 08. Display/Indication : Flow meter with LCD screen backlight based local display and keypad. If required, transmitter shall be suitably located away from the sensor for better access and visibility.
 09. Recording / Totalizing /



**WBPDCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- Logging Facilities : Yes. Should be able to compute cumulative flow over intervals selectable by Owner i.e., daily, weekly, monthly etc. The data shall be stored in the memory of flow computer for access in future.
10. Software features : Compensation for any cross path errors Programming, configuration, shall be possible from front panel.
11. Diagnostics : False signal tolerance , power supply failure etc.
12. Protection Class : IP-65 or better, Weather protection against direct sunlight, rain etc for Flow meter and suitable for Cooling water for Transducer.
13. Accuracy : $\pm 1\%$
14. Electrical connection : Plug and socket
15. Accessories : All mounting hardware required like clamping fixtures, mechanism to remove the transducers online, interconnecting cables etc.
- All weather canopy for protection from direct sunlight and direct rain. Material of all fittings shall be SS 316
- g) Bidder shall submit certified flow calculation and differential pressure Vs. flow curves for each element for Owner's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Owner's approval.

2.00.00 NOT USED**3.00.00 CONTROL PANEL/DESK MOUNTED INSTRUMENTS AND ELECTRICAL SYSTEM ACCESSORIES.**

(For electrical System's Meter and for synchronisation, bidder shall refer to Electrical volume of specification)

3.01.00 Digital Indicator (If required)

01. Type : Five and half digit LED seven-segment display with sign.
02. Display Character : 13.8 mm, RED (LED)
03. Accuracy : 0.1% of reading, ± 2 digit



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 04. Input : 4-20mA DC/1-5 V DC/ pulse (as applicable)
- 05. Mounting : Flush Panel
- 06. Power Supply : 240V \pm 10%, 50 \pm 2.5 Hz

3.02.00 PUSH BUTTON

- 01. Type : Shrouded square format
- 02. Face Dimension : 32 x 32 mm (maximum)
- 03. Contact Configuration : 2 NO + 2 NC
- 04. Contact Addition : Add-on block up to 4 each with 2 pairs of contacts
- 05. Contact Material : Hard Silver Alloy
- 06. Contact Rating : 500V / 10 A
- 07. Utilization Category : AC11 / DC11
- 08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
- 09. Mechanical Life : 1 million operation
- 10. Construction : Aluminum shrouding with plastic lens
- 11. Colors : Red, Green, Yellow, Black, etc.
- 12. Connection : Screw terminals
- 13. Enclosure Class : IP-52
- 14. Legend : Engraving

3.03.00 ILLUMINATED PUSH BUTTON

- 01. Type : Square format
- 02. Face Dimension : 32 x 32 mm (maximum)
- 03. Contact Configuration : 2 NO + 2 NC (minimum)
- 04. Contact Addition : Add-on-Block up to 4 each with 2 pairs of contacts
- 05. Contact Material : Hard Silver Alloy
- 06. Contact Rating : 500 V/ 10A



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 07. Utilization Category : A C11 / DC11
- 08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
- 09. Mechanical Life : 1 Million Operation
- 10. Lamp : LED with built-in resistors as required
- 11. Lamp Rating :-
 - a) Voltage : 240 V AC
 - b) Watt : 2 Watt (approx.)
- 12. Lamp and Lens Replacement : From front
- 13. Construction : Transparent Plastic Lens
- 14. Color : Red, Green, Amber, Yellow etc.
- 15. Connection : Screw terminals
- 16. Enclosure Class : IP-52
- 17. Legend : Engraving

3.04.00

SELECTOR SWITCH

- 01. Type : 2/3/4 position stay put type with rotary lever actuator.
- 02. Face Dimension : 32 x 32 mm (maximum)
- 03. Contact Configuration : 4 pair of contacts
- 04. Contact Addition : Add-on-Block up to 4 each with 2 pairs of contact
- 05. Contact Material : Hard silver Alloy
- 06. Contact Rating : 500 V/10 A
- 07. Utilization Category : AC11 / DC11
- 08. Insulation Voltage : 2 KV for 1 minute between terminals and earth
- 09. Mechanical Life : 1 million operation
- 10. Construction : Aluminum shrouding
- 11. Connection : Screw terminals



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

12. Enclosure Class : IP-52

3.05.00**INDICATING LAMP**

- 01. Type : LED with built-in resistor
- 02. Face Dimension : 32 x 32 mm (maximum)
- 03. Voltage : 240 V AC
- 04. Watt : 2.5 Watt (approximate)
- 05. Lamp and Lens Replacement : From front
- 06. Construction : Transparent Plastic lens
- 07. Color : Red, Green, Amber, Yellow etc.
- 08. Connection : Screw terminals
- 09. Legend : Engraving

3.06.00**INDICATING METERS (A.C)**

- 01. Type : Rectifier type taut band
- 02. Face Dimension : 96 x 96 mm
- 03. Scale : Radial arc of 240 Deg.
- 04. Accuracy : 1.5% of full scale.
10.5 Hz for frequency meter
- 05. Input : 0-1/0-5A for current measurement, 0-240V for voltage measurement, 50 I 2.5 Hz for Frequency measurement
- 06. Zero Adjustment : Screw on meter face
- 07. Enclosure : Shielded Case IP-52
- 08. Mounting : Flush Panel
- 09. End Scale
Suppression : 6 times the measuring range only for motor ammeters

3.06.01**INDICATING METERS (D.C)**

- 01. Type : Taut band moving coil
- 02. Face Dimension : 96 x 96 mm



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | | |
|-----|-----------------|---|--|
| 03. | Scale | : | Radial arc of 240 Deg. |
| 04. | Accuracy | : | 1.5% of full scale |
| 05. | Input | : | 0-75 mA for current measurement. Direct reading for voltage measurement. |
| 06. | Zero Adjustment | : | Screw on meter face |
| 07. | Enclosure | : | Shielded case IP-52 |
| 08. | Mounting | : | Flush Panel |
| 09. | End Scale | : | |
| | Suppression | : | 2 times the measuring range only for motor ammeters. |

3.07.00 AUXILIARY RELAY

- | | | | |
|-----|-----------------------|---|---|
| 01. | Type | : | Plug-in type with base/DIN rail Mounted |
| 02. | Coil voltage | : | 240 V AC/24V DC / 220V DC |
| 03. | Contact Configuration | : | 2 NO & 2 NC (Minimum), additional contacts as per requirement |
| 04. | Contact rating | : | 250V/5A (A.C/D.C.) |
| 05. | Operating range | : | 80 to 110% of rated voltage |
| 06. | Insulation | : | 2 KV for 1 minute between terminals & earth. |
| 07. | Mechanical life | : | 20 million operations |
| 08. | Enclosure | : | Transparent cover |
| 09. | Connection | : | Screw terminals. |
| 10. | Mounting | : | Projection mounting inside panel /DIN rail Mounting |

Note : Coil protection: diode/surge suppressor shall be provided

3.08.00 COUPLING RELAY

- | | | | |
|-----|--------------|---|---|
| 01. | Type | : | Miniature plug-in type/ DIN rail Mounting |
| 02. | Coil voltage | : | 24 V D.C. / 48 V DC or others as required. |
| 03. | Contact | : | 2 NO & 2 NC (Minimum)-Additional contact as per requirement |





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

04. Contact rating : 250 V/10A (A.C)/220V/2A (D.C)
05. Operating range : 70 to 110% of rated voltage.
06. Insulation : 2 KV for 1 minutes between terminal & earth.
07. Mechanical life : 20 million operations
08. Coil protection : Diode
09. Indication : Coil on LED
10. Enclosure : Transparent cover
11. Connection : Screw terminals.
12. Mounting : Projection mounting inside panel / DIN rail mounting





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

4.00.00 CONTROL VALVES, ACTUATORS & ACCESSORIES

4.01.00 GENERAL REQUIREMENTS

4.01.01 Bidder shall exercise extreme caution in selecting severe service control valves like BFP recirculation valves, HP & LP bypass valves, superheater & reheater attemperator valves, PRDS valves for Boiler & Turbine, Soot blower steam pressure control valve, control valves whose down stream are connected to condenser and in vacuum such as HP/LP heater emergency level control, condenser make up water control valve and CEP minimum flow control valve etc. For such critical applications, Bidder shall offer valves which are proven for similar application for not less than 2 years of continuous service in power plant environment. All the above valves shall have leakage class equal or better than class-V or as specified hereunder with metal-to-metal seating. For Severe Service Control Valves viz. BFP Recirculation Valves, PRDS Valves, Feed Control Valve, SH/RH Attemperation valve, Soot blower steam pressure control valve etc. multistage-multipath discrete pressure drop stage design shall be provided. HP and LP Bypass valves shall be designed for 60% bypass capacity with twin valves. Typical Requirements for these Control Valves shall be as follows:

Service	:	BFP Recirculation Valve/RH-SH Attemperator Valves
Type	:	Multi Stage, Multi Path stack Plate radial Flow design
Trim	:	Angle Design (side inlet and bottom outlet, over the plug flow) or Globe design (for straight pipe)
Trim exit <i>velocity</i>	:	Not exceeding 23m/sec
Pressure reducing /drop	:	Achieved in multi stage orificed, drilled hole or axial flow cage design
Seat Leakage	:	In accordance with MSS-SP-61
Actuator type	:	Pneumatic Piston type ensuring MSS-SP-61 seat leakage

4.01.02 Control valves for regulating service shall normally be globe body, cage guided, metal-to-metal seated, pneumatically operated and shall be provided with characterized plugs having ANSI leakage class-IV as minimum. All steam temperature conditioning control valves shall be ANSI leakage class-V.

4.01.03 Where the operating time is critical for the operation of the plant, as in case of HP or LP bypass valves, hydraulic actuators with electro-hydraulic interface shall be offered. Block valve in the spray water line for HP or LP bypass valves shall also be hydraulically operated.



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- 4.01.04 Bidder shall provide redundant control valves for main condensate control station, Superheat attemperation control and Reheat attemperation control as a minimum. For other application, if the availability criteria for the plant can not be met even with the best established product, redundant control valves shall be provided.
- 4.01.05 All control valves shall be located near floor or platform for ease of access with adequate clearances for maintenance and lay-down and shall be placed as control station with up-stream and down-stream motorized isolating valves, manual drain valves and motorized inching bypass valve. For Superheat attemperation control and Reheat attemperation control, upstream and down stream isolation valves shall be solenoid operated pneumatic on-off valves. Block valve in the spray water line shall also be solenoid operated pneumatic on-off valve.
- 4.01.06 Control Valves and accessories shall be designed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, ASME Boiler and pressure vessel code, Indian Boiler Regulation (IBR), ISA and other standards as specified elsewhere and in accordance with the applicable requirements of the Federal Occupational Safety and Health Standards, USA or acceptable equal standards.
- 4.01.07 The start-up system control valves and HP & LP bypass control valves shall be proven in similar application.
- 4.01.08 All control valves shall meet the specification requirements and process requirements.
- 4.01.09 For large flow conditions with low pressure drops, as in case of cooling water applications, butterfly valves shall be used.
- 4.01.10 High Pressure Bypass Control Valve
1. Body shall be designed to withstand thermal cycling. Thin walled sections shall be provided in areas after pressure reduction to reduce thermal fatigue.

Transitions between thick and thin wall sections shall be gradual. The body shall be a single shape steam entry from the bottom (under the plug) to facilitate easy and clean installation.
 2. Valves shall be designed that they can operate in any orientation. For maintenance purposes the preferred orientation is vertical.
 3. The HP bypass shall have desuperheating function in the valve body. Water injection must be at a fixed point inside the valve spraying into the turbulent steam flow. Water shall not be injected through the stem due to leakage potential past internals seals and to eliminate possibility of stem cracking due to combined thermal and mechanical stress. Water spray should be fully atomized within 1m of valve outlet to ensure uniform reheater temperature and flexibility in downstream piping layout.
 4. Body shall be protected from damage due to water injection by means of multi function contoured cage. Contoured cages shall be used as they have higher mechanical strength and no tendency to resonate.



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

5. Cage material must be of a high alloy material such as X20Cr Mo V121 for good thermal cycling and erosion resistance.
6. Contour of cage to be of hour glass shaped form to improve the strength of the cage. The cage shall be firmly attached at one end and located radically at the other end to provide good guiding and allow axial growth due to thermal differentials.
7. Plug type shall be channel slotted design for acoustic attenuation and to allow passages of nominal contamination. Plugs of multiple holes design are unacceptable due to contamination catching between plug and seat. Contoured plug designs are not allowed because of poor acoustic performance.
8. Packing box design shall consist of two independent sets of rings separated by a metallic spacer. Packing to be compressed by means of a bolted flange design. Screwed gland type packing retainers shall not be provided.
9. Bolted bonnets are preferred. If pressure seal bonnet are used, seal areas shall be inlaid with corrosion resistant materials to minimize leakage potential.
10. The bypass valve should conform to MSS SP-61 or EN12266-1 Rate C leakage class (block/isolation valve tightness). Bidder to provide calculation.

4.01.11 Low Pressure Bypass Control Valve

1. Body shall be designed in angle shape for ease of installation and maintenance.
2. Valves shall be designed that they can operate in any orientation.
Note that the typical orientation for LP-Bypass valves is horizontal with straight outlet to the condenser.
3. Skirted-plugs shall not be used due to potential for contamination and sticking between plug and seat. A combination of cage guiding and top guiding for plugs shall be provided to eliminate possibility of vibration.
4. No components may be screwed or welded inside the valve body for ease of maintenance.
5. Inlet cage and seat shall be easily removable for inspection maintenance and replacement. They shall be hold in place by the bonnet bolting and flexible gaskets shall accommodate differential thermal expansion.
6. Water injection to be downstream of pressure reduction to maximize evaporation.
7. Diffuser in the outlet to reduce noise and guide steam towards spray nozzles for good mixing of water and steam.
8. Water shall not be injected through the stem due to leakage potential past internals seals and to eliminate possibility of stem cracking due to combined thermal and mechanical stress.
9. Water injection shall be performed through spray nozzles. Spring loaded nozzles are preferred to maximize atomization at lower flow



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

rates. Multiple nozzles shall be used for uniform spray pattern. Water injection shall be perpendicular to stem flow for good penetration and mixing.

10. Packing to be compressed by means of a bolted flange design. Screwed gland type packing retainers shall not be provided.
11. Bolted Bonnets are preferred. If pressure seal bonnets are used, seal areas shall be inlaid with corrosion resistant materials to minimize leakage potential.
12. The bypass valve should conform to MSS SP -61 or EN12266 – 1 Rate C leakage class (block/isolation valve tightness). Vendor to provide calculation.

4.01.12 Spray water Valves

1. Valves shall be provided with rated cavitation index (K_{cr}) above Cavitation index for the process (K_c) where $K_c = (P_1 - P_2) / (P_1 - P_v)$
2. Valves shall be free of cavitation. Should process condition produce cavitation, valve design shall be upgraded to eliminate cavitation.
3. The trim should be quick change type. No parts should be screwed or welded.
4. Isolation valves must be provided upstream of the HP-Bypass spraywater control valves, to ensure tightness of the spraywater line whenever the steam valve is closed. Individual isolation valves per control valve are recommended. Isolation valves are to be shut whenever the steam valve is closed.
5. Isolation valves upstream of the LP-Bypass spraywater control valves are recommended to allow shut-off of the water line. Isolation valves are to be shut whenever the steam valve is closed.
6. The valves should conform to MSS SP -61 or EN12266 –1 Rate C leakage class (block/isolation valve tightness). Valve trim exit velocity should be below 23 m/sec.

4.01.13 Hydraulic System

Hydraulic actuation is used for positioning of bypass control valves to fulfill the high stroking speed, high actuation forces and accurate positioning requirements. The hydraulic actuation system consists of one or more hydraulic supply units as required by the capacity and the distances between the valves and the hydraulic actuators and accessories.

4.01.14 Hydraulic supply unit

The hydraulic supply unit shall have the following features:

- fully redundant main pumps with 100% capacity. Switch over from main to standby pump should be fully automatic. Both pumps can be main or standby pump.
- Operating pump should run continuously to avoid unnecessary switching of main pumps and power peaks.



**WBPDC**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- Filter loop with continuous filtration of the oil. Filter change possible without switching off main pumps to avoid shutting down bypass for filter change.
- Oil filling must take place with the filter pump through the filter.
- Oil cooler with controlled fan to keep oil temperature within limits for the used hydraulic oil.
- Optional oil heater if ambient temperatures are getting below minimum limits of hydraulic fluid.
- The hydraulic supply unit should be able to generate constant outlet pressure of 160 bars and should have constant pressure and forces at the actuator.
- Accumulator pressure should be above the controlled outlet pressure to ensure sufficient reserve volume in the accumulators.
- Reserve volume in accumulator should be sufficient to allow min. 2 strokes of all actuators after trip of main pumps.
- Hydraulic supply unit should be equipped and completely wired and tested with local control and power switches. Manual control of the hydraulic supply unit through push buttons on the front panel for commissioning and testing.
- Drip tray shall be supplied together with the hydraulic supply unit.

4.01.15 Hydraulic actuators

- Hydraulic actuators shall be of compact heavy duty design and shall fulfill all force, stroke and stroke speed requirements of the valves.
- Actuators shall be of compact design with proportional valves and auxiliary elements directly flanged to the actuator, without connection pipes between these elements and the actuator
- Position control shall be performed with the help of proportional valves
- System must include accessories for quick stroking and safe opening and safe closing. Quick stroking accessories are not required if control through proportional valves meets quick stroking speeds (typically 2-3 seconds).
- Energy for safe opening or closing (e.g. condenser protection) shall be independent of the oil pressure from the HSU, either through steam force or a separate hydraulic accumulator.

4.01.16 Hydraulic positioner

- Hydraulic positioned shall be of digital smart type featuring simple adjustment through digital interface.
- For easy commissioning and maintenance positioners are located close to the valve/actuator and must be suitable for the harsh environment. Connections to the actuator shall be prefabricated and pluggable.
- The positioned is the only connection point for the plant cabling to the valve/actuator.





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- Positioner should be absolutely stable at stroke speeds of 2 seconds
- Positioner shall have standard 4-20 mA signals for position demand and position feedback.
- Power supply options must be available for easy adaptation to the power supply available in the plant.

4.01.17 Bypass Controller

- Control system shall be state of the art, digital type.
- Control system should have redundant power supply to ensure reliability
- Control system shall be suitable to operate from 0 to 50 degree Celsius.
- Input/output modules, Power supply modules and CPU modules shall have hot swap feature and shall be replaceable while the plant is in operation without any disturbance of the other module.
- Input/output modules, Power supply modules and CPU modules shall have no slot dependencies for easier use.
- Interface with main DCS shall be MODBUS.

4.02.00 VALVE CONSTRUCTION

4.02.01 All valves shall generally be of globe body design and straight through pattern with single seat unless otherwise is specified or recommended by the manufacturer for particular application. However, Bidder may offer angle body valve for high pressure drop applications. For high pressure drop applications, construction of the valve shall be such that the gland is not exposed to full line pressure.

4.02.02 Valves with high lift cage guided plugs and quick replacement trims shall be provided for easy maintenance.

4.02.03 Plug shall be one piece construction either cast, forged or machined from solid stock. Plug shall be screwed and pinned to valve stem or shall be integral with valve stem.

4.02.04 Bonnet joint shall be of flanged and bolted type or manufacturer standard acceptable to Owner. Bonnet joints of internal threaded or union type is not acceptable.

4.02.05 Extension Bonnet shall be provided for fluid temperature above 280 deg C.

4.02.06 Valve characteristics shall match with the process characteristics.

4.02.07 All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum application (i.e. double vee type chevron packing).

maximum

4.02.08 Flanged valves shall have ~~minimum~~ body rating ANSI 300 lbs.

4.02.09 The direction of flow shall be clearly marked/engraved on the body.



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 4.02.10 Valve body rating shall meet the process pressure and temperature requirement as per ANSI B 16.34.
- 4.02.11 Control valve body shall be selected as per the ISA guideline. Generally control valve body shall be cast and machined for pressure rating up to 1500 lbs. Above 1500 lbs, valve body shall be of forged steel. For Demineralized Water application valve body shall be Stainless Steel.
- 4.03.00 VALVE BODY

Valve body material shall generally be guided as per the Table below:

SR. NO.	SERVICE	BODY MATERIAL
1.	Non corrosive, non-flashing and non cavitating service for fluid temperature upto 275°C (like Aux steam flow to Deaerator, condensate flow to Deaerator, CRH flow to Deaerator)	Compatible with piping material but not inferior to Cast carbon steel ASTM A216 Gr. WCB
2.	Severe flashing / cavitating services (like HP & LP heaters emergency drain, Deaerator overflow drain to hotwell etc.)	Alloy steel as per ASTM A217 Gr. WC9
3.	Low flashing / cavitating services (like HP & LP heaters normal drain level control, GSC minimum flow, gland seal steam pressure control etc.)	Alloy steel as per ASTM A217 Gr. WC6
4.	DM water application (like condenser hotwell normal and emergency make up, ECW DP control etc.)	316 stainless steel ASTM A351 Gr. CF8M

4.04.00 VALVE TRIM

4.04.01 Valve trim for most applications up to leakage class-V shall be stainless steel 316 SS for pressure drop up to 7 Kg/ Sq. cm.. For pressure drops above 7 Kg/Sq. cm hard trim (stelliting or equivalent) shall be used. Other alloys shall be substituted if required for corrosion and other fluid conditions.

4.04.02 Balanced trim valves shall be offered for high shut-off pressure or high pressure drop condition to reduce the size of the actuators. For flashing services and two stage mixtures, the trim material shall be 17-4 PH or equivalent. If cavitating condition is foreseen, Bidder shall offer multistage or labyrinth trim valves. Trim of severe service valves as indicated in Cl. 4.01.01 shall be of multistage and multipath design with sufficient no. of discrete



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

pressure drop stages to eliminate the chances of erosion, cavitation, noise and vibration throughout the control range of the valve.

4.04.03 Quick replacement type trim shall be considered for easy maintenance.

4.04.04 Trim Material

Valve trim material shall generally be guided as per the Table below :

<u>SR. No.</u>	<u>SERVICE</u>	<u>MATERIAL</u>
1.	Non corrosive, non-flashing and non cavitating service for fluid temperature upto 275°C.	316 SS with satellite faced guide posts and bushings
2.	Severe flashing / cavitating services	400 series SS or equivalent to suit the specific requirement
3.	Low flashing / cavitating services	400 series SS or equivalent to suit the specific requirement
4.	DM water application (condenser hotwell normal, emergency make up etc.)	316 SS

cavitation resistance, corrosion resistance, temperature resistance, erosion resistance, hardness etc. of the offered material vis-à-vis the specified material for Bidder may offer valves with body and trim material better than the specified material and in such cases Bidder shall furnish the comparison of properties including Owner's approval.

4.05.00 VALVE END PREPARATION

Valve body ends shall be either butt welded/socket welded, or flanged (Rubber lined for condensate service). Control valves of size 65 mm and above shall have butt welded ends as per ANSI B 16.25. For valve size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends shall be of ANSI pressure-temperature class equal to or greater than that of control valve body.

4.06.00 VALVE SIZE

The control valve sizing (Cv / Kv) shall be based on following guidelines :

- a) The valves shall pass normal rate of flow (MCR condition) with 65 to 75 percent opening for linear characterised valves and 75 to 85 percent opening for equal percentage characterised valves.
- b) The valves shall have adequate rangeability to pass the minimum and maximum rated flows at 10% and 80% of the valve opening



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

respectively. Valve stem travel range from minimum to maximum flow condition shall not be less than 50% of the total valve stem travel.

- c) Valve Cv shall be selected in such a way that the valve shall be capable of handling at least 120% of required rated flow.
- d) The valve selection shall be based on the highest size dictated by the above considerations unless noise, flashing or other factors dictate the final selection.
- e) The sizing procedure followed shall be as per latest edition of ANSI/ISA or equivalent standard.
- f) While deciding the valve size, Bidder shall ensure that valves port outlet velocity does not exceed 8 m/sec for liquid services, 150 m/sec for steam services and 50% of sonic velocity for flashing services.
- g) Control valve induced noise shall not greater than 85 dBA at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.
- h) Bidder shall submit the sizing calculation clearly indicating the valve outlet velocity, noise calculation during detail engineering stage for Owner's approval.

4.07.00 VALVE TOPWORK

4.07.01 Topwork shall be sized so that the valve shall operate properly when upstream pressure is 10 percent above maximum inlet pressure and downstream pressure is atmospheric.

4.07.02 Bonnet material shall be same as that of valve body or equivalent forged material.

4.07.03 Extended bonnet/Finned bonnet and high temperature packing shall be used for high temperature application. Extension bonnet shall be used when the fluid temperature is high and may damage valve stem packing.

4.07.04 The gland material shall be chosen to suit the operating temperature. PTFE may be chosen for low temperature application and for high temperature application graphited asbestos glands are to be provided. For vacuum services, the glands shall be dry seal type.

4.08.00 NOISE LEVEL

The equivalent sound level measured at 1.5 M above nearest floor level in elevation and 1 M horizontally from the control valve expressed in decibels to a reference of 0.0002 microbar shall not exceed 85 dBA. If the calculated noise is more than the above limit, even with low noise trim design, diffusers shall be included. Diffusers shall be made of stainless steel and shall be integrally connected to the control valve with necessary spool piece. The spool piece shall be in conformity with the main line piping specification.



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- 4.09.00 VALVE ACTUATORS
- 4.09.01 Spring-diaphragm type valve actuators shall be used in general applications. However piston type actuators shall be offered in case of high shut-off pressure & quick response requirement. Bidder shall provide piston type actuators for regulating services for the following services as a minimum requirement. Piston actuator shall be of double acting type for the regulating duty valves with long stem travel for better regulation and quick response.
- a) Auxiliary Pressure reducing & De-super heating stations.
 - b) Superheat and Reheat Spray Control Valves.
 - c) Condensate extraction pump minimum recirculation valve.
 - d) Feed control valves
- 4.09.02 The actuator shall be designed for 150% thrust required for the valve (at shut-off pressure) at an air line supply pressure of 5.5 Kg/Sq. cm.
- 4.09.03 All the actuators shall be supplied mounted on the valve with all the accessories integrally mounted. The diaphragms shall be designed for 200% maximum operating pressure.
- 4.09.04 Nylon reinforced neoprene shall be used as diaphragm material.
- 4.09.05 Valve actuators shall be capable of operating at 60 deg C ambient, continuously.
- 4.09.06 Entire actuator assembly shall be painted with corrosion inhibiting paint.
- 4.09.07 Air connection size shall be 1/4" NPT (F) unless otherwise dictated by process response time. Integral tubing shall be of stainless steel construction.
- 4.09.08 Bidder shall indicate the stroking time of the valve assemblies with positioner, which shall not exceed 10 sec unless otherwise stated.
- 4.09.09 All actuators shall be of fail safe design signifying that the spring direction will tend to move the valve (open or close) in a direction safe for the process. "Failure to Open" or "Failure to Close" shall be marked on the actuator.
- 4.09.10 HP and LP bypass and spray valves, turbine inlet stop & control valves shall be electro-hydraulic actuators and all other control valves shall have pneumatic actuators.
- 4.10.00 VALVE POSITIONERS
- 4.10.01 All regulating service valves shall be offered with HART protocol based Smart Electro Pneumatic Positioners to ensure accuracy and repeatability of response.
- 4.10.02 Positioners shall have integral I-P converter, Position feedback transmitter, input and output gauges, local keypad & display .



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 4.10.03 Positioners shall be capable of functioning under hot, humid and vibrating conditions.
- 4.10.04 Positioner casings shall be dust tight, corrosion resistant and weatherproof (IP-55).
- 4.10.05 In general, positioner shall operate at signal range 4 – 20 mA DC for the full travel of the valve. Split range operation in few cases may be required. Remote calibration from control room shall be possible through HART management station.
- 4.11.00 **VALVE ACCESSORIES**
- The accessories of the valves shall include side mounted hand wheels, smart positioner, limit switches, tubing and air set, junction boxes, airlock relays, volume booster, solenoid valves, and any other devices as required.
- 4.12.00 **TESTS**
- All valves shall be tested in accordance with the Quality Assurance Programme (QAP). Bidder shall submit QAP for Owner's approval. The tests shall include but not be limited to the following :
01. Non destructive test as per ANSI B 16.34.
 02. Hydrostatic shell test as per ANSI B 16.34 prior to seat leakage test.
 03. Valve closure test and seat leakage test as per ANSI B 16.34 and as per the leakage class
 04. Functional test : The fully assembled valves with actuator and all accessories shall be functionally tested to demonstrate from open to close position and vice versa. Valve lift shall be checked at 5 points at 0, 25, 50, 75 and 100% in both the directions with increasing and decreasing inputs. Performance of the valve with Positioner shall be as follows :
 - a. Linearity : +/- 1%
 - b. Hysteresis : +/- 1%
 - c. Sensitivity : +/- 0.5%
 - d. Deadband : +/- 1%
 - e. Reproducibility : 0.3% of total stroke
 - f. Overall accuracy : +/- 1%
 05. CV test : Cv test shall be carried out as type test on each size, type and design of the valves as per ISA 75.02 standard and test report shall be submitted for Owner's approval.

5.00.00 CONTROL DESK / PANEL / RACK

- 5.00.01 Convenient and logical approach to operational interfaces shall be considered to enhance aesthetics in the overall view of the control room..



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 5.00.02 For items susceptible to vibration, suitable rubber gaskets or padding shall be provided to prevent damage or malfunction.
- 5.00.03 All items like MCB, Terminals, instruments, lamps etc. inside the panels/cabinets shall be neatly arranged with easy access/ maintenance approach to avoid undue disturbing the wiring.
- 5.00.04 Incoming power supply feeders shall be Redundant UPS Power supply feeders, so that a single failure shall not affect the operation of the unit. Required isolation & protection through MCB shall be provided in all cases. Alarm shall be provided against failure of a single power supply. Duplication/looping of Power supply feeders at the Panel terminal is not acceptable. Redundant UPS power supply feeders shall form Primary & Secondary power supply Bus and further power distribution shall be from these busbars.
- 5.00.05 Desk / panel shall be provided with interior illumination lamp with door switch, space heater with thermostat and 5A, 3 Pin receptacle with plug. Exhaust/cooling fans with fan failure alarm shall be provided.
- 5.00.06 Lamp, heater, exhaust fan and receptacle circuits shall be suitable for available AC supply and furnished with individual ON-OFF switch. The ON-OFF switch of the 3 pin receptacle circuit shall be Illuminating type.
- 5.00.07 Panel / Desk shall have gland plate at cable entry to panel. Thickness of gland plate shall not be less than 3 mm.
- 5.00.08 Panels / enclosure shall be provided with 20% spare terminals. In addition, the spare hot on rail mounted input output channels /modules shall be in fully wired & terminated condition for system cabinets.
- 5.00.09 Wire shall be routed/laid in the covered PVC cable trough/tray.
- 5.00.10 Nameplate
- a) Nameplate shall be furnished for each instrument or device mounted on the panel/desk.
 - b) The material shall be laminated phenolic, 3 mm thick with white letters on black background.
 - c) The nameplates for panels / consoles shall be provided both on the front and the rear.
 - d) Nameplates for all devices shall be located adjacent to the respective devices.
- ~~5.01.00 UNIT CONTROL DESKS~~
- ~~5.01.01 All devices mounted on the control desks shall be flush type. Instruments / devices shall be so mounted that the removal and replacement can be accomplished individually without interruption of services to others.~~



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

xiv) Front and Rear door shall be considered.

5.02.00 BACK UP PANEL / ELECTRICAL PANEL

5.02.01 Back Up Panel shall be of free standing type vertical panel with doors at the back. Construction shall be made from sheet steel of thickness not less than 3mm with mosaic grid structure of approximate size 24 X 48 on the front surface. Grid shall be heat resistant, flame retardant, self extinguishing, shrinkage free, non reflecting type. Finish shall be mat type without flaring. Indicators /ammeters, conductivity type EWLI for seperator, electromatic safety valve controls etc. shall be mounted on the panel..

5.02.02 Electrical Panel construction & design shall be similar to back up panel. Required control switches, meters, indicators, synchronizer, excitation control switch, annunciation window etc. alongwith associated mimic diagram shall be provided for manual synchronization of generator.

5.02.03 Crating of the panels shall protect against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.

5.03.00 CABINETS / ENCLOSURE / PANELS

- | | | | |
|-----|----------------------------|---|---|
| 01. | Material of construction | : | Cold rolled steel sheet |
| 02. | Thickness of Sheet | : | a) 3.0 mm for faces supporting instruments / terminals. Mounting plate shall also be 3.0 mm.
b) 2.0 mm for other sides inclusive of top. |
| 03. | Construction | : | Welded throughout as per (metallic parts) approved National Standards. |
| 04. | Panel height | : | 2300 mm maximum |
| 05. | i)Corners | : | 7 mm inner radius |
| | ii) Dimensional Tolerances | : | a) In height & length - 3 mm
b) In height between adjacent sections - 2 mm.
c) Total for a group - 6 mm |
| 06. | Doors | : | Double, recessed, turned back edges. Doors shall have 4 point IP Lock |
| | i) Thickness of Sheet | : | 2 mm |



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- | | | | |
|------|----------------------|---|--|
| ii) | Hinges | : | Stainless steel |
| iii) | Door latches | : | Three point type |
| iv) | Door gaskets | : | Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure. |
| v) | Opening of the doors | : | Outward. Door swing shall be Min. 110-120 Degree |
| vi) | Louvers | : | With removable wire mesh to ensure dust and vermin proof. |
| 07. | Color of interior | : | Brilliant white (Approval shall be accorded by owner during detail engineering) |
| 08. | Colour external | : | RAL 7032
(Approval shall be accorded by Owner during engineering) |
| 09. | Painting | : | Epoxy powder coated or better. Minimum Paint thickness shall be 80-100 microns |
| 10. | Gland plates | : | Removable 4 mm thick (bottom) |
| 11. | Cable entry | : | Bottom |
| 12. | Hardware | : | a) Anti vibration pad- 15 mm
b) Predrilled base channel ISMC - 100 or equivalent for all sides.
c) Lifting hook / Eye bolt
d) Drawing pocket
e) Door switch, lamps, thermostat, heaters and fans |
| 13. | Enclosure Protection | : | As per environment condition of the area of installation. Refer to Section-I of Vol-II E clause 6.16.00. |

5.04.00 LOCAL INSTRUMENT RACKS & ENCLOSURE (EXCEPT OFFSITE/BOP AREAS)

Transmitters and switches located in the field shall be grouped together and shall be installed in the enclosure (Closed Transmitter Racks) in case of outdoor area such as Boiler area etc. and in Open Type Rack in case of



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

covered area. Racks shall be factory prefabricated & painted and complete with internal tubing, manifold, isolation valves, integral junction box with outside access door, illumination etc. Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging. Following requirements for LIE/LIR shall be met:

- 1) Not more than Six (6) Instruments shall be grouped in a single Rack/enclosure".
- 2) Racks shall be installed above the tapping points for air, flue gas and coal air mixture application where as for applications such as for water and steam, racks to be installed below the source point.
- 3) Service air connection shall be provided for continuous and intermittent purging of impulse pipe in dusty medium. Continuous purging shall be adopted for differential and guage Pressure measurements such as flue gas, furnace and coal air mixture applications. Intermittent purging shall be adopted for Pressure measurements in air application or wherever required.

5.04.01 Closed Type Transmitter Racks

- a) Required number of transmitter racks shall be furnished to house transmitters, switches and converters by grouping them suitably, area-wise / function-wise. Closed type Instrument rack to have the list of the Transmitters & Switches along with the service and KKS tag on the inner face of the front door. Moreover each Transmitter/switches mounted on the 2" pipe shall have label indicating the KKS tag.
- b) The transmitter enclosures shall be constructed of 3 mm thick steel plate. The enclosures shall preferably be of modular construction and with two end plate assembly bolted to the frame. Base frame shall be made of ISMC 100 and black colour finish
- c) The enclosure shall approximately be 1200 millimeters wide, 1000 millimeters deep and 2200 millimeters high to allow easy access to the internals. Racks shall be reinforced as required to ensure true surfaces and to provide adequate support for instruments and equipment mounted therein. Double interlocking doors shall be provided and shall be arranged for maximum possible access to the interior. Center posts or any member which would reduce access shall not be provided.
- d) 2"NB Galvanised pipes shall be laid horizontally and supported at two end channels to mount transmitters/switches at accessible height. Adequate support for Manifold, impulse pipe and cable tray to be provided and the same shall be adjustable.
- e) Doors shall have concealed quick removal type pinned hinges and locking handles. Doors locks shall accept the same key all over the plant. Gaskets shall be used between all mating sections to achieve dust proof enclosure rating for the modules and a IP-65 waterproof



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

and dust tight rating on the terminal boxes. All enclosures shall have access doors on front side. Doors shall have three point Locking system. Doors shall have concealed quick removal type pinned Stainless steel hinges.

- f) Bulkheads, especially designed to provide isolation from process line vibration shall be installed on modular bulkhead plates of the transmitter enclosures to meet the process sensing line connection requirements. Removable top and bottom plates shall be furnished. Removable bulk head plates of thickness not less than 6mm shall be mounted on the racks with suitable high temperature gasket impulse line within the enclosures shall be properly clamped..
- g) All internal wirings and/or data bus connections, if any, between the transmitters and terminal junction box shall run through flexible dust tight conduits connected to the terminal box hub. No exposed wirings within transmitter racks, both open and closed type, is admissible.
- h) All racks shall have a common closed drain trough to connect transmitter drain points to a common header after suitable pressure breaking. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. The trough shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header. Individual Instrument blowdown line shall be connected to the common blowdown drain header through regulating globe type blowdown valves. The common blowdown drain header shall be 2" NB ASTM A106, Sch-80 Gr. C installed at a slope of 1:25
- i) Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations.
- j) Service Power and Lighting
 - i) Each enclosure shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.
 - ii) Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.
- k) Control Air



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- i) A control air supply header shall be furnished in each enclosure having pneumatic devices. The header shall be 25 mm NB brass header stock drilled and tapped for 8 millimeter valves.
- ii) A valve with double compression end fittings shall be installed in each tap. Not less than three spare connections shall be furnished in each enclosure. The air header shall originate at a bulkhead penetration or fitting located in one of the bulkhead plates. Each pneumatic instrument shall have an individual air shut-off valve.
- iii) Pressure reduction shall be achieved by air filter regulator sets. One filter regulator shall be furnished for each group of components making a system.

l) Service Air

In case of Continuous air purging, a 25NB (1") service header shall be formed which shall receive air through isolation valve and air filter regulator. Air shall be fed from air header to impulse pipes near to take-off points through isolation valves and flow regulators. Service Air header shall be Stainless steel. Impulse pipe for such applications shall have four-way valve. one port of the valve shall have an adaptor to connect flexible stainless steel braided nylon to the service air. Rating of the hose having a burst pressure 15 Kg/Sq.cm. four way valve shall have two position operations. One position for service and other one for purging. Required pressure gauges shall be provided for monitoring of air pressure. Complete purging arrangement shall be integral to the enclosure and racks.

m) Power Supplies

Contractor shall supply all required transformers, regulators and other power supply equipment to adapt sources of power to the requirements of the enclosure mounted equipment. This shall include but not be limited to internal instrument illumination transformers. The circuits shall be separately isolated with MCBs.

n) Equipment Installation

Special attention shall be given in the piping layout to avoid air traps in liquid filled piping, or water pockets in piping.

o) Impulse Piping /Tubing

- i) Transmitter enclosures shall be complete with impulse piping & tubing, valves from enclosure bulkhead connection to all instruments and necessary drain / blow down connections. The type, size, material and pressure class of pipes/tubes, fittings, valves etc. shall be suitable for the intended applications.
- ii) Blow down piping / tubing may be shared, but individual instrument piping / tubing and valves shall be furnished. Piping / Tubing material



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

within enclosures shall conform to the application requirements. The final flexible connection to each instrument shall be fabricated with a double offset so that it may readily be disconnected to permit "in situ" calibration of the instrument.

- iii) Bulkhead connection shall be used when instrument piping/ tubing enters the enclosure. For instrument lines which enter through the bottom of the enclosure, the primary process line from the instrument valve shall be neatly installed, anchored and terminated at approximately 150 millimeters above the floor of the enclosure. The enclosure shall have a removable, gasketed floor plate to provide an effective seal around the incoming field primary process line. An angle shall be installed 600 millimeters above the floor, running the length of the enclosure for anchoring of incoming field process lines.
- iv) Pulsation dampeners shall be furnished wherever required.
- v) Drain pots shall be furnished for instruments measuring flue gas parameters and vacuum.
- vi) All liquid filled blow down lines, except those measuring vacuum shall be connected to a header extended through one end of the enclosure and turned downward for directing the blow down into drain. Gas filled lines and lines equipped with drain pots shall not be connected to the blow down header. The connection between the blow down valve and blow down header shall be constructed so that it can be removed to permit the connection of test instruments to the blow down valves.
- vii) The draft instrument line four-way valves shall be installed so that the quick disconnect fitting is readily accessible for connection with the service air hose.
- viii) Pipe and stainless steel tube welding shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.
- ix) Instrument piping and tubing shall be hydrostatically tested at one and one-half times the maximum system pressure for that instrument except for low pressure and vacuum measurement the test pressure will be as per piping standard.
- p) Instrument Tubing
 - i) Pneumatic tubing shall be installed in a neat workmanlike. It shall be supported frequently enough that it does not shake when subjected to vibration. All tubes which enter or leave the enclosure shall be terminated on bulkhead fittings in the bulkhead plate.
 - ii) Pneumatic tubing material shall be 6 mm OD stainless steel tubing, unless otherwise specified. Flareless tubing fittings shall be used for tubing connections smaller than one inch. Tubing shall be stretched before installation to assure straightness. Special tools shall be used for all bending and forming operations. Tubing shall be carefully



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

handled to avoid flat spots, kinks, and short bends. All piping and tubing shall be air blown after erection and before attachment to equipment at either end.

5.04.02 Open Type Transmitter Racks

- a) Open type transmitter racks may be provided for mounting transmitters, switches, gauges, converters and other accessories in rooms, buildings and closed areas like the power house building.
- b) The open type racks shall be shop fabricated. Transmitters, switches, converters and transducers of enclosure class IP-65 or better can be directly mounted on open racks. However, enclosures not conforming to the above protection standard shall have to be housed in enclosures conforming to IP-65 class prior to mounting them on open structures.
- c) The following shall be provided for open type transmitter racks:
 1. Rack shall be constructed from 6mm thick steel channel frame.
 2. Canopy shall be of 3mm thick CRCA steel.
 3. 2"NB Galvanised pipes shall be laid horizontally and supported at two end channels to mount transmitters/switches at accessible height.
 4. Adequate support for Manifold, impulse pipe and cable tray to be provided and the same shall be adjustable.
 5. Individual Instrument blowdown line shall be connected to the common blowdown drain header through regulating globe type blowdown valves. The common blowdown drain header shall be 2" NB ASTM A106, Sch-80 Gr. C installed at a slope of 1:25
- d) For operational convenience, the open type racks shall be used for mounting pressure and temperature gauges and switches and the local operating stations for electrical drives in the vicinity. Gauges mounted in racks shall be bottom connected and secured by double lock nuts. All gauges shall be located within 1500 mm from the floor for easy readability.
- e) The structural design shall be such that no item shall interfere with maintenance and removal of instrument, equipment and their accessories.
- f) Service Power and Lighting
 - i) Each rack shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Outlet box, switch box and device covers shall be galvanized stamped steel. Light fixtures shall be installed on the canopy of the rack.
 - ii) Power supply for receptacles and lighting shall be arranged. Power supplies for miscellaneous devices shall be provided with MCB located within the rack JB. MCBs shall be mounted in blocks. MCB ratings will be given on electrical schematic diagrams. Nameplates



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

shall be furnished above the MCB blocks, identifying the devices being served.

g) Control Air

Same as for closed type transmitter rack. Refer 5.01.01 (j) above

h) Service Air

Same as for closed type transmitter rack. Refer 5.01.01 (k) above

i) Power Supplies

Same as for closed type transmitter rack. Refer 5.01.01(l) above

j) Equipment Installation

Contractor shall prepare rack fabrication and piping drawings indicating the layout of each instrument. The drawings shall clearly indicate Contractor's piping arrangement for the sharing of process connections between two or more instruments. Special attention shall be given in the piping layout to avoid air traps in liquid filled piping or water pockets in piping intended to be dry.

k) Impulse Piping / Tubing

Same as for closed type transmitter rack. Refer 5.01.01 (n) above

l) Instrument Tubing

Same as for closed type transmitter rack. Refer 5.01.01 (o) above

5.04.03 Wiring of the Racks

a) A fully enclosed IP 65 type junction box shall be provided in each rack for housing the terminal blocks connectors, power supply fuses and other electrical accessories, as required.

b) Junction boxes for modular enclosures shall be fabricated externally on one end of each enclosure assembly to accept field wiring/cablings through the top or bottom of the junction box. A hinged door shall give access to the interior of the junction box.

c) All electrical connections between instruments and the junction box terminal blocks shall be made. In addition all utility wiring for lighting and service power shall be installed.

d) All wiring used within the enclosures shall conform to NEC /IEC standards. All wiring shall run through flexible or rigid conduits and shall be terminated at suitable terminal blocks. Sufficient clearance shall be provided for all control and instrument leads and all incoming





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

and outgoing leads shall be connected to terminal blocks suitably located for connecting external circuits.

- e) High impedance circuits shall be connected using shielded or coaxial wire suitable for the service.
- f) Conduits shall be supported properly at regular intervals with suitable conduit clamps.
- g) Wire shall be neatly arranged and routed/laid in PVC trough/tray.

5.04.04 Junction Box

Junction boxes shall be of metallic construction.

- a) Junction box shall be provided with front opening type cover. Junction box shall be of sheet steel construction with thickness not less than 2 mm. Junction box shall be complete with DIN rail mounted terminals, MCB, receptacles and earth bar. Earth bar shall be made of tinned copper of 25 X 6 MM size. Earth stud shall be furnished for safety grounding.
- b) Terminals shall be screwless cage-clamp type and 20% spare terminals shall be furnished. Power terminals shall be screw type.





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

5.00.00 ANALYZERS & SAMPLING SYSTEM SPECIFICATIONS

All the analysers shall be microprocessor based with drift free, auto compensation and calibration provision. Analyzers shall have facility to programme from the front key pad and shall have necessary fault diagnostic features. Each analyzer shall have a self-contained readout meter.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

The general technical specification of the analyzers is provided in this section. The system design should ensure that the pH and conductivity transmitters are mounted close to the respective sensors.

Multichannel analyzers are acceptable only for Silica, Sodium, Chloride & Phosphate measurements, as these measurements are more to monitor the trend. In all other measurements, such as Conductivity, pH, Dissolved Oxygen & Hydrazine measurements, Single channel analyzers must be offered.

Silica analyzers must be able to have analysis cycle completed within less than 10 minutes. A grab sampling facility is a must with the silica analyzer, as this helps to compare lab readings of a known silica solution with the analyzer reading. Silica analyzer should be able to display silica concentration, Alarm status, Calibration Constants, channel selection, current outputs, diagnostics, trend curves, historical data. In the diagnostics the analyzer should give information such as Lack of Sample / Reagent, Calibration solution & Calibration error, hardware failure etc.

Bidder in his offer shall indicate the sample flow requirement of each analyzer and the total quantity of cooling water required for the system.

5.01.00 Conductivity Analyzer

A. Sensor

- | | | |
|------------------------------|---|---|
| 01. Type of Cell | : | Flow through type / removable type (withdrawable with sealing valve) |
| 02. Conductivity Range | : | As per instrument schedule |
| 03. Cell Constant | : | 0.01 / 0.1 / 1.0 depending upon range |
| 04. Temperature Compensation | : | Manual and Automatic (Integral) upto 0-100°C with PT-100 Sensor |
| 05. Process Connection | : | Screwed |
| 06. Wetted Parts | : | Electrodes : SS 316L or better
Insulators : .KYNAR & VITON or better |
| 07. Pressure Rating | : | 10 kg/cm ² |
| 08. Accessories | : | Vessel (SS 316) with ½" NPT connection. |
| 09. Cable | : | Upto transmitter in flexible conduct |

B. Transmitter

- | | | |
|--------------|---|---|
| 01. Type | : | Microprocessor based, Single stream with multi-range facility |
| 02. Mounting | : | Flush Panel |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

03. Protection Class : IP-55 or better
04. Output : 4-20 mA DC (isolated) to a load of 600 ohms (min.)
05. Display
- i) Digital Display of process variable in Engineering Unit, Temperature, Alarm Status.
 - ii) Back lit LCD
 - iii) Character Height 12 mm
06. Zero / Span Adjustment : Front Panel Membrane type Keyboard.
07. Temperature Compensation : Manual or Automatic - selectable through keyboard
08. Diagnostic : Self diagnostic programme for electronics, measuring electrode, open wiring etc.
09. Alarm : Dual alarm set point (2 SPDT, high & low), hysteresis and time delay adjustable from membrane keyboard. Switch contact rating of 5 Amp, 240 VAC / 0.2 Amp, 220 VDC
10. Enclosure : Polycarbonate or better ; Enclosure class IP-55 or better
11. Cable Termination : Internal (cable entry through conduit)
12. Accuracy : ± 1.0 % of measured range
13. Response time : Less than 5 sec.
14. Stability : ± 1.0 % of full scale / month non-cumulative
15. Power Supply : 240 V AC, 50 Hz UPS
16. Operating Temp. : 0 -50°C
17. Accessories :
- a) For cation conductivity analyzer Dual Ion-Exchange column, resin, etc. (minimum 12 months requirements).
 - b) Phenolic Nameplate, cable gland
 - c) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory)



**WBPDCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

5.01.00

pH Analyzer

A. Sensor

01. Type of Cell : Measuring and reference electrode combination with flow through type (polypropylene flow chambers).
02. Process Connection : Screwed
03. Type of measurement : Combination electrode
04. Temperature Compensation : a) Automatic (Integral) upto 0-100°C with PT-100 Sensor
b) Manual Temperature Compensation
05. Preamplifier : Integral or separate
06. Range : 0-14 pH
07. Measuring Electrode : Glass
08. Liquid Junction : Ceramic/Kyner or equivalent
09. Pressure Rating : 10 kg/cm²
10. Accessories : Vessel (SS 316) with ½" NPT connection
11. Cable : Upto transmitter in flexible conduct

B. Transmitter

01. Type : Microprocessor based, Single stream with adjustable range facility
02. Mounting : Flush Panel
03. Protection Class : IP – 55 or better
04. Output : 4-20 mA DC (isolated) to a load of 600 ohms (min.)
05. Display : i) Digital Display of process variable in Engineering Unit, Temperature, Alarm Status.
ii) Back lit LCD
iii) Character Height 12 mm
06. Calibration : Two-point calibration with standard buffer solutions.
07. Temperature : Manual or Automatic - selectable through



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Compensation	keyboard
08. Diagnostic	: Self diagnostic for "Calibration required"/ "Calibration O.K.", electrode checking etc.
09. Alarm	: Dual alarm set point (2 SPDT, high & low), hysteresis and time delay adjustable from membrane keyboard. Switch contact rating of 5 Amp, 240 VAC / 0.2 Amp, 220 VDC
10. Enclosure	: Polycarbonate or better; Enclosure class IP-55 or better.
11. Cable Termination	: Internal (cable entry through conduit)
12. Accuracy	: $\pm 0.2\%$ of FSD or better"
13. Repeatability	: ± 0.02 pH or better
14. Response Time	: Less than 2 seconds or better
15. Stability	: 0.001 pH / week
16. Power Supply	: 240 V AC, 50 Hz UPS
17. Operating Temp.	: 0 - 50°C
18. Accessories	: a) Ultrasonic Electrode Cleaner for uncleaned water. b) Phenolic nameplate giving tag number, service, cable gland etc. c) Pre-amplifier, special cable, ultrasonic cleaner, etc. d) Buffer tablets. e) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory)
19. Preferred feature	Self cleaning type sensor

5.02.01

Silica Analyzer

01. Type	: Colorimetric Analyzer, gravity / pumped feed Microprocessor based
02. Operating range	: As per instrument schedule
03. Output	: 4-20 mA DC (isolated) into 600 ohms



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | | |
|-----|-------------------------------|---|---|
| 04. | Readout | : | Digital Indicating meter for direct readout |
| 05. | Accuracy | : | ± 1% of F.S.D or better |
| 06. | Reproducibility | : | ± 2% of F.S.D. or better |
| 07. | Calibration | : | Manual & automatic |
| 08. | Cycle time | : | Less than 10 min or better |
| 09. | Operating ambient temperature | : | 0-45 °C |
| 10. | Ambient humidity | : | Up to 95% relative humidity |
| 11. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 12. | Mounting | : | Flush panel |
| 13. | Life of light source | : | 9,000 hours (approx.) |
| 14. | Power supply | : | 240V, 50 Hz, 1 Phase UPS |
| 15. | Alarm Facility | : | 2 HI & 2 LO independently adj. over span.
Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 16. | Alarm for | : | a) Monitor mal-function
b) Monitor on standby
c) Monitor auto-zeroing
d) Concentration high
e) Loss of sample
f) Concentration low
g) Loss of reagent |
| 17. | Preferred features | : | a) Hi and Lo alarm LED visible from front.
b) Power supply on/failure LED visible from front. |
| 18. | Accessories | : | a) Reagent cabinet
b) Sample strainer
c) Reagent Reservoir etc.
d) Phenolic name plate
e) Reagents & consumables
f) Special cables upto transmitter with flexible conduit
g) Serial interface (RS 232) for data logger download to PC (No data loss after |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

power failure, all data shall be saved in non-volatile memory)

5.03.00 Sodium Analyzer Assembly

- | | | | |
|-----|---|---|---|
| 01. | Type of Cell | : | Flow Through ion-selection electrode |
| 02. | Flow Chamber | : | Plexi Glass Body or equivalent |
| 03. | Operating Range | : | As per instrument schedule |
| 04. | Measuring Electrode | : | Sodium Selective Glass Electrode |
| 05. | Output | : | 4-20 mA DC (isolated) into 600 ohms |
| 06. | Temperature Compensation | : | Automatic upto 45 deg.C |
| 07. | Read Out | : | Digital Indicating meter |
| 08. | Accuracy | : | < 5% of reading |
| 09. | Response Time | : | 2 minutes or better |
| 10. | Operating Ambient Temperature | : | 0 - 45 ° C |
| 11. | Ambient Humidity | : | Up to 95% relative humidity |
| 12. | Mounting | : | Flush Panel |
| 13. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 14. | Calibration | : | Automatic |
| 15. | Power Supply | : | 240V, 50 Hz, 1 Phase UPS |
| 16. | Alarm Facility | : | 2 HI and 2 LO independently adjustable over span. Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 17. | Accessories
(Preassembled, pre-wired and pre-tubed in enclosure) | : | <ul style="list-style-type: none"> i) Phenolic tag plate etc. ii) Sample filter. iii) Pressure regulator & flow meter iv) Automatic calibration kit v) Reagents and consumables vi) Special cables upto transmitter with flexible conduit vii) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory) |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

5.04.00

Phosphate Analyzer Assembly

- | | | | |
|-----|-------------------------------|---|---|
| 01. | Type of Cell | : | Flow Through |
| 02. | Flow Chamber | : | Plexi Glass Body or equivalent |
| 03. | Operating Range | : | As per instrument schedule |
| 04. | Measurement Principle | : | Colorimetric Detection system |
| 05. | Output | : | 4-20 mA DC linear |
| 06. | Read Out | : | Digital Indicating meter |
| 07. | Accuracy | : | 5% of Scale Range or better |
| 08. | Response Time | : | 90% in 10 minutes or better |
| 09. | Operating Ambient Temperature | : | 0 - 45 ° C |
| 10. | Ambient Humidity | : | Up to 95% relative humidity |
| 11. | Mounting | : | Flush Panel |
| 12. | Calibration | : | Manual through Zeroing solution |
| 13. | Power Supply | : | 240V, 50 Hz, 1 Phase UPS |
| 14. | Alarm Facility | : | 2 HI and 2 LO independently adjustable over span. Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 16. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 17. | Accessories | : | i) Phenolic tag plate etc.
ii) Sample filter.
iii) Pressure regulator & flow meter
iv) Automatic calibration kit
v) Reagents and consumables
vi) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory) |

5.05.00

Hydrazine Analyzer

- | | | | |
|-----|-----------------|---|-------------------------------|
| 01. | Type | : | Electrochemical |
| 02. | Operating Range | : | As per instrument schedule |
| 03. | Output | : | 4-20 mA DC linear & 1-5 volts |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | | |
|-----|-------------------------------|---|--|
| 04. | Readout | : | Digital Indicating Meter, linear read-out |
| 05. | Accuracy | : | $\pm 2\%$ of FSD or better |
| 06. | Reproducibility | : | 2% of FSD or better |
| 07. | Drift | : | 2 ppb/month or better |
| 08. | Temperature Compensation | : | Automatic up to 45 ° C |
| 09. | Operating Ambient Temperature | : | 0-45 ° C (maximum) |
| 10. | Response Time | : | 1 minutes or better |
| 11. | Mounting | : | Flush Panel |
| 12. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 13. | Pressure Rating | : | As required |
| 14. | Power Supply | : | 240V, 50 Hz, 1 Phase UPS |
| 15. | Alarm Facility | : | 2 HI and 2 LO independently adjustable over span. Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 16. | Preferred Feature | : | i) 2 Hi and LO alarm LED visible from front
ii) Power supply on/failure LED visible from front |
| 17. | Accessories | : | i) All chemical reagents for 12 months operation etc.
ii) Phenolic nameplate etc.
iii) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory) |

5.06.00 Dissolved Oxygen Analyzer

- | | | | |
|-----|--------------|---|--|
| 01. | Type | : | Electro-chemical, Microprocessor based. |
| 02. | Range | : | As per approved instrument schedule |
| 03. | Type of Cell | : | Flow through sampling type (continuous) |
| 04. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 05. | Output | : | 4-20 mA DC isolated to a load of 600 Ohms (minimum) |
| 06. | Temperature | : | |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | | |
|-----|----------------------|---|---|
| | Compensation | : | Automatic up to 45°C |
| 07. | Ambient Temp. | : | 45 °C |
| 08. | Readout | : | Digital Indicating meter |
| 09. | Accuracy | : | Better than ±4% of full scale for Transmitter |
| 10. | Sensor Response Time | : | 90% in 30 seconds or better |
| 11. | Mounting | : | Flush panel |
| 12. | Readable Distance | : | 3 meters (minimum) |
| 13. | Power Supply | : | 240 V AC, Single Phase, 50 Hz UPS |
| 14. | Alarm Facility | : | 2 HI & 2 LO independently adjustable over entire span.
Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 15. | Preferred Feature | : | a) HI & LO Alarm LED visible from front.
b) Power supply on/failure LED visible from front.
c) In-built calibration facility. |
| 16. | Accessories | : | a) Phenolic nameplate giving tag no., service etc.
b) Reagent Cabinet (if applicable)
c) Reagent Reservoir (if applicable)
d) Other as per requirement including piping etc.
e) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory) |

5.07.00 Chloride Analyzer

- | | | | |
|-----|--------------------------|---|--|
| 01. | Type | : | Electro-chemical, Microprocessor based. |
| 02. | Range | : | As per approved instrument schedule |
| 03. | Type of Cell | : | Chloride Ion Selective Electrode |
| 04. | Enclosure | : | Polycarbonate or better; Enclosure class IP-55 or better |
| 05. | Output | : | 4-20 mA DC isolated to a load of 600 Ohms (minimum) |
| 06. | Temperature Compensation | : | Automatic with Pt 100 |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | | |
|-----|---------------------|---|--|
| 07. | Ambient Temp. | : | 45 °C |
| 08. | Readout | : | Digital Indicating meter |
| 09. | Accuracy | : | ± 2% or better |
| 10. | Reproducibility | : | <3% |
| 11. | Detection Limit | : | 0.5 mg/l or better |
| 12. | Analysis Time | : | 5 minutes (max) |
| 13. | Cycle time | : | Adjustable |
| 14. | Calibration | : | Manual and automatic |
| 15. | Mounting | : | Flush panel |
| 16. | Readable Distance | : | 3 meters (minimum) |
| 17. | Power Supply | : | 240 V AC, Single Phase, 50 Hz UPS |
| 18. | Alarms | : | 1 HI, 1 LO and 1 system alarm
Contact rating, 5A, 240 V AC / 0.5A, 220 V DC. |
| 19. | Control accessories | : | a) Sample level detector
b) Reagent level detector
c) Calibration solution level detector
d) Automatic sample, rinse and drain valve
e) Pump for calibration solution
f) Pump for reagent solution |
| 20. | Accessories | : | a) Phenolic nameplate with tag no., service etc.
b) Reagent solution tank
c) Calibration solution tank
d) Serial interface (RS 232) for data logger download to PC (No data loss after power failure, all data shall be saved in non-volatile memory) |



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

6.00.00 DESIGN CRITERIA

This section lays down the general design criteria to be adapted in designing the Control & Instrumentation system of the plant.

6.01.00 General Requirements

6.02.00 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.
- g) Able to withstand high vibration.
- h) Easily accessible for operation & maintenance.

6.03.00 Parts subject to high pressure, temperature or other severe duty shall be of materials and construction suitable for the service conditions and long operating life.

6.04.00 Components of instruments, control devices, accessories, piping etc. which contact steam, condensate or boiler feed water shall be manufactured from copper-free materials.

6.05.00 Instrument Accuracy, Standard Scales and Ranges

6.05.01 Instrument Accuracy

Instruments shall meet the following general requirements.

- a) Pressure measurement shall be linear with respect to the measured pressure.
- b) Flow meter shall meet the specified accuracy criteria when operating between 25 and 100 % of full-scale flow. The accuracy shall include the effect of errors in the differential head measuring device, square root converter and signal generator.
- c) Level measurement shall be linear with respect to the measured level based on a water specific gravity of 1.00.
- d) Wherever the measured parameter is influenced by process pressure & temperature, required compressibility correction shall be introduced.





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

6.05.02 Instrument Scale Displays

- a) All displays shall be in engineering units. Instrument scales displayed on screen will have graduations with scale divisions based on multiples of 10. The smallest division shall preferably be a whole number approximately 1% of the scale range if not otherwise impracticable.
- b) Pressure instrument shall have the unit suffixed with 'a' or 'g' to indicate absolute or gauge pressure, respectively.
- c) Scales and charts of all instruments shall have linear graduations

6.05.03 Instrument Ranges

Instrument range shall be selected to have the normal reading, preferably between 50% and 70% of full scale for linear parameters and 70% to 80% for flow measurements. Deviation indicators shall have the null position at mid scale. The normal operating parameter shall be identified with a clear green mark.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

6.11.00 Burn-In And Elevated Temperature Test

Solid-state equipment / system shall be certified to be tested for a minimum period of 168 hours continuously under power. Solid-state logic systems shall be subject to the elevated temperature test and burn-in test as complete assemblies.

6.12.00 Elevated Temperature Test

- a) During the first 48 hours the ambient temperature shall be maintained at 50° C and the equipment shall be made to repeatedly perform operations it will be expected to perform in service with loads on various components being equal to those which will be experienced in actual service.
- b) The 48 hours test period shall be continuous but shall be divided into four 12-hour segments. The power supply voltage during each 12 hours segment shall be nominal voltage for 11 hours; followed by 110 percent of nominal voltage for 30 minutes; followed by 90 percent of nominal voltage for 30 minutes.
- c) During the elevated temperature test the cubicle doors shall be kept closed and inside temperature in the zone of highest heat dissipating

component /module shall be monitored. Temperature rise inside the cubicle shall not exceed 10 Deg.C above the ambient temperature of 50 Deg.C.

6.13.00 Burn in Test

The 48 hours elevated temperature test shall be followed by 168 hours of burn in test at normal operating temperature. This test shall also be conducted as per above procedure.

6.14.00 Panels, Cubicles and Enclosures

6.14.01 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 CRCA steel for UCP / backup panel and other panels/cabinets shall be as described in Section VII of this volume of the specification. Panels and cabinets shall be of adequate strength to support mounted components during shipment



**WBPDCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

and to support a concentrated load of 100 Kilograms on their top after erection.

- d) Panel /cabinet shall have eyebolt on top for lifting.
- e) Mounting , wiring , powering of all items to be mounted / installed on desks irrespective of the source of procurement shall fall in the scope of erection of Bidder ,this shall include freeissue items furnished by Owner.

6.14.02 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 surface shall be applied to all exterior and interior surfaces, each coat of primer surface 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 Min. Paint shade thickness at exterior & Interior shall be 80 to 100 Microns.The finish colors for exterior and interior surfaces shall conform to the following shades:
 - i) Exterior : RAL 7032
 - ii) Interior – Brilliant White (Preferred) / RAL 7032.
- c) Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections shall not be acceptable.

6.14.03 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.





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- d) Internal wiring shall 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. Looping of wires for power distribution in the panel to be avoided. Busbars to be provided for Power distribution".
- 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 : 2.5 sq. mm or higher as per load
/illumination wiring : load



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

4-20mA DC current and low : 0.5 Sq. mm
voltage signal upto 48V DC

- p) Identification of conductors shall be done by insulation color-coding identified on drawings or by printed wiring lists.

6.14.04 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 6 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.

6.15.00 Panel / Cabinet/ Desk/ Enclosures / junction boxes & instruments Environmental Protections

- a) Panels, cabinets, desks, distribution boxes, racks ,junction boxes, terminal boxes , instruments 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.



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

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-32 with suitable canopy at top to prevent ingress of dripping water.
4.	Outdoor type in non-hazardous areas	IP-65 with anticorrosion coating.
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.

6.16.00

Terminal Blocks

- a) Terminals shall be chromated galvanized DIN rail mounted screwless cage clamp type or maxi termi type. Terminals shall have screwed connection for conductor cross-section above 2.5 mm². Terminal blocks shall conform to IEC 947-7-1.
- b) The characteristics of the terminal blocks shall be as follows.
- High contact force, independent of conductor cross-section and large contact surface area.
 - Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.
 - Inspection and maintenance free (resistant to thermal aging and vibration)
 - Low and constant voltage drop
- c) Material of the clamping yoke of screwed terminals shall be electroplated, chromated, case hardened steel with high strength clamping screw. For screwless terminals, the 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.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 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 20 percent spare unwired terminals shall be provided for all panels /cabinets /desks /junction box etc... This shall be in addition to 20% spare wired terminals of spare IO channels.
- 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 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 terminal 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 above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.
 - v) Where more than one connection to a terminal block is required, two tier terminals shall be used.
 - vi) The terminal blocks for Power, control and signal cable terminal block shall be separate with separate colour coding for ease in recognition..

7.00.00 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 ² |
| | Differential Pressure | : mm of H ₂ O column / Kg/cm ² |
| ii) | Draught | : mm of H ₂ O column |
| iii) | Vacuum | : Kg/cm ² (abs)/mm of Hg column |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- | | | |
|-------|------------------------------------|--|
| iv) | Temperature | : Degree Celsius (^o C) |
| v) | Flow (Steam, Water) | : Tonnes / hr, M ³ /Hr |
| vi) | Flow (Oil) | : M ³ / Hr, Liter/Hr |
| vii) | Flow Air | : Tonnes / hr / M ³ / Hr. |
| viii) | Density | : gms / c.c. |
| ix) | Level | : mm /% |
| x) | Conductivity | : Micro Siemens / cm |
| xi) | Gas Analyzer | : Percentage by weight or as specified in respective case. |
| xii) | Dissolved Oxygen / Silica / Sodium | : ppm /ppb |

8.00.00 PROCESS CONNECTION & INSTRUMENT HOOK UP

- 8.01.00 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.
- 8.02.00 Each instrument shall have its own independent connection to the process except for instruments located on standpipe. Each instrument shall be connected independently to the standpipe through isolation valve.
- 8.03.00 Process connection for instruments lines and vessels shall be in accordance to standards such as ASME or other recognized international standards.





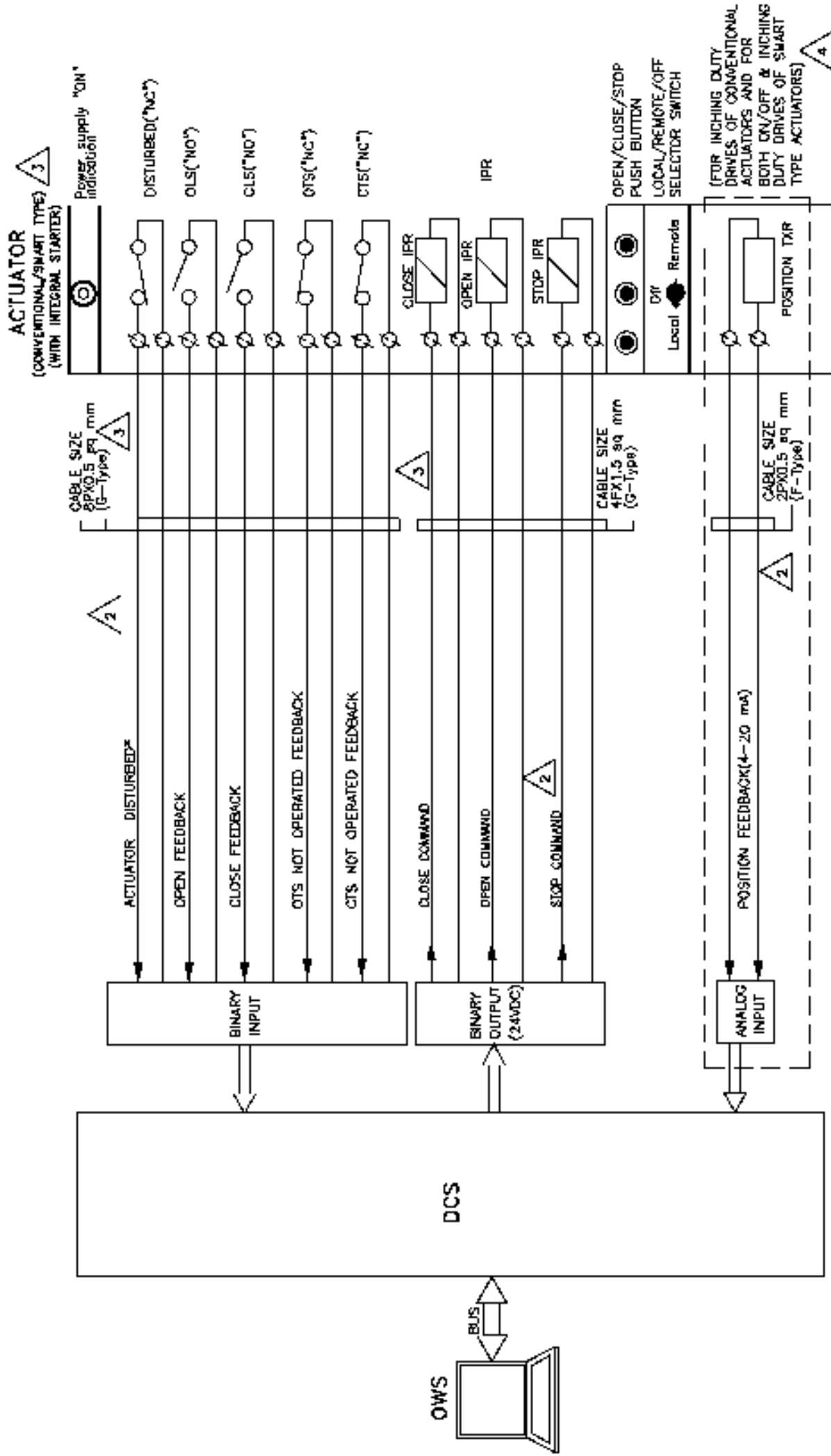
**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

**SIGNL EXCHANGE BETWEEN DRIVES &
DCS**

|

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

- * DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply/ Motor thermostat trip/ Thermal over load/ Local/Off/Remote Sel. switch in local or off mode/ Stop PG optid/ Torque open/close cutoff/ Valve jammed

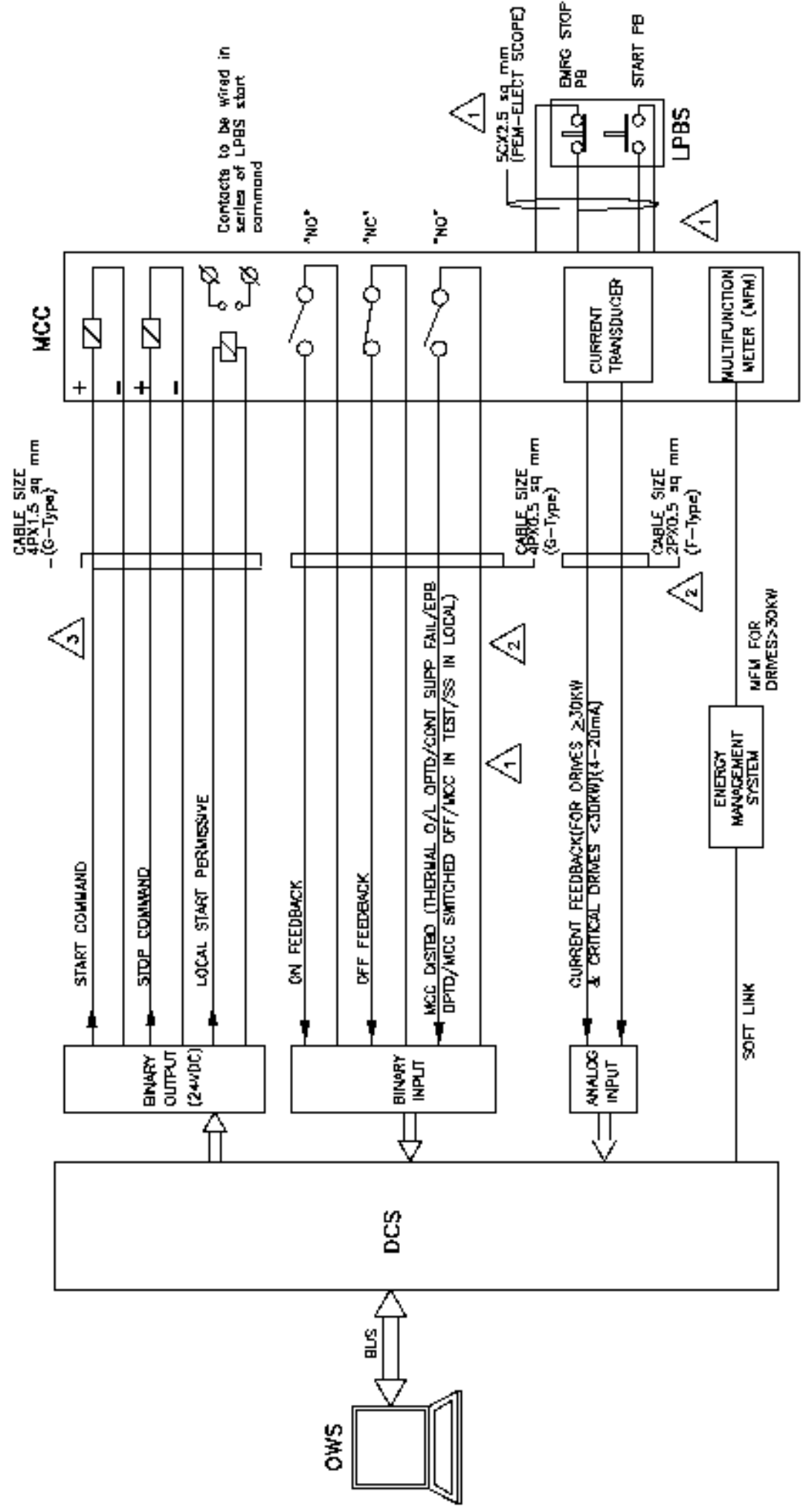


PROJECT: 1X860MW SAGARDIGI THERMAL POWER EXTENSION PROJECT (UNIT #5)

TITLE: ODCMIS INTERFACE FOR BIDIRECTIONAL DRIVE

DRG.NO.	PE-DM-445-145-1002
DATE	15.03.2021
REV.NO.	04
SHT	7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR OPERATED)



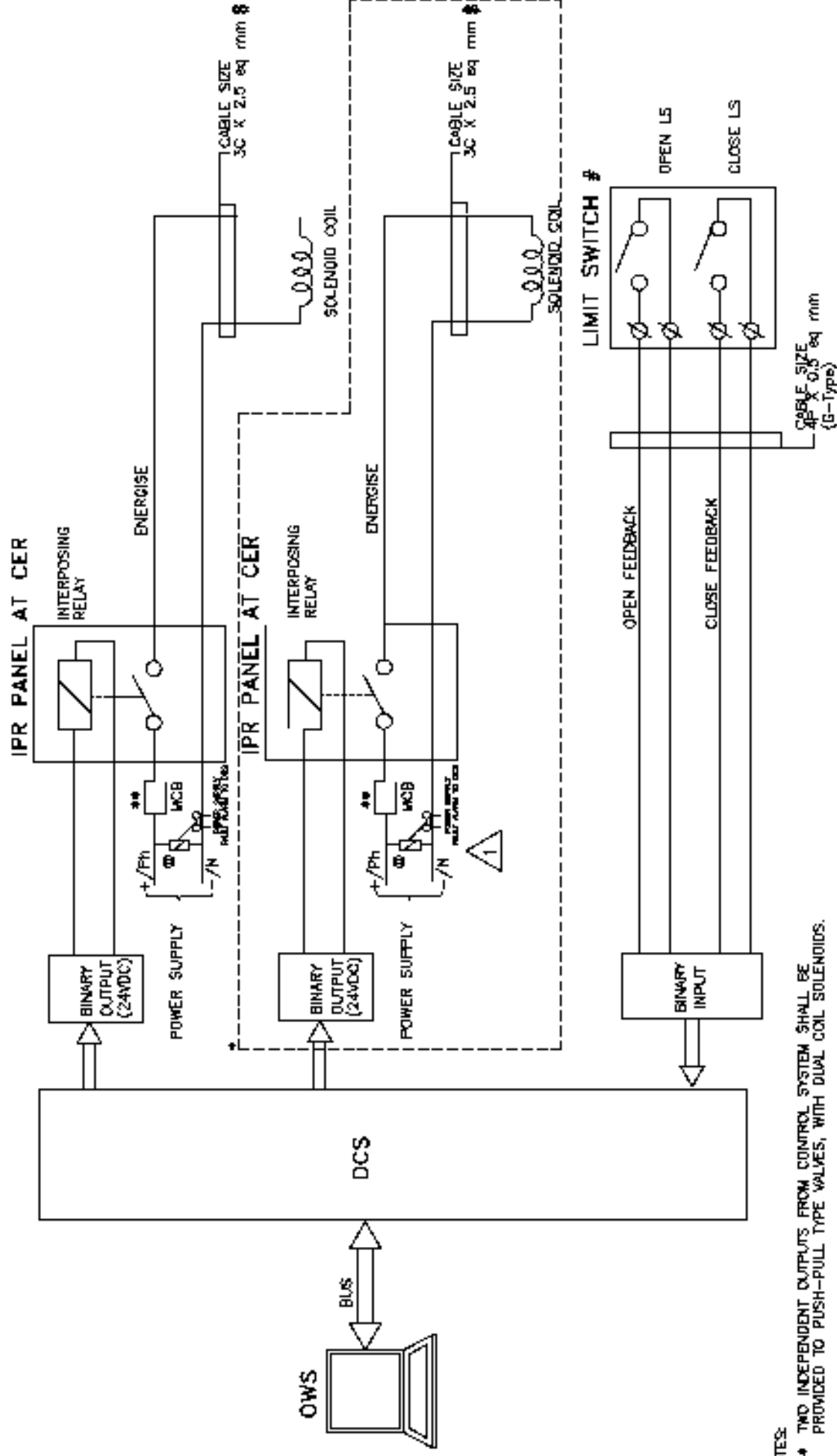
NOTES:
 REDUNDANCY IN OUTPUT SHALL BE PROVIDED FOR ALL CRITICAL LT DRIVES



PROJECT: 1X860MW SAGARDIGI THERMAL POWER EXTENSION PROJECT (UNIT #5)
TITLE: DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR OPERATED)

DRG. NO.	PE-DM-445-145-1002
DATE	15.03.2021
REV. NO.	04
SHT	8 OF 11

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



NOTES:

- * TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.
- ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
- # FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL/ PNEUMATIC VALVE.
- COMMON FOR ALL SOLENOID VALVES SIMILAR COIL VOLTAGE RATING PER PANEL.
- § POWER CABLE CROSS SECTION SHALL BE AS PER CABLE SIZING CALCULATION.

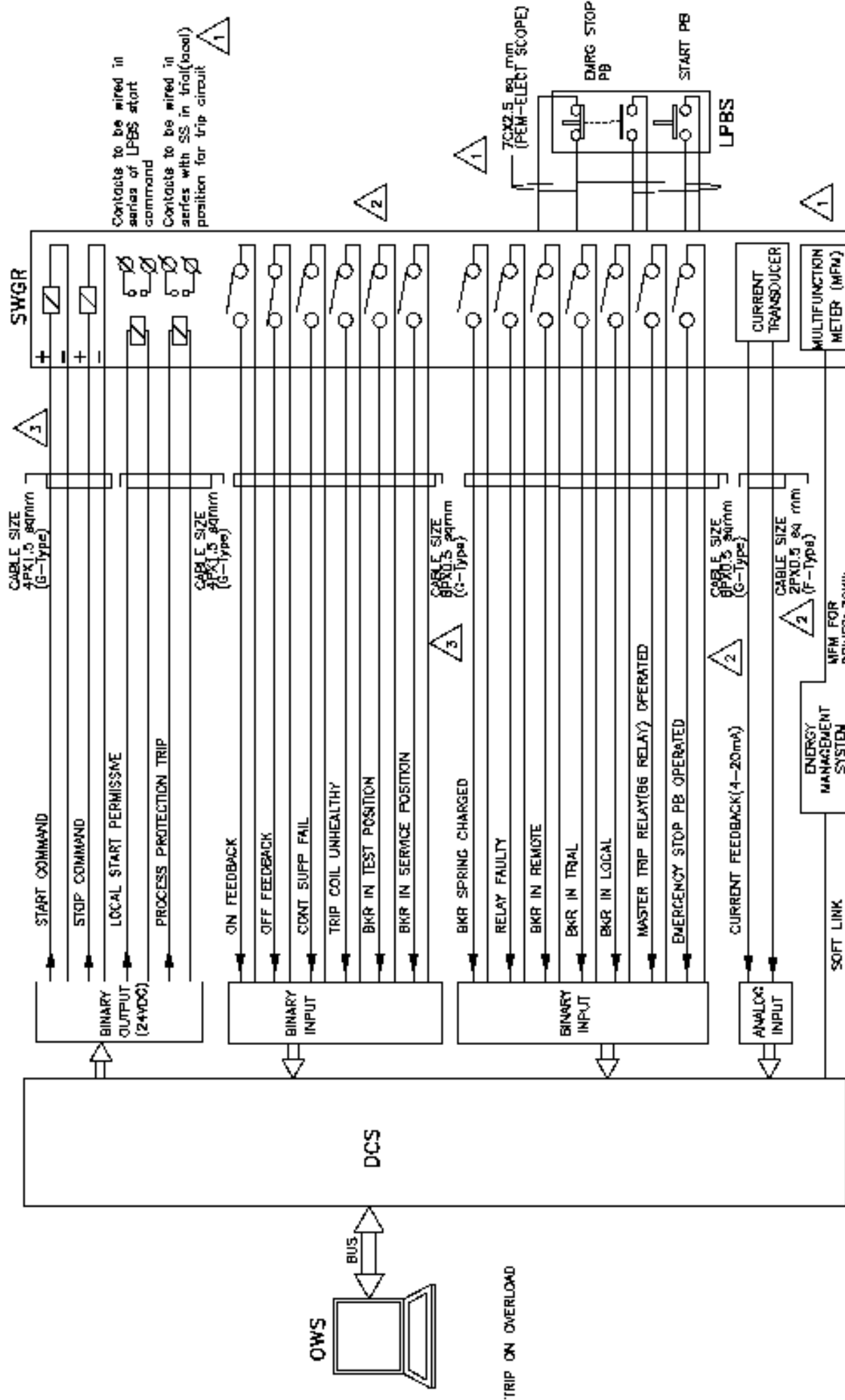


PROJECT: 1X860MW SAGARDIGI THERMAL POWER EXTENSION PROJECT (UNIT #5)

TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE

DRG. NO.	PE-DM-445-145-1002
DATE	15.03.2021
REV. NO.	04
SHT	9 OF 11

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



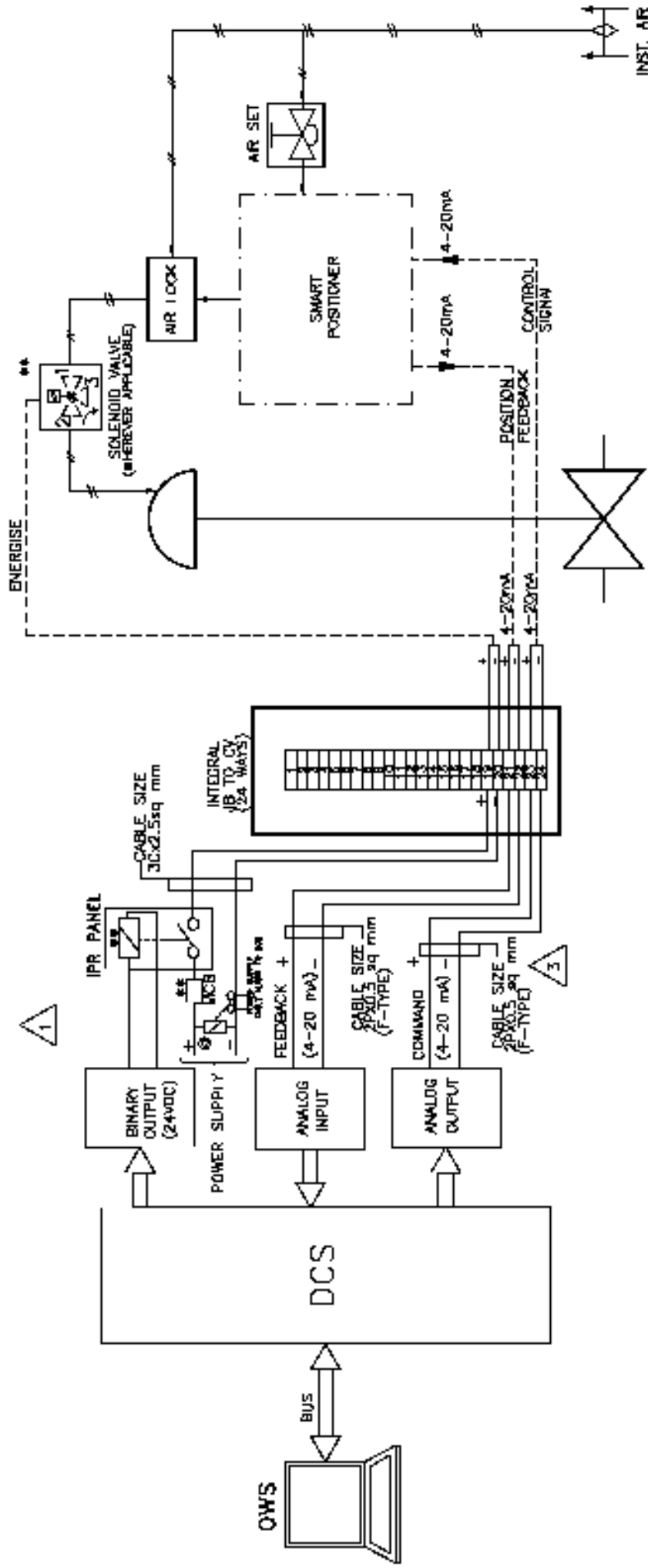
Contacts to be wired in series of LPBS start command
 Contacts to be wired in series with SS in trial(local) position for trip circuit

NOTES:
 REDUNDANCY IN OUTPUT SHALL BE PROVIDED FOR ALL HT AND CRITICAL LT DRIVES

PROJECT: 1X860MW SAGARDIGI THERMAL POWER EXTENSION PROJECT (UNIT #5)
TITLE: DDCMIS INTERFACE FOR UNIDIRECTIONAL HT DRIVE

DRG.NO.	PE-DM-445-145-1002
DATE	15.03.2021
REV.NO.	04
SHT	10 OF 11

DCS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:

- ▶ APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.
- COMMON FOR ALL SOLENOID VALVES PER PANEL.
- ▲ REDUNDANCY IN OUTPUT SHALL BE PROVIDED FOR ALL MODULATING DRIVES



PROJECT: 1X560MW SAGARDIGI THERMAL POWER EXTENSION PROJECT (UNIT #5)
TITLE: TYPICAL HODK-UP DIAGRAM ANALOG DRIVE (WITH SMART POSITIONER)

DRG. NO.	PE-DM-445-145-1002
DATE	15.03.2021
REV. NO.	04
SHT	11 OF 11



**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

**INSTRUMENTATION CABLE
INTERCONNECTION AND TERMINATION
PHILOSOPHY**

|



WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

11.00.00 INSTRUMENTATION CABLES

11.01.00 General Requirements

11.01.01 Bidder shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under his scope.

11.01.02 Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Bidder.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 11.01.03 Other type of cables like co-axial cables for system bus, cables for connection of peripherals etc. (under Bidder's scope) are also to be furnished by the Bidder.
- 11.01.04 Bidder shall supply all cable erection and laying hardware like cable trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.
- 11.01.05 All instrumentation cables covered in this specification shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and its amendments read along with this specification.
- 11.01.06 The thermocouple extension cables shall be of Two pair/multi pair, twisted & shielded, PVC insulated, FRLS PVC sheathed and compatible for the type of thermocouples employed. The material of conductor shall be as per ANSI MC-96.1.
- 11.01.07 Traid cables shal be used for all RTD (3-wire) measurements. In case of 4-wire RTD, 2 pair instrumentation signal cables shall be used.
- 11.01.08 All cables near high temperature zone like burner front devices, metal temperature thermo-couples on main steam & turbine casing etc. shall be high temp cables, which shall be terminated at a junction box in normal temperature zone. Thermocouple extension cables and copper conductor cables for high temperature applications shall be with insulation of individual conductor and outer sheath of extruded FEP (i.e., Teflon) as per VDE 0207 Part 6 and ASTMD 2116. The thickness of insulation shall be 0.5 mm nominal (i.e., 0.4 mm minimum). These cables shall be single/ multipair, twisted & shielded.
- 11.01.09 Cable accessories such as harnessing components, markers, bedding, cable joiner, binding tape etc. shall have flame retardant quality.
- 11.01.10 The thickness of outer sheath shall be as per the guidelines given in VDE 0816. Thickness of outer sheath shall not be less than 1.8 mm in any case. Allowable tolerance of overall diameter of the cables shall be ± 2 mm max. over the declared value in technical data sheets. The variation in diameter and the ovality at any cross section shall not be more than 1.0 mm.
- 11.01.11 The Cables shall be supplied in non returnable standard seasoned drums. The drum length shall be 1000m ($\pm 5\%$) up to & including 8 pairs and 500 m ($\pm 5\%$) above 8 pairs. Drum shall be anti rodent, anti termite and smooth finish. Both ends of cable shall be capped by means of non hygroscopic sealing material.
- 11.01.12 Durible marking shall be provided on the outer sheath of the cable at intervals not exceeding 5 metres. Marking shall include Manufacturer's name, Year of manufacture, Voltage grade, Type of cables (Conductor size & no. of pairs / type of compensating /extension cable, Analog or Binary), Insulation material, FRLS etc.

paired
instrumentation cable
acceptable

11.01.07

Traid cables shal be used for all RTD (3-wire) measurements. In case of 4-wire RTD, 2 pair instrumentation signal cables shall be used.

11.01.08

All cables near high temperature zone like burner front devices, metal temperature thermo-couples on main steam & turbine casing etc. shall be high temp cables, which shall be terminated at a junction box in normal temperature zone. Thermocouple extension cables and copper conductor cables for high temperature applications shall be with insulation of individual conductor and outer sheath of extruded FEP (i.e., Teflon) as per VDE 0207 Part 6 and ASTMD 2116. The thickness of insulation shall be 0.5 mm nominal (i.e., 0.4 mm minimum). These cables shall be single/ multipair, twisted & shielded.

11.01.09

Cable accessories such as harnessing components, markers, bedding, cable joiner, binding tape etc. shall have flame retardant quality.

11.01.10

The thickness of outer sheath shall be as per the guidelines given in VDE 0816. Thickness of outer sheath shall not be less than 1.8 mm in any case. Allowable tolerance of overall diameter of the cables shall be ± 2 mm max. over the declared value in technical data sheets. The variation in diameter and the ovality at any cross section shall not be more than 1.0 mm.

11.01.11

The Cables shall be supplied in non returnable standard seasoned drums. The drum length shall be 1000m ($\pm 5\%$) up to & including 8 pairs and 500 m ($\pm 5\%$) above 8 pairs. Drum shall be anti rodent, anti termite and smooth finish. Both ends of cable shall be capped by means of non hygroscopic sealing material.

11.01.12

Durable marking shall be provided on the outer sheath of the cable at intervals not exceeding 5 metres. Marking shall include Manufacturer's name, Year of manufacture, Voltage grade, Type of cables (Conductor size & no. of pairs / type of compensating /extension cable, Analog or Binary), Insulation material, FRLS etc.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

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

- 11.01.13 Bidder shall furnish all documentary evidence including cross-sectional drawings, test certificates to substantiate the suitability of cables offered for different applications. Bidder shall also clearly bring out the application wise details for each type of cable offered.
- 11.01.14 All prefabricated cables shall have 10% spare cores which will not be connected to pin connectors.
- 11.01.15 All the instrumentation cables i.e. twisted and shielded multipair cables, compensating cables, pre fabricated cables etc. shall be flame retardant low smoke and low halogen (FRLSH) type.
- 11.01.16 For all Digital Output (DO) signal from DCS or PLC, Minimum 1.5 Sq mm cable shall be used, except for Solenoid valves where 2.5 Sqmm cable shall be used. Moreover, bidder shall submit the calculations for selecting the cable size.
- 11.02.00 Instrumentation Cable Specifications
- 11.02.01 INSTRUMENTATION MULTI PAIRED SIGNAL CABLE
01. Conductor type : Multi-stranded annealed tinned high conductivity copper
 02. Conductor size : 0.5 / 1.0 / 1.5 Sq.mm (as required)
 03. Conductor resistance : 39 Ω /Km/18 Ω /Km/12 Ω /Km
 04. Conductor Insulation : Extruded PVC meeting the requirements of VDE 0207 Part 4 compound Y I3. Insulation thickness for individual core shall be between 0.28 and 0.35 mm for 0.5 mm² cables, 0.5 to 0.6 mm for 1.0 mm² cables and 0.8 to 0.9 for 1.5 mm² cable.
 05. Voltage Grade : 225 V (peak value)
 06. Twisting : Twin twisted with lay of 50 mm (max)
 07. Twisting Direction : All pairs in the same direction. Lapped to form bunch with mylar tape.
 08. Screen (Pair & Overall) : Aluminium mylar tape with a thickness of 28 μ m (min.) for individual pair screen and 60 μ m (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyester tape shall be



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

applied with minimum overlap of 25%.
 Metallic side of the screen shall be in
 contact with drain wire.

Analog signals - Individual pair & overall
 shield.

Binary signals - overall shield.

- | | | | |
|-----|------------------------|---|---|
| 09. | Drain wire | : | Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm). Separate drain wire for individual pair shield (wherever applicable) as well as overall shield. |
| 10. | Inner Sheath | : | Extruded PVC (compound YM1) as per VDE 0207 Part 5 (anti rodent, anti termite & moisture resistant properties) and shall be of flame retardant low smoke (FRLS) type |
| 11. | Fillers | : | Non metallic flame & moisture retardant |
| 12. | Armouring | : | GI wire / strip |
| 13. | Outer Sheath | : | Extruded PVC (compound YM1) as per VDE 0207 Part 5 and shall be of flame retardant low smoke low halogen (FRLSH) type |
| 14. | Temperature Range | : | 70 ^o C (continous) except for high temperature resistant Teflon insulated cables which shall be suitable for continous operation at 205 ^o C |
| 15. | Sheath colour | : | Inner- Black and Outer- Sky Blue |
| 16. | Tests on outer sheath: | | <ul style="list-style-type: none"> a) Oxygen Index: Min.29% at room temp. (ASTMD-2863) b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I c) Temp Index : Min 250^o C (ASTMD-2863) d) Smoke Density Rating :Max.60% (ASTMD-2843). e) Complete cable assembly shall pass Swedish Chimney Test- as per SEN-4241475 AND Flammability Test as per IEEE-383. |



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- f) Halogen Content Measurement as per ICEA T-33-655 (Permissible limit for halogen shall not be more than 0.2%)
17. High voltage test
- a) Core to core - 1.5 KV for 1 min.
- b) Core to screen - 1.0 KV for 1 min.
- c) Screen to Armour – 1.0 KV for 1 min
18. Rodent & Termite repulsion test Presence of lead shall be confirmed
19. Colour of core insulation for Instrumentation Cable

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

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

11.02.02 THERMOCOUPLE EXTENSION & COMPENSATING CABLE (TWO PAIR & MULTI-PAIR)

01. Conductor : Solid conductor
02. Conductor size : 16 AWG (1.31 Sq. mm)
03. Type : Kx (Extension) (Chromel Alumel),
Rx (Compensating) (Copper-Copper alloy),
04. Conductor Insulation : Extruded PVC meeting the requirements of VDE 0207 Part 4 compound Y 13. Insulation thickness for individual core shall be between 0.35 to 0.45 mm for 1.31 mm² cables
05. Voltage Grade : 225 V (peak value)



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

06. Twisting : Twin twisted with lay of 50 mm (max)
07. Twisting Direction : All pairs in the same direction. Lapped to form bunch with mylar tape.
08. Screen (Pair & Overall) : Aluminium mylar tape with a thickness of 28 μm (min.) for individual pair screen and 60 μm (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyester tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire.
09. Drain wire : Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm). Separate drain wire for individual pair shield as well as overall shield.
10. Inner Sheath : Extruded PVC (compound YM1) as per VDE 0207 Part 5 (anti rodent, anti termite & moisture resistant properties) and shall be of flame retardant low smoke (FRLS) type
11. Fillers : Non metallic flame & moisture retardant
12. Armouring : GI wire / strip
13. Outer Sheath : Extruded PVC (compound YM1) as per VDE 0207 Part 5 and shall be of flame retardant low smoke low halogen (FRLSH) type
14. Temperature Range : 70^oC (continuous) except for high temperature resistant Teflon insulated cables which shall be suitable for continuous operation at 205^oC
15. Sheath colour : Inner- Black and Outer- Yellow for Type Kx, Green for Rx.
16. Tests on outer sheath: a) Oxygen Index: Min.29% at room temp. (ASTMD-2863)
- b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I
- c) Temp Index : Min 250^o C (ASTMD-2863)
- d) Smoke Density Rating :Max.60% (ASTMD-2843).





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- e) Complete cable assembly shall pass Swedish Chimney Test- as per SEN-4241475 AND Flammability Test as per IEEE-383.
 - f) Halogen Content Measurement as per ICEA T-33-655 (Permissible limit for halogen shall not be more than 0.2%)
 - g) Thermal EMF Test as per ANSI MC96.1
17. High voltage test
- a) Core to core - 1.5 KV for 1 min.
 - b) Core to screen - 1.0 KV for 1 min.
 - c) Screen to Armour – 1.0 KV for 1 min
18. Rodent & Termite repulsion test Presence of lead shall be confirmed
19. Conductor material & sheath color for thermocouple extension /compensating cable as per ANSI MC 96.1

CABLE TYPE	OVERALL SHEATH COLOR	WIRE	SHEATH COLOR	CONDUCTOR MATERIAL
Kx	Yellow	Positive	Yellow	Nickel / Chromium
		Negative	Red	Nickel / Aluminum
Rx	Green	Positive	Black	Copper
		Negative	Red	Copper Alloy

11.02.03 INSTRUMENTATION TRIAD CABLES

- 01. Conductor type : Stranded tinned Electrolytic copper
- 02. Conductor size : 1.0 Sq.mm
- 03. Stranding : 7 x 0.43 mm
- 04. Conductor Insulation : HRPVC Type-C, 0.6 mm thick
- 05. Twisting : Triad twisted with lay of 50 mm
- 06. Twisting Direction : All triads in the same direction. Lapped to form bunch with mylar tape.
- 07. Colour : Outer sheath colour shall be black for non-IS cable and light blue for IS cable.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Individual traide color code shall be Light blue-Brown-Black.

- | | | | |
|-----|---|---|---|
| 08. | Individual Pair Overall Shield mm thick). | : | Polyethylene coated aluminum foil with 100% coverage with 25% Overlap (0.08 |
| 09. | Drain wire | : | Annealed Tinned copper wire, Size 0.5 Sq. mm. minimum |
| 10. | Inner Sheath | : | Extruded FR PVC, Thickness as per International Standard |
| 11. | Armoring | : | N/A |
| 12. | Outer Sheath | : | Extruded FR PVC, Thickness as per International Standard |
| 13. | Rip Cord | : | Yes |
| 14. | Operating Voltage | : | 300 V / 500V R.M.S (Core to Earth / Core to Core.) |
| 15. | Temperature Range | : | Up to 85 °C |
| 16. | Electrical Characteristics Resistance | : | 18.4 Ohms/Km (max.) at 20 °C |
| | Mutual Capacitance at 1 kHz | : | a) Between adjacent cores 150 nf / Km.
b) Between conductor and Screen 400 nf / Km |
| | L/R ratio | : | 25 μH/Ohms (max) |
| | Insulation at 20° C | : | 100 M Ohms/Km (Min) |
| 17. | Codes & Standards | : | a) IPCEA-S-61-402
b) IEC 332-1 ASTM-B-33 |
| 18. | Tests | : | a) Oxygen Index: Min.29 at room temp. (ASTM-D-2863)
b) Temp Index : Min 250 °C at 21Oxy. Ind. (ASTM-D-2863)
c) Flammability Test : as per IEC 332 Part-I
d) Swedish Chimney Test-S-424-1475
e) High Voltage Test :1.0 KV for1 Min |





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

f) Type Test for material

19. No. of Triads : 2T, 6T, 12T

11.02.04 Cable parameters such as mutual capacitance between conductors, conductor resistance, insulation resistance, characteristic impedance, cross talk and attenuation figures at 20 deg. C (± 3 deg. C) for various types of cables as applicable shall be as specified in TABLE-1.

TABLE- 1
CABLE PARAMETERS

SL. No.	PARAMETER / TYPE	TYPE – E, F	TYPE – G, I	TYPE – A, B & C	REMARKS
01.	Mutual Capacitance at 0.8 kHz (max.)	120 nF/Km.	100 nF/Km.	120 nF/Km.	
02.	Conductor Resistance (max.)	73.4 Ohm/km (Loop) For Type F, 13.3 ohm/km (loop) for Type E	73.4 ohm/km (loop)	26.6 ohm/km (loop)	
03.	Insulation Resistance (minimum)	100 M ohm/km	100 M ohm/km	100 M ohm/km	
04.	Cross-talk figure at 0.8 kHz (minimum)	60 dB	60 dB	60 dB	
05.	Characteristic Impedance (maximum) at 1 kHz	320 ohm	340 ohm	320 ohm	
06.	Attenuation at 1 kHz (maximum)	1.2 dB/Km for Type F; 0.8 dB/Km for Type E	1.2 dB/Km	1.2 dB/Km	

11.02.05 Identification of the cores & pairs shall be done with suitable colour coding & band marking as well as by numbering of cores/pairs as per VDE: 0815. The details of colour coding etc. shall be as approved by Owner during detailed stage. Also refer TABLE - 2 for description of various type of cables.





WBPDC

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

TABLE- 2
DESCRIPTION OF VARIOUS TYPES OF CABLES

SL. NO.	TYPE	CONDUCTOR SIZE IN SQ.MM	REMARKS
01.	A	1.31	Two pair shielded and twisted pair thermo-couple, extension cable, ANSI type Kx, solid alloy conductor.
02.	B	1.31	Two pair shielded & twisted thermo-couple, extension cable, ANSI type Sx, solid alloy conductor.
03.	C	1.31	Two pair shielded & twisted Heat resistant Teflon insulation & outersheath thermo-couple, extension cable, ANSI type Kx, solid alloy conductor.
04.	E	0.5	Two pair individual pair and overall shielded twisted pair instrumentation cable for both analog and digital signal to be used from field mounted instruments to local junction box.
05.	F	0.5	Multipair individual pair & overall shielded twisted pair instrumentation cable (4/8/12pair) for analog signals with stranded copper conductor.
06.	G	0.5	Multipair overall shielded & twisted pair instrumentation cable (4/8/12pair) for binary signals with stranded copper conductor.
07.	H	1.0	2 Triad / MultiTriad individual pair & overall shielded instrumentation cable (2/6/12Triad) for RTD signals with stranded copper conductor.
08.	I	0.5	Type F cable / type G cable with heat resistant Teflon insulation & outersheath for high temperature application.
09.	S	As per specific standard / requirement for each applicable	Multicore / multipair shielded cable for system specific cables like conductivity type level switches, system bus cable, flame scanner etc. as applicable.

11.03.00 Instrumentation Cable Interconnection and Termination Philosophy

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group JB's at strategic locations (where large concentration of signals are available, e.g. switchgear) is done and consequently cable with higher number of pairs are extensively used. JB's to be furnished under this specification shall be of 6/12/24/36/48 way. The material dimension and interior / exterior colour of JB's shall be subject to Owner's approval. The details of termination to be followed is mentioned in TABLE – 3 :





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

TABLE- 3
CABLE TERMINATION TO BE FOLLOWED

SL. No	APPLICATION		TYPE OF TERMINATION		TYPE OF CABLE
	FROM (A)	To (B)	END (A)	END (B)	
01.	Valves / Dampers Drive (Integral Junction Box)	Marshalling Cubicle / Local Group JB / Termination Control Cabinets / System Cabinets	Plug-in Connector	Post mounted Maxitermi / Cage Clamp type	G
02.	Transmitters, Process actuated switches to be mounted in LIE / LIR	Integral Junction Box of LIE / LIR	Plug-in Connector	Maxitermi / Cage Clamp (Rail mounted) type.	F, G
03.	RTD Heads	Local Junction Box	Plug-in Connector	Maxitermi / Cage Clamp (Rail mounted) type.	H
04.	Thermocouples	CJC Box	Manufacturer's standard	Screwed / Cage Clamp Type	A,B,C*
05.	Local Junction Box, CJC Box, Int. Junction Box of LIE / LIR / Group JB / MCC / Switchgear	Marshalling Cubicle / Local Group JB / Termination / Control Cabinets / System Cabinets	Maxitermi / Cage Clamp (Rail mounted) type.	Post mounted Maxitermi / Cage Clamp type	F, G
06.	Local Junction Box, MCC / Switchgear	Group JB	Maxitermi / Cage Clamp (Rail mounted) type.	Maxitermi / Cage Clamp (Rail mounted) type.	F, G
07.	Field mounted Instrument	Group JB	Maxitermi / Cage Clamp (Rail mounted) type.	Maxitermi / Cage Clamp (Rail mounted) type.	F, G
08.	Marshalling Cubicle /	Electronic System	Post mounted Maxitermi /	Post mounted Maxitermi /	F, G



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

SL. NO	APPLICATION		TYPE OF TERMINATION		TYPE OF CABLE
	FROM (A)	To (B)	END (A)	END (B)	
	Termination Cabinet	Cabinet	Cage Clamp type.	Cage Clamp type.	
09.	UCP mounted equipments	Post mounted Maxitermi / Cage Clamp type	Post mounted Maxitermi / Cage Clamp type.	Plug in Connector / Cage Clamp type (rail mounted)	F, G (with connector at one end)
10.	DCS/ PLC Cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Manufacturer Standard

NOTES :

01. For Sl. No. 05, 06, 07 & 08, normally 10% spare core shall be provided.
02. For analog signals individual pair shielding & overall shielding & for Binary signals only overall shielding of instrumentation cables shall be provided.
- 03 *For high temperature application only.

11.04.00 CONTROL & POWER CABLE

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

11.05.00 OPTICAL FIBER CABLE

11.05.01 This specification defines the minimum general requirements for the Design, manufacture, supply, inspection, installation, testing & commissioning of optical fiber cables and accessories, such as fiber distribution (patch) panels, adapters, connectors, joint boxes, pigtailed and other components, as required to complete the system. Bidder shall consider all related activities, such as cable stripping, cable entry in boxes and panels, cable fiber splicing/fusion, cable performance testing and other services, to achieve a properly documented and operational cable network. all Fibre Optic cables shall be Single Mode type.

11.05.02 Fiber Optic Cables shall be installed on cable tray, duct bank, cable trench installation as necessary. For outdoor applications the cable shall be armoured with Poly Ethylene sheathing. In all cases cable shall be routed through suitable grade HDPE permanently lubricated protection pipe as per IS 4984, IS 12235 & TEC.G/CDS-08 /01of suitable size @ 53% fill factor. Permanent route marking in FRP (Fibre Reinforced Plastic) material shall be provided at intervals not exceeding 5 meters for all FO cables layed outdoor buried under the ground.

11.05.03 The Optical Fiber core shall be of ultra pure fused silica glass coated with UV-cured acrylate suitable to withstand temperature of about 80°C (continuous).



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

Fiber optic distribution panels shall be provided as required. The fiber optic distribution panels shall be of a standard wall mounted sheet metal enclosure type. Fiber optic distribution panels shall be equipped to secure optical fiber patch cables and pigtails to prevent damage during all operation and maintenance functions. In general splice enclosure are envisaged. However, if no optical fiber splice enclosures are implemented, than the fiber optic distribution panels shall be equipped with splice trays for storage and protection of fusion splice connections of single-mode fiber optic cable and pigtails. Each fiber optic distribution panel shall be fully equipped with 'SC' type bulk head connector sleeves or equivalent. Unused sleeve ports shall be equipped with reusable caps to prevent the intrusion of dust.

11.06.03 Pigtail and Patch Cord

All pigtails shall be factory SC-connectorized, and satisfy specified performance for optical links. All unused pigtails (including spares) shall be terminated with the connector to a bulkhead connector sleeve, protected by a reusable cap on the opposite sleeve port, to prevent the intrusion of foreign material or dust. All necessary connectorized pigtails shall be provided in the lengths required.

11.06.04 Fiber Optic Tool Kit

Fiber Optic Splicer, Terminator And Tool Kit Box

Bidder shall provide new unused tools comprise of Splicer and Fusion Jointer and tool kit comprise of cutter, stripper, polishing tool, handheld microscope, heat shrinkable sleeve, scissor, knife etc. as required for maintenance and commissioning.

11.07.00 Tests

Following minimum test as per any approved standards shall be carried out on the cables

- a. Attenuation And Dispersion Characteristics Tests
- b. Proof Tests
- c. Macro-Bend Resistance Test
- d. Mechanical Tests
- e. Low And High Temperature Cable Bend Test
- f. Impact Resistance Test
- g. Compressive Strength Test
- h. Tensile Strength Test
- i. Cable Twist Test
- j. Cable Cyclic Flexing Test
- k. Environmental Characteristics Test
- l. Temperature Cycling Test





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- m. Color Permanence Test Cable Aging Test
 - n. Water Penetration Test
 - o. Lightning Test
 - p. Routine Test / Sample Test
- Site Test (Like Continuity & Attenuation)





**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

ERECTION HARDWARE

|

**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- m. Color Permanence Test Cable Aging Test
 - n. Water Penetration Test
 - o. Lightning Test
 - p. Routine Test / Sample Test
- Site Test (Like Continuity & Attenuation)

12.00.00 ERECTION HARDWARE

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

12.01.00 ELECTRICAL ACCESSORIES

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

a) Rigid Steel Conduit

- i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
- ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.
- iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with ANSI C 80.1 and UL6. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.
- iv) All conduit fittings shall conform to the requirements of ANSI C 80.4 and UL-514 where these standards apply.

b) Flexible Conduit

- i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.
- ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.

c) Special Fittings



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.
- ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

12.01.01 Junction Box

01. Type of Enclosure : Dust tight & weatherproof conforming to IP 65
02. Material : 2 mm sheet steel
03. Type of Cover : Solid Hinged Door with steel handle and IP lock
04. Paint : 631 IS 5 Epoxy Powder Coated
05. Mounting : Surface
06. Cable Entry : 3 mm (min) Gland plate
07. Gasket : Neoprene
08. Grounding : Brass earth lug with green screw head
External-2 nos , Internal-1no.M6.
09. Number of Drain Holes : Two at bottom capped.
10. Identification : Label for JB and Tags for cable
11. Accessories : a) Rail mounted cage clamp type screwless terminals with markers
b) Cable gland
c) Ferrules
d) Canopy at top

12.01.02 Cable Gland

01. Type : Double compression
02. Entry Thread : NPT
03. Material : Brass
04. Finish : Cadmium Plated.
05. Protection : IP 65 or better





WBPDC

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

06. Accessories : Neoprene gasket, locknuts, reducers etc.

12.01.03 Cable Tray

01. Material : Mild steel

02. Thickness : not less than 2.0 mm

03. Finish : Hot dip galvanized

04. Perforation : As per MFR standard.

05. Cover : Suitable for tray

06. Height of the cable tray : 100 mm for 450mm and above width.
(width cannot be less than 100 mm)

12.02.00 PROCESS HOOK UP ACCESSORIES & SPECIFICATION

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

12.02.01 Specification for Process Hook Up Materials





WBPDCCL

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

07.	BFP SUCTION / CONDENSATE SYSTEM / EXTRACTION TO LPH / EXTRACTION-4 TO BFP-T, DEAERATOR / AUXILIARY STEAM	G	ASTM- A106 GR. B	80 INCH) (½	ASTM- A105	ASTM-A- 182 GR. F6A	3000 LB	800
10.	Purge Air	–	ASTM- A106 Gr. C	80 (¾ inch)	ASTM- A 105 Gr. F-22	SS or better	3000 lb	800
11.	DM Cooling Water	–	ASTM A312 TP 316	40 (½ inch)	ASTM A182 F316	SS or better	3000 lb	800
12.	CW & ACW	–	ASTM- A106 Gr. C	80 (½ inch)	ASTM- A 105	SS or better	3000 lb	800
<p>NOTE :</p> <p>(1) RATING OF PIPING / FITTINGS / VALVES ETC. IS SUBJECTED TO THE DESIGN PRESSURE & TEMPERATURE DURING THE DETAILED ENGINEERING.</p> <p>(2) IN CASE TEMPERATURE IS MORE THAN 540 DEG. C, THE MATERIAL SHALL BE P-91 ONLY.</p>								



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

12.02.02 Seamless Stainless Steel Pipe

- 01. Reference : ASTM A-312 TP 316
- 02. Material Grade : TP 316
- 03. Type : Seamless /Plain end
- 04. Size : ½” NB
- 05. Schedule : 40
- 06. Standard Length : 5 meter

12.02.03 Stainless Steel Pipe Fittings

- 01. Reference : ASTM A-182 F 316 / ANSI B16.11
- 02. Type : Forged
- 03. Rating : 3000 lbs / 6000 lbs / 9000 lbs
- 04. Size : ½” NB
- 05. End connection : Generally socket weld
- 06. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

12.02.04 Seamless Stainless Steel Tube

- 01. Reference : ASTM A-213 TP 316
- 02. Material Grade : TP 316
- 03. Size : ½” OD X 2.1 MM Thick
- 04. Type : Cold drawn annealed, pickled, passivated, de-scaled, ,hydraulically cleaned seamless tube.
- 05. Properties : The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
- 06. Test Pressure : 400 Kg/Sq. cm (minimum)
- 07. Tolerance : ± 0.13 mm for outside diameter
 ± 15 % for wall thickness



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 08. Standard Length : 5 meter
- 09. Test : Flare, Hardness, Ball and Bubble Test

12.02.05 Stainless Steel Tube Fittings

- 01. Reference : ASTM-A-182
- 02. Type : Double ferrule double compression
- 03. Material : 316 Stainless steel forged
- 04. Ferrule : 316 Stainless Steel
- 05. Type of Fittings : Male / female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation.
- 06. Size : To suit SS tubing and NPT end connection

12.02.06 C.S. Pipe

- 01. Reference : ASTM-A 106 Gr. C
- 02. Material : Cold drawn seamless black C.S.
- 03. Type : Seamless / Plain ends
- 04. Size : ½" NB
- 05. Schedule : 80, 160, XXS as required
- 06. Standard Length : 5 meter

12.02.07 C.S. Pipe Fittings

- 01. Reference : ASTM-A 105 / ANSI B16.11
- 02. Type : Forged
- 03. Rating : 3000 lbs / 6000 lbs / 9000 lbs
- 04. Size : ½" NB
- 05. End connection : Generally socket weld
- 06. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- 12.02.08 A.S. Pipe
- 01. Reference : ASTM-A 335 P22 AS PER ANSI B 36.10
 - 02. Material : Cold drawn seamless A.S.
 - 03. Type : Seamless / Plain ends
 - 04. Size : ½" NB
 - 05. Schedule : XXS
 - 06. Standard Length : 5 meter
- 12.02.09 A.S. Pipe Fittings
- 01. Reference : ASTM-A 182 F22 AS PER ANSI B 16.11
 - 02. Type : Forged
 - 03. Rating : 9000 lbs
 - 04. Size : ½" NB
 - 05. End connection : Generally socket weld
 - 06. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.
- 12.02.10 Carbon Steel Globe Valve
- 01. Reference : ASTM A-105
 - 02. Type : Globe
 - 03. Construction : Forged Body Cadmium Plated
 - 04. End Connection : ½" Socket Weld
 - 05. Rating : Cl. 800 / CL. 2500
 - 06. Material : Body - Carbon steel
Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited
 - 07. Packing : Teflon / Grafoil as required



**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 08. Yoke : ASTM A105
- 09. Handwheel : Carbon steel
- 10. Design standard : As per ANSI B 16.34

12.02.11 Stainless Steel Globe Valve

- 01. Reference : ASTM A-182 F316
- 02. Type : Globe
- 03. Construction : Forged Body
- 04. End Connection : Socket Weld
- 05. Proof Pressure : 400 Kg/Cm2
- 06. Material : Body - Stainless steel
Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited
- 07. Packing : Teflon as required
- 08. Yoke : ASTM A182 F316
- 09. Handwheel : Carbon steel
- 10. Design standard : As per ANSI B 16.34

12.02.12 Alloy Steel Globe Valve

- 01. Reference : ASTM A-182 F22
- 02. Type : Globe
- 03. Construction : Forged Body
- 04. End Connection : ½" Socket Weld
- 05. Rating : CL. 2500
- 06. Material : Body - Alloy steel
Stem - Hardened Steel
Plug - AISI 316 SS
Seat- Stainless steel stellited



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- 07. Packing : Grafoil as required
- 08. Yoke : ASTM A182 F22
- 09. Handwheel : Carbon steel
- 10. Design standard : As per ANSI B 16.34

12.02.13 Condensate Pot

- 01. Reference : ASTM A182 F22 /ASTM A105
- 02. Material : Alloy steel / carbon steel as per application
- 03. Construction : Drilled from barstock
- 04. End connection : 3 nos. ½" socket weld end
- 05. Accessories : Vent valves

12.02.14 Instrument Valve Manifold

- 01. Type : a) Two valve manifold
b) Five valve manifold
- 02. Mounting : Remote 2" Pipe Mounting
- 03. Construction : Single block (bar stock)
- 04. Material : Forged body and bonnet AISI 316 stainless steel
- 05. Ports : 1/2 " NPT (F)
- 06. Rating : 420 Kg/Sq. cm at ambient
- 07. Operating Temperature : (-) 30 to (+) 170 Deg C
- 08. Packing : PTFE Wafer
- 09. Seat & Stem : AISI 316 SS
- 10. Plug : AISI 316 SS free to turn on stem / 17-4 PH
- 11. Handle Bar : AISI 316 SS
- 12. Connection : Straight
- 13. Accessories : i) Plugs for all ports



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

ii) Mounting Bracket , bolts , nuts

12.03.00 PNEUMATIC HOOK UP ACCESSORIES

12.03.01 Air Header

Technical Particulars :

		For Panel	For Field
01.	Material of Construction :	Stainless steel	Stainless steel
02.	Inlet Connection :	2" NPT (M)	1" NPT (M)
03.	Header Take-off :	Stainless steel	Stainless steel
04.	Take off connection :	1 / 2" NPT (M)	1/ 2" NPT (M)
05.	Take-off Valves :	stainless steel	stainless steel
06.	Tube Take-off :	Tube adapter on valve	Tube adapter on valve
07.	Drain :	SS drain valve at lowest point	SS drain valves at lowest point

12.03.02 Seamless Stainless Steel Tube

01.	Reference :	ASTM A-269 TP 31605
02.	Material Grade :	TP 316
03.	Size :	¼" OD X 0.049" wall thickness
04.	Type :	Cold drawn annealed, pickled, passivated, de-scaled, ,hydraulically cleaned seamless tube.
05.	Properties :	The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
06.	Test Pressure :	400 Kg/Sq. cm
07.	Tolerance :	± 0.13 mm for outside diameter ± 15 % for wall thickness
08.	Standard Length :	5 meter





WBPDCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

09. Test : Flare, Hardness, Ball and Bubble Test





**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

QUALITY ASSURANCE

|

**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III

2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

- 2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured and tested at all the stages, as well as Services provided for erection, commissioning and testing shall be as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Bidder for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Bidder's responsibility to draw up and implement such programme and reviewed by by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Owner's representative for review. Schedule of finalisation of such quality plans will be finalised before award.
- 2.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Bidder's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.
- 2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Bidder's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.
- 2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Consultant's approval without which manufacture shall not proceed. In these approved quality plans, Owner/Authorised representative/Consultant shall identify Customer Hold Points (CHP), test/checks which shall be carried out in presence of the Owner/Consultant/Owners Owner's Engineer or his Authorised Representative and beyond which the work will not proceed without consent of Owner/Authorised representative/Consultant in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised Representative/Consultant for acceptance and dispositioning.
- 2.05.00 The Bidder shall provide adequate notice to the Owner for inspection before the material is dispatched as per the provisions of the Contract. No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III**

all previous tests/inspections by Owner's Owner's Engineer/Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

2.08.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.09.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Bidder's/Sub-Vendor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

Under no circumstances any repair or welding of castings be carried out without the consent of the Owner. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Owner.

All pressure parts shall be subjected to hydraulic testing as per the requirements of IBR. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than thirty (30) minutes.

2.10.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for acceptance.

All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III**

penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed. Statutory payments in respect of IBR approvals including inspection shall be made by Bidder. Bidder's scope and responsibility shall also include preparation and submission of all necessary documents in the specific formats and manner stipulated by the statutory bodies, coordination and follow up for above approvals.

2.11.00 All the Sub-Vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Bidder and finalised with the Owner shall be subject to Owner's review. Quality Plans of the successful Sub-Vendors shall be discussed, finalised and accepted by the Owner/Authorised representative and form part of the Purchase Order between the Bidder and the Sub-Vendor.

2.12.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Bidder and finalised with the Owner shall be furnished to the Owner for comments and subsequent acceptance before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Bidder's or their Sub-Vendor's quality management and control activities. The Bidder shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/acceptance of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Bidder in earning satisfactory performance of equipment as per specification.

2.13.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.14.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the acceptance of the Owner.

2.15.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 **QUALITY ASSURANCE DOCUMENTS**

3.01.00 The Bidder shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

a) Material mill test reports on components as specified by the specification.



**WBPDCCL**

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III**

- b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.
- f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- g) Stress relief time temperature charts.
- h) Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed inspection hold points. During the course of inspection, the following will also be recorded :
 - i) When some important repair work is involved to make the job acceptable.
 - ii) The repair work remains part of the accepted product quality.
- i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

4.01.00 The Successful Bidder shall give the Owner's Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Successful Bidder's account except for the expenses of the Inspector. The Owner's Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Successful Bidder may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.02.00 The Owner's Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Successful Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Successful Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Owner's Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase – III**


- 4.03.00 When the factory tests have been completed at the Bidder's or sub-Vendor's works, the Owner/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Owner/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Owner/Inspector. Failure of the Owner/Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.
- 4.04.00 The Bidder shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.




	QUALITY PLAN FOR ULTRASONIC FLOWMETER									
	QUALITY PLAN NO.: PE-QP-445-145-I011									
	VOLUME IIB									
	SECTION D									
	REV. NO. 01 DATE: 05.02.21 SHEET 2 OF 3									

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	Electronic Housing	Chemical Property	Major	Visual	100%	Approved drg/ Data sheet	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	2	---	1	
2.0	Standard Certificates	Certificate of Compliance, Warranty Certificate	Major	Visual	As applicable	Technical documents/ Approved documents	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	2	---	2,1	
3.0	Visual Check	Mechanical	Major	Visual	100%	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	2	1	1	
4.0	Complete assembly	Overall dimension and end connection	Major	Measurement	100%	Approved drg/ Data sheet	Technical catalogue/ Approved documents	Inspection Report	2	2	1	
		Marking-Tag No. direction of flow	Minor	Visual	100%	Approved drg/ Data sheet	Technical catalogue/ Approved documents	Inspection Report	2	2	1	
5.0	Function test & power ON	Electrical	Major	Visual	100%	Functional test report for meter & transducer	Approved documents	Technical catalogue/ Approved documents	2	---	1	
6.0	HART Communication	Electrical	Major	---	100%	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	Technical catalogue/ Approved documents	--	---	1	



LEGEND:	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor/Sub-vendor	
---------	---	-----------------------------------	---

 PEM :: C&I	QUALITY PLAN FOR ULTRASONIC FLOWMETER	QUALITY PLAN NO.: PE-QP-445-145-I011
		VOLUME IIB
		SECTION D
		REV. NO. 01 DATE: 05.02.21
		SHEET 3 OF 3


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		
7.0	PACKING & DISPATCH	Soundness of Packing against transit damage	Major	Visual	100%	Manufacturer Standard	Technical catalogue/ Manufacturer Standard			2	1	---	



NOTE:



1. Protection class shall be IP-65 or better or as per approved datasheet.
2. Type test certificates/Type test reports for "Protection class" shall be verified by BHEL.
3. CALIBRATION Test to be carried out at NABL or BHEL approved laboratory.
4. All test reports / test certificates shall be submitted to WBPDCI for information.

<p>LEGEND:</p> <p>\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.</p>	 <p>1 - BHEL 2 - Vendor/Sub-vendor</p>
---	---




PEM :: C&I

QUALITY PLAN FOR FLOW ORIFICE PLATE ASSEMBLY

QUALITY PLAN NO.: PE-QP-445-145-I005	
VOLUME	IIB
SECTION	D
REV. NO.	00
DATE: 24.05.19	
SHEET	5 OF 6

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 1.1	MATERIAL Orifice Plate	1. Physical, Chemical properties	MA	Physical, Chemical Tests	One / Plate OR One/ Heat	AP / DS / SP	AP / DS / SP	Lab Report	3/2	---	2,1	IBR certification (if applicable) to be verified by BHEL
		2. Dimensions	MA	Measurement	100%	AP	AP	IR	3/2	---	1	
1.2	Flanges A. Forgings	Chemical, Mech Properties, UT & Heat Treatment	MA	Chem & Mech UT test	Sample	Material Spec as per ASTM A 388 for UT	ANSI B 16.34	MTC, UT cert, HT cert	3/2	---	1	
		B. Machining	MA	Measurement	100 %	AP / DS	AP / DS	IR	3/2	---	1	
2.0	IN PROCESS Machine	1. Dimension	MA	Measurement	100%	AP	AP	IR	3/2	2	2	
		2. Surface finish	MA	Visual	100%	-----	Mirror Finish	-----	3/2	2	---	
		3. Surface flaw on machined surface	MA	Penetrant test	100%	ASTM 165 / IS:3658	No surface flaw	IR / TC	3/2	2	1	
3.0	ASSEMBLY and FINAL INSPECTION	1. Overall dimensions	MA	Measurement	100%	AP	AP	IR	3/2	2,1	---	
		2. Marking, Tag no. Direction of flow	MA	Visual	100%	AP / DS	AP / DS	IR	3/2	2	1	
		3. Calibration	MA	Performance Test	One per type	-----	SP	TC	3/2	---	1	
		4. Painting	MA	Visual	100%	SP / MS	SP / MS	IR / MR	3/2	---	1	
		5. Root valve BOQ	MA	Measurement	100%	AP / DS	AP / DS	IR	2	---	1	

LEGEND: * CR - Critical characteristics IR - Inspection Reports DS - Data Sheet MR- Manufacturer records § P - Agency Performing the Test. 1 - BHEL
 MA - Major characteristics TC - Test Certificates SP - Tech. Spec. MS- Manufacturer standards W - Agency Witnessing the Test. 2 - Vendor
 MI - Minor characteristics AP - Approved Drawings/doc V - Agency Verifying the Test. 3 - Sub-vendor

 PEM :: C&I	QUALITY PLAN FOR FLOW ORIFICE PLATE ASSEMBLY							QUALITY PLAN NO.: PE-QP-445-145-1005				
								VOLUME	IIB			
								SECTION	D			
								REV. NO.	00	DATE: 24.05.19		
							SHEET	6	OF	6		
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	
4.0	PACKING	Soundness of Packing against transit damage	MA	Visual	100%	SP / MS	SP / MS	----	3/2	----	----	Refer Note 4

NOTE:

1. All test reports & dimension reports shall be verified by BHEL wherever verification is by BHEL at the time of Final Inspection. Positive material identification testing shall be performed by vendor and the same shall be witnessed by BHEL.
2. Minimum 2 coats of primer paint to be applied before dispatch.
3. CALIBRATION Test to be carried out at IIT-DELHI / FCRI or BHEL approved laboratory.
4. Sea worthy packing shall be provided, if called for in the Data sheets.

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	IR - Inspection Reports TC - Test Certificates AP - Approved Drawings/doc	DS - Data Sheet SP - Tech. Spec.	MR- Manufacturer records MS- Manufacturer standards	^{\$} 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	QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)	QUALITY PLAN NO.: PE-QP-445-145-I 006	VOLUME IIB
			SECTION D
		REV. NO. 01	DATE:
		SHEET 1	OF 6

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 5. Pressure test for shell	MA MA MA MA MA	Physical, Chemical tests Review of H.T. Chart RT for Body & UT for Bonnet 1. Visual 2. MT/PT Hyd. Test	One/ Heat(HT Batch) Each H.T. 100% 100% 100%	Approved drg. / data sheet Approved drg. / data sheet ASME B 16.34 MSS-SP-55 ASME B 16.34 ISA-S-75.19/ ASME B 16.34	Approved drg. / data sheet Approved drg. / data sheet ASME B 16.34 MSS-SP-55 ASME B 16.34 ISA-S-75.19/ ASME B 16.34	Test Certificate Test Certificate Test Report / FILM Test Certificate Test Certificate Test Certificate	3 3/2 3/2 3/2 3 2	---	2,1 1 2 2 1 1	TC for body/bonnet from foundry only 1.IBR Certification (if applicable) to be verified by BHEL. 2.Applicable for body /bonnet only Applicable for Body and Bonnet for rating ANSI 900 and above. After Machining on machined surface only For Body & Bonnet after machining

LEGEND: * CR - Critical characteristics RT- Radiographic Test PT – Dye penetrant Test \$ P - Agency Performing the Test.
 MA - Major characteristics UT – Ultrasonic Test MT- Magnetic Test W - Agency Witnessing the Test.
 MI - Minor characteristics V - Agency Verifying the Test.

1 - BHEL 4 - WBPDCI
 2 - Vendor
 3 - Sub-vendor

 <p>PEM :: C&I</p>		QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)									
		QUALITY PLAN NO.: PE-QP-445-145-I 006									
		VOLUME IIB									
		SECTION D									
REV. NO. 01			DATE:			SHEET 2 OF 6					

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	
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2	
		2. Hardness	MA	Measurement	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2	
		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	
		2. Mech. Properties	MA	Mech. Test	One sample/Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2	
		3. Performance	MA	1. Stiffness ratio 2. Scragging 3. Cyclic test (Endurance) 4. Dimension (Measurement)	100%	Material spec. / Mfr. standard 10,000 cycles Mfr. standard	Material spec. / Mfr. standard Material spec. / Mfr. standard Material spec. / Mfr. standard	Test Certificate Test Certificate Test Certificate	3 3 3	---	2 2 2,1	
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test	MA	HV, IR, Continuity function	100%	Relevant Standards	Relevant Standards	Test Certificate	3	---	2	
		2. Degree of protection	MA	IP/NEMA Tests	One sample / type	Approved Data sheet	Approved Data sheet	Test Certificate	3	---	2,1	

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor	4 - WBPDCI
--	---	--	---	--	------------



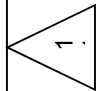
<h2 style="margin: 0;">QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)</h2>		QUALITY PLAN NO.: PE-QP-445-145-I 006			
		VOLUME IIB			
		SECTION D			
		REV. NO. 01	DATE:		
		SHEET 3	OF 6		

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	
1.5	Pressure Gauges (if provided externally)	1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2	
		2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Records	3	---	2	


2.0 IN PROCESS INSPECTION												
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	


3.0 TESTS ON COMPLETED VALVE												
3.1	Actuator Chamber	Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	No Leakage	Test Certificate	2	1	1,4	Refer Note-4
3.2	Body	Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19/ ASME B16.34	No Leakage	Test Certificate	2	1	1,4	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	1,4	Refer Note-4
4.0	OPERATION TEST ON COMPLETED VALVE (Final inspection)	1. Valve Travel	MA	Measurement	100%	Mfr. Procedure	Approved drg./ data sheet	Test Report	2	1	1,4	Refer Note-4
		2. Opening/Closing time	MA	Measurement	100%	Mfr. Procedure	Approved drg./ data sheet	Test Report	2	1	1,4	Refer Note-4
		3. Linearity/cam characteristic	MA	Measurement	100%	Mfr. Procedure	Approved drg./ data sheet	Test Report	2	1	1,4	Refer Note-4

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor	4 - WBPDCI
--	---	--	---	--	------------



<h2 style="margin: 0;">QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)</h2>		QUALITY PLAN NO.: PE-QP-445-145-I 006			
		VOLUME IIB		SECTION D	
		REV. NO. 01		DATE:	
		SHEET 4		OF 6	

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	
4.	Repeatability		MA	Measurement	100%	Mfr. Procedure	Approved drg. / data sheet	Test Report	2	1	1,4	Refer Note-4
5.	Hysteresis		MA	Measurement	100%	Mfr. Procedure	Approved drg. / data sheet	Test Report	2	1	1,4	Refer Note-4
6.	Sensitivity		MA	Measurement	100%	Mfr. Procedure	Approved drg. / data sheet	Test Report	2	1	1,4	Refer Note-4
7.	Accuracy (Overall)		MA	Measurement	100%	Mfr. Procedure	Approved drg. / data sheet	Test Report	2	1	1,4	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	Mfr. Procedure	Approved drg. / data sheet	Test Certificate	2	--	1,4	◆ Size = Body & port size Or Body size & CV for non std port. Refer Note 1.
9.	Operation of limit switch & solenoids and other accessories		MA	Function	100%	Mfr. Procedure	Approved drg. / data sheet	Test Report	2	1	1,4	On assembled valve Refer Note-4
10.	Overall dimensions		MI	Visual and dimensional	100%	Approved drg. / data sheet	Approved drg. / data sheet	Records	2	1	1,4	Refer Note-4
11.	Pre defined valve position in case of air failure		MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	1	1,4	
12.	Cleanliness, painting, stamping (for direction of flow), Tag No.		MA	Visual and dimensional, paint thickness	100%	Mfr. Procedure	Approved drg. / data sheet	Test Certificate	2	1	1,4	
13.	Surface Quality		MA	Visual	100%	MSS-SP-55	MSS-SP-55	Test Certificate	3/2	--	2,1,4	

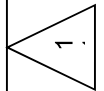
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	
\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			
1 - BHEL 2 - Vendor 3 - Sub-vendor		4 - WBPDCI	

 QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)	QUALITY PLAN NO.: PE-QP-445-145-I 006	
	VOLUME	IIB
	SECTION	D
	REV. NO.	01
	SHEET	5 OF 6

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	

AUXILIARY ITEMS (Performance test of auxiliary items shall be performed on the completely assembled valve)												
5.0	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	---	---	Certificate of Conformance (C.O.C)
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	---	(C.O.C)
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	---	(C.O.C)
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	---	(C.O.C)
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	---	(C.O.C)
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	---	(C.O.C)
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	---	(C.O.C)
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet /	Approved drg. / data sheet /	Inspection Report	2	---	---	(C.O.C)
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet /	Approved drg. / data sheet /	Inspection Report	2	---	---	(C.O.C)

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor	4 - WBPDC
---	---	--	---	--	-----------



QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)		QUALITY PLAN NO.: PE-QP-445-145-I 006	
		VOLUME	IIB
		SECTION	D
		REV. NO.	01
		DATE:	
		SHEET	6 OF 6

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	
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	---	(C.O.C)
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	---	(C.O.C)
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet /	Approved drg. / data sheet /	Inspection Report	2	---	---	(C.O.C)
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet /	Approved drg. / data sheet /	Inspection Report	2	---	---	(C.O.C)
		5. Calibration with Hand Held Communicator	MA	Measurement	Each type	Mfr. Standard	Mfr. Standard	Test Certificate	2	---	---	(C.O.C)
6.0	PAINTING	Soundness of Painting	MA	Visual and Measurement	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---	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 size, same CV, same trim characteristics) is not submitted to BHEL by the vendor, CV test shall be conducted at FCRI/Any govt. approved laboratory/ BHEL approved Laboratory.
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 called for in the Data sheets.
4. The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency.
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), C.O.C's(Certificates of Conformance) shall be submitted to BHEL for verification and acceptance.

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor	4 - WBPDCI
--	---	--	---	--	------------





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

CHECK LIST FOR ANALYTICAL INSTRUMENTS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	VISUAL						
	MAKE, MODEL No.						
	POWER SUPPLY						
	TYPE						
2	DIMENSIONS CHECK			P	V	V	
3	FUNCTIONAL CHECK			P	V	V	
4	LEAKAGE TEST			P	V	V	
5	HV / IR TEST			P	V	V	
6	LINEARITY			P	V	V	
7	RESPONSE TIME			P	V	V	
8	ENCLOSURE CLASS			P	V	V	
9	ACCESSORIES, AS APPLICABLE			P	V	V	
10	ACCURACY / CALIBRATION			P	V	V	
11	ALARM CONTACT TEST	P	V	V			
12	ANALOG OUTPUT CHECK	P	V	V			
13	BURN-IN TEST OF ELECTRONIC PARTS	1/LOT	P	V	V		
14	IN-BUILT INDICATOR, ZERO, SPAN, RANGE SCALE SELECTION ETC	SEE NOTE-1 BELOW	P	V	V		

Legend :

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

Note :

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



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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

- 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.
- When material correlation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



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

CHECK LIST FOR TEMPERATURE ELEMENT

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 No./TAG No.								
	PROCESS CONNECTION								
2	STABILITY					P	W	V	
3	INSULATION RESISTANCE					P	W	V	
4	ENCLOSURE CLASS					P	W	V	
5	RESPONSE TIME					P	W	V	
7	ACCURACY					P	W	V	
8	HYDROSTATIC TEST					P	W	V	
9	ELECTRICAL CHARACTERISTIC OF SENSOR (CONTINUITY OF T/C WIRES & INSULATION RESISTANCE OF RTD LEADS w.r.t. BODY)					P	W	V	
10	TEMP CURVES / CHARTS					P	V	V	
11	AMBIENT TEMP. EFFECT CHECK			P	W	V			
12	HV TEST			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.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.
- IBR certificate to be provided, if applicable



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

CHECK LIST FOR SOLENOID VALVES

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									
	MAKE									
	MODEL No.									
2	MATERIAL (BODY. PLUNGER/TRIM)					P		W	V	
3	PORT SIZE					P		W	V	
4	CABLE CONNECTION SIZE					P		W	V	
5	ENCLOSURE CLASS					P		W	V	TYPE TEST CERTIFICATE TO BE FURNISHED BY VENDOR
6	No. OF COILS & INSULATION CLASS					P		W	V	TEST CERTIFICATE TO BE FURNISHED FOR INSULATION CLASS BY VENDOR
7	POWER SUPPLY CHECK			P	W	V				
8	IR / HV TEST			P	W	V				
9	FUCTIONAL TEST			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.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



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

CHECK LIST FOR TEMPERATURE GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V		
	DIAL SIZE							
	MODEL NO./TAG NO./TYPE							
	RANGE/SCALE							
	END CONNECTION							
2	CALIBRATION	SEE NOTE-1 BELOW		P	W	V		
	ACCURACY							
	REPEATABILITY							
	HYSTERESIS							
3	OVER TEMP. TEST			P	W	V		
4	AMBIENT TEMP. COMPENSATION CHECK	1 OF TYPE	P	V	V			
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT	V	V	V			
	SENSOR							
	MOVEMENT							
	PROCESS CONNECTION							
	THERMOWELL							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V			
7	THERMOWELL	SEE NOTE-1 BELOW	AS PER APPD DWG		V	V		
	MATERIAL TC & DIMN. CHECK							
	HYD. TEST							
	OVER RANGE TEST							

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 %.
- IBR certificate to be provided if called for in specn.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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



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

CHECK LIST FOR LEVEL GAUGE

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

Legend :

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

Note :

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



**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

TYPE TEST REQUIREMENT

|

**WBPDC**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

13.00.00 TYPE TEST REQUIREMENTS

13.01.00 General Requirements

13.01.01 Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'Type Test Requirement for C&I Systems' at the end of this sub-section. For the balance equipment instrument, type tests may be conducted as per manufacturers standard or if required by relevant standard.

13.01.02 Out of the tests listed, Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Owner or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.

13.01.03 For the rest, submission of type test results and certificate shall be acceptable provided:

- a) The same has been carried out by Bidder/ sub-vendor on exactly the same model / rating of equipment.
- b) There has been no change in the components from the offered equipment & tested equipment.
- c) The test has been carried out as per the latest standards along with amendments as on the date of bid opening.

13.01.04 In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by Bidder within the quoted price and no extra cost will be payable by Owner on this account

13.01.05 As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by Bidder or his authorized representative and the balance have to be approved by Owner.

13.01.06 The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.

13.01.07 For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Owner. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

13.01.08 Bidder shall indicate in his bid, the cost of the type test for each items only for which type tests are to be conducted specifically for this project.



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

13.02.00 Special Requirement for Solid State Equipments/ Systems

The minimum type tests reports, over and above the requirements of above clause which are to be submitted for each of the major C&I systems like SG-C&I system, TG- C&I system, Station - C&I system, Flame monitoring system, Coal feeders control and instrumentation system, Boiler flame analysis system, Turbine supervisory system, BFP Turbine supervisory instruments, Analyzer instruments, Vibration monitoring systems, etc. shall be as indicated below:

13.02.01 Surge Protections for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Hence, all front end cards which receive external signals like analog input & output modules, binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of IEC-255-4 which is equivalent to ANSI 37.90a/ IEEE-472 may also be adopted for SWC test.

13.02.02 Dry heat test as per IEC-68-2-2.

13.02.03 Damp heat test as per IEC-68-3.

13.02.04 Vibration test as per IEC-68-2-6.

13.02.05 Electrostatic discharge tests as per IEC 801-2 or equivalent.

13.02.06 Radio frequency immunity test as per IEC 801-6 or equivalent.

13.02.07 Electromagnetic immunity as per IEC 801-3 or equivalent.

Test listed at clause no. 13.02.05, 13.02.06 & 13.02.07 above are applicable for front end cards only as defined under clause no. 13.02.01 above.



13.03.00 Type Test Requirement for C&I Systems

Sl. No.	ITEM	TEST REQUIREMENT	STANDARD	TEST TO BE SPECIFICALLY CONDUCTED	APPROVAL REQUIRED ON TEST CERTIFICATE	REMARKS
01.	THERMOCOUPLES	DEGREE OF PROTECTION TEST	IS-2147	NO	NO	
02.	RTD	AS PER STANDARD	IEC-751	NO	NO	
03.	C.J.C. BOX	DEGREE OF PROTECTION TEST AMBIENT TEMP. EFFECT	IS-2147	NO	YES	
			APPROVED PROCEDURE	NO	YES	
04.	ELECTRONIC TRANSMITTER	AS PER STANDARD	BS-6447 / IEC-770	NO	YES	
05.	E/P CONVERTER	AS PER STANDARD	MFR. STANDARD	NO	YES	
06.	DUST EMISSION MONITOR	DEGREE OF PROTECTION TEST	IS-2147	NO	YES	
07.	INSTRUMENTATION CABLES TWISTED & SHIELDED			YES	YES	
	A) CONDUCTOR	• RESISTANCE TEST	VDE-0815			
		• DIAMETER TEST	IS-10810			
		• TIN COATING TEST (DRAIN WIRE)				
	B) INSULATION	• LOSS OF MASS	VDE-0472			
		• AGING IN AIR OVENS	VDE 0472 **			** AS PER VDE 0207 FOR TEFLON INSULATED CABLES
		• TENSILE STRENGTH AND ELONGATION	VDE 0472 **			
		• HEAT SHOCK	VDE 0472 **			
		• HOT DEFORMATION	VDE 0472			
		• SHRINKAGE	VDE 0472			
		• BLEEDING & BLOOMING	IS-5831			
	C) INNER SHEATH	• LOSS OF MASS	VDE-0472			
		• HEAT SHOCK	VDE 0472 **			
		• COLD BEND / COLD IMPACT TEST	IS-5831			
		• HOT DEFORMATION	VDE 0472			

SL. NO.	ITEM	TEST REQUIREMENT	STANDARD	TEST TO BE SPECIFICALLY CONDUCTED	APPROVAL REQUIRED ON TEST CERTIFICATE	REMARKS
		• SHRINKAGE	VDE 0472			
	D) OUTER SHEATH	• LOSS OF MASS	VDE-0472			
		• AGING IN AIR OVENS	VDE 0472 **			
		• TENSILE STRENGTH AND ELONGATION TEST BEFORE AND AFTER AGEING	VDE 0472 **			
		• HEAT SHOCK	VDE 0472 **			
		• HOT DEFORMATION	VDE 0472			
		• SHRINKAGE	VDE 0472			
		• BLEEDING & BLOOMING	IS-5831			
		• COLOUR FASTNESS TO WATER	IS-5831			
		• COLD BEND / COLD IMPACT TEST	IS-5831			
		• OXYGEN INDEX TEST	ASTMD-2863			
		• SMOKE DENSITY TEST	ASTMD-2843			
		• ACID GAS GENERATION TEST	IEC-754-I			
	E) FILERS	• OXYGEN INDEX TEST	ASTMD-2863			
		• SMOKE DENSITY TEST	ASTMD-2843			
		• ACID GAS GENERATION TEST	IEC-754-I			
	F) AL-MYLAR SHIELD	• CONTINUITY TEST				
		• SHIELD THICKNESS				
		• OVERLAP TEST				
		• NOISE INTERFERENCE	IEEE TRANSACTIONS			
	G) OVERALL CABLE	• FLAMMABILITY	IEEE 383			
		• NOISE INTERFERENCE				

SL. NO.	ITEM	TEST REQUIREMENT	STANDARD	TEST TO BE SPECIFICALLY CONDUCTED	APPROVAL REQUIRED ON TEST CERTIFICATE	REMARKS
		•	DIMENSIONAL CHECKS	IS 10810		
		•	CROSS TALK			
		•	MUTUAL CAPACITANCE	VDE 0472		
		•	HV TEST	VDE 0472		
		•	DRAIN WIRE CONTINUITY			
08.	PRESSURE GAUGE	•	DEGREE OF PROTECTION TEST	IS-2147	NO	NO
		•	TEMPERATURE INTERFERENCE TEST	IS-3624	NO	NO
09.	TEMPERATURE GAUGE		DEGREE OF PROTECTION TEST	IS-2147	NO	NO
10.	PRESSURE & DIFFERENTIAL PRESSURE SWITCH	•	DEGREE OF PROTECTION TEST	IS-2147	NO	NO
		•	AS PER STANDARD	BS 6134	NO	NO
11.	LEVEL SWITCH		DEGREE OF PROTECTION TEST	IS-2147	NO	NO
12.	CONDUCTIVITY LEVEL SWITCH		DEGREE OF PROTECTION TEST	IS-2147	NO	YES
13.	CONTROL VALVES		CV TEST	ISA 75.02	YES	NO
14.	FLOW NOZZLES & ORIFICE PLATE		CALIBRATION	ASME PTC, BS-1042	YES	NO
15.	PLCs		ALL TESTS AS PER IEC-1131	IEC-1131		
16.	DCS					
	a)	I/O MODULES	CMRR & NMRR VERIFICATION	Mfr. standard	NO	YES
	b)	OTHER MODULES	CMRR & NMRR VERIFICATION	Mfr. standard	NO	YES
	c)	CLCS SYSTEMS	MODEL TEST	Approved Procedure	YES	YES
17.	LIE / LIR / JUNCTION BOX		DEGREE OF PROTECTION TEST	IS-2147	YES	YES
18.	FLUE GAS O ₂ ANALYZER		DEGREE OF PROTECTION TEST	IS-2147	NO	YES
19.	FLUE GAS CO ₂ ANALYZER		DEGREE OF PROTECTION TEST	IS-2147	NO	YES

SL. NO.	ITEM	TEST REQUIREMENT	STANDARD	TEST TO BE SPECIFICALLY CONDUCTED	APPROVAL REQUIRED ON TEST CERTIFICATE	REMARKS
20.	FLUE GAS SO ₂ ANALYZER	DEGREE OF PROTECTION TEST	IS-2147	NO	YES	
21.	FLUE GAS NO _x ANALYZER	DEGREE OF PROTECTION TEST	IS-2147	NO	YES	



**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

APPLICABLE CODES AND STANDARDS

1



WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

5.00.00 CODES AND STANDARDS

The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE , IS etc. 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





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- 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)
 - k) Direct Acting Electrical Indicating Instruments - IS - 1248 - 1968
- 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) / IEC 60947 / IEC 60529
 - c) Protection Class for Enclosures , Cabinets Control Panels and Desks - IS 2147 1962





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- 7) Apparatus, Enclosures and Installation Practices in Hazardous Area
 - a) Classification of hazardous area - NEMA Article 500, Volume-6, 1978./ NFPA Article 500 , Vol.70-1984
 - 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, 1982.
- 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.
 - c) Steam and water sampling ,conditioning and analysis in the power cycle - ASME PTC - 19.11
 - d) Standard methods of sampling system - ASTM D 1066-69
- 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.
 - f) Installation and operation of Pulverized fuel system - ANSI / NFPA 8503
 - g) Functional diagramming of Instrument and control systems - SAMA PMS 22.1





WBPDCCL

**EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III**

- h) Digital interface for programmable instrumentation - ANSI / IEEE 488
- 11) 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
- 12) Process connection Piping and 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
 - i) Forged and Rolled alloy steel pipe flanges , forged fittings , valves and parts ASTM A - 182
 - j) Pipe fittings of wrought carbon steel and ally steel - ASTM A - 234
 - k) Composition bronze metal castings ASTM B - 62
 - l) Seamless copper tube , bright annealed ASTM B- 168
 - m) Valves flanged and butt welding ends ANSI B 16.34
- 13) 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



**WBPDCCL**

EPC Bid Document
Sagardighi Thermal Power Project
1x660 MW Unit No. 5, Phase - III

- e) Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B33.
- 14) 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
- 15) 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.

Codes and standards as described in different sub-sections of this specification shall also be followed .

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.



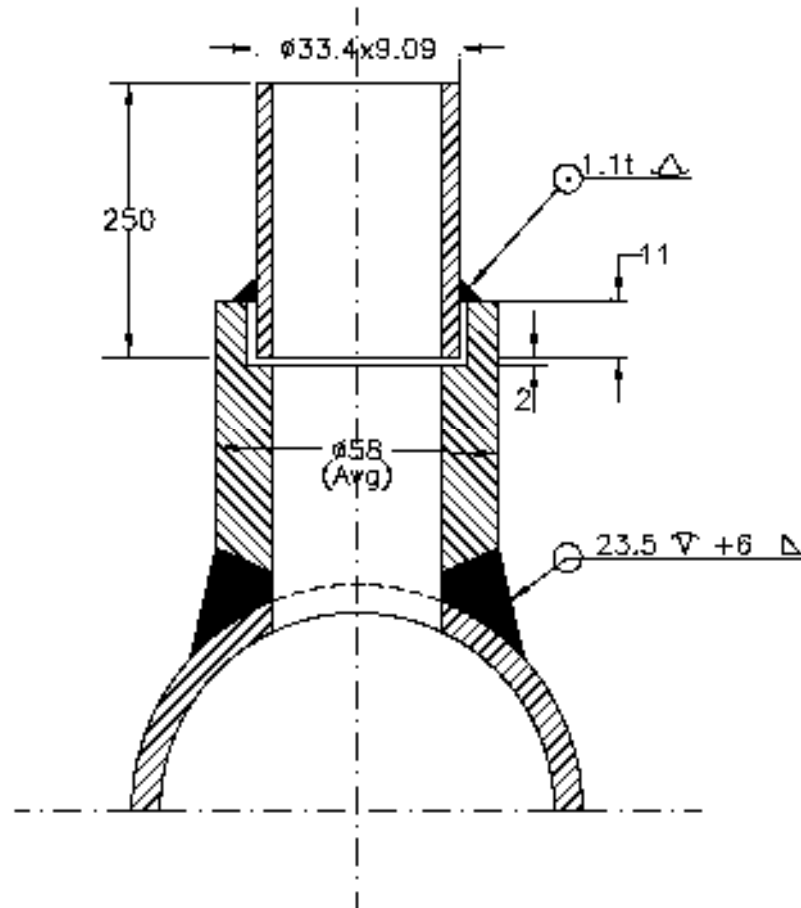


**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**


SECTION: C
SUB SECTION: C&I

INSTRUMENT STUB DETAILS

|



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHOULD BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. STUB & NIPPLE SHALL HAVE IBR CERTIFICATION AS APPLICABLE, ACCORDING TO 

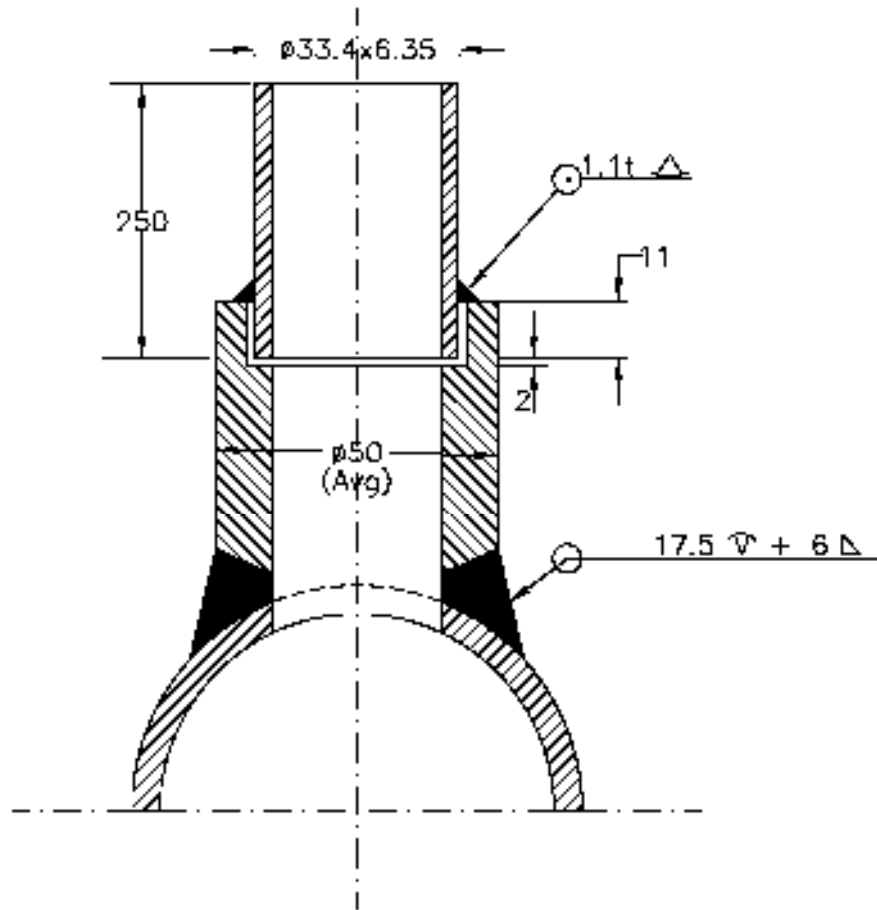


TITLE :
**INSTRUMENT STUB DETAILS
 FOR PRESSURE MEASUREMENT**


(TEMP > 500 DegC AND Nb25, CLASS 9000 #)
 OR (PRESS > 455 Kg/Cm² AND Nb25, CLASS 9000 #)

DRG. NO.
PE-DG-445-145-1101

REV. 01
 SH. 2 OF 8 SHS.



NOTE :

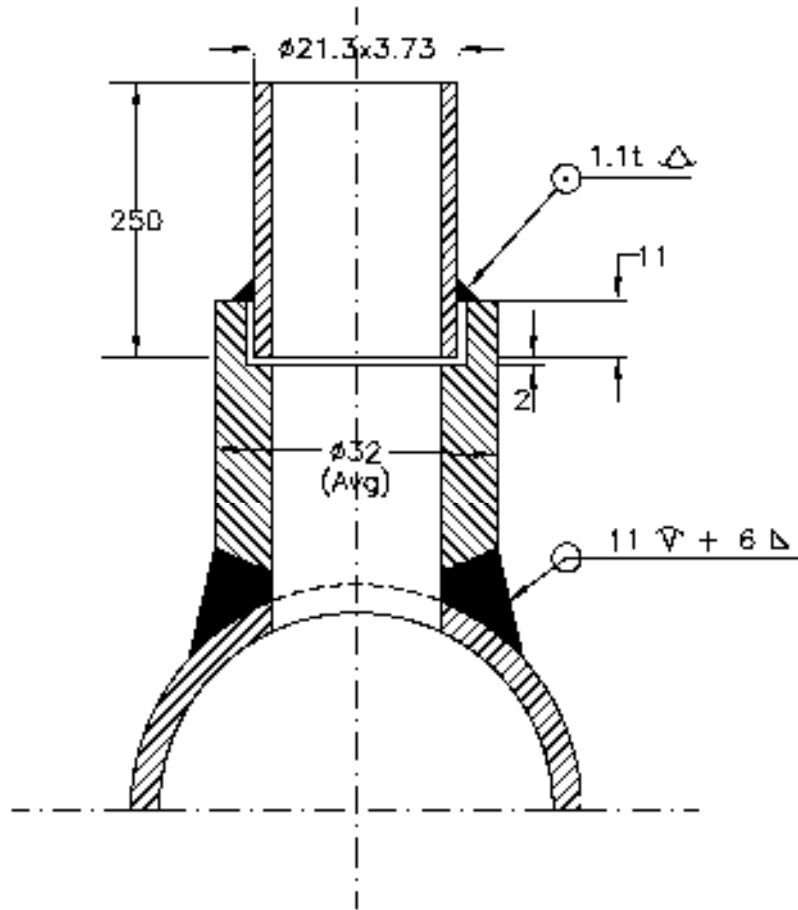
1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
6. STUB & NIPPLE SHALL HAVE IBR CERTIFICATION AS APPLICABLE, ACCORDING TO 




TITLE :
**INSTRUMENT STUB DETAILS
 FOR PRESSURE MEASUREMENT**

DRG. NO.
PE-DG-445-145-1101

(60Kg/Cm²<PRESS≤455Kg/Cm², TEMP≤425 DegC & Nb25, CLASS 6000#) REV. 01
 OR (PRESS≤455Kg/Cm², 425DegC<TEMP≤500 DegC & Nb25, CLASS 6000#) SH. 3 OF 8 SHS.



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
6. STUB & NIPPLE SHALL HAVE IBR CERTIFICATION AS APPLICABLE, ACCORDING TO 

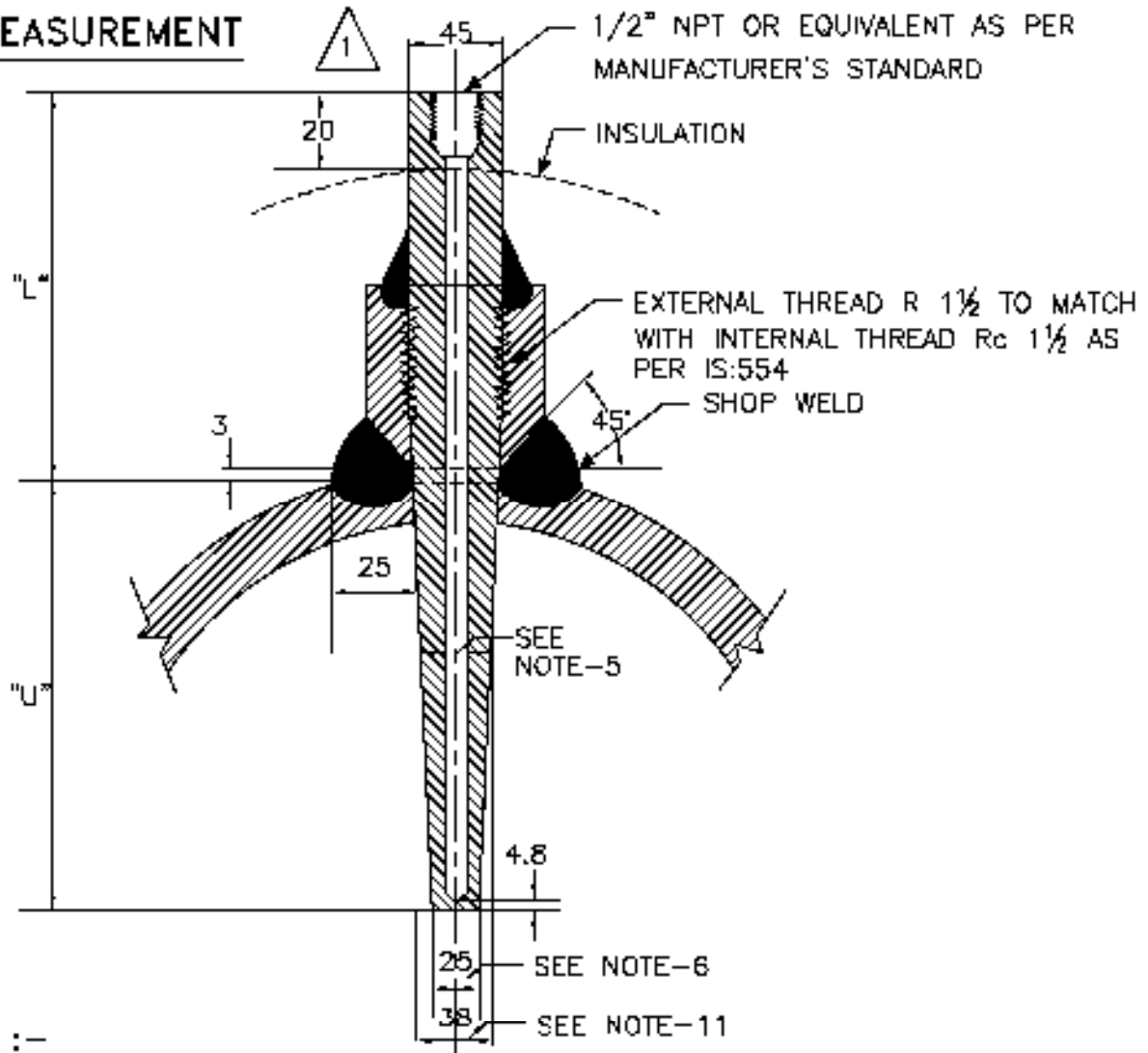


TITLE :
INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT

DRG. NO.
PE-DG-445-145-1101
 REV. 01
 SH. 4 OF 8 SHS.

(PRESS < 60Kg/Cm², TEMP < 425DegC & Nb15, CLASS 3000#)

TEMP. MEASUREMENT



NOTES :-

1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE DESIGN PRESS EQUAL/ ABOVE 40 KG/CM²(g) AND FOR DESIGN TEMP EQUAL/ABOVE 400 DegC EVEN IF THE DESIGN PRESSURE IS LESS THAN 40 Kg/Cm²(g)
2. THE MATERIAL OF THE BOSS SHALL BE SIMILAR TO PIPING MATERIAL.
3. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
4. THERMOWELL SHALL BE DRILLED BAR STOCK TYPE.
5. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME PTC-19.3.
6. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS AND TEMP AS PER ASME PTC-19.3.
7. THE 'U' & 'L' DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION.
8. ORIENTATION OF STUB ON VERTICAL / HORIZONTAL PIPES SHALL BE 90° TO THE CENTRE LINE OF THE PIPES, FOR PIPE SIZE LARGER THAN 4". HEIGHT OF STUB SHALL BE 64mm FOR PIPE OD < 200Nb AND 45mm FOR PIPE OD ≥ 200Nb.
9. STUB SHALL HAVE IBR CERTIFICATION, AS APPLICABLE, ACCORDING TO PROCESS DATA.
10. BOSS OD SHALL BE DEPENDENT ON PROCESS PRESS, TEMP & PIPE DIAMETER.
11. THERMOWELL SHALL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER Rc 1 1/2.
12. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



TITLE :
**INSTRUMENT STUB DETAILS
FOR TEMPERATURE MEASUREMENT**

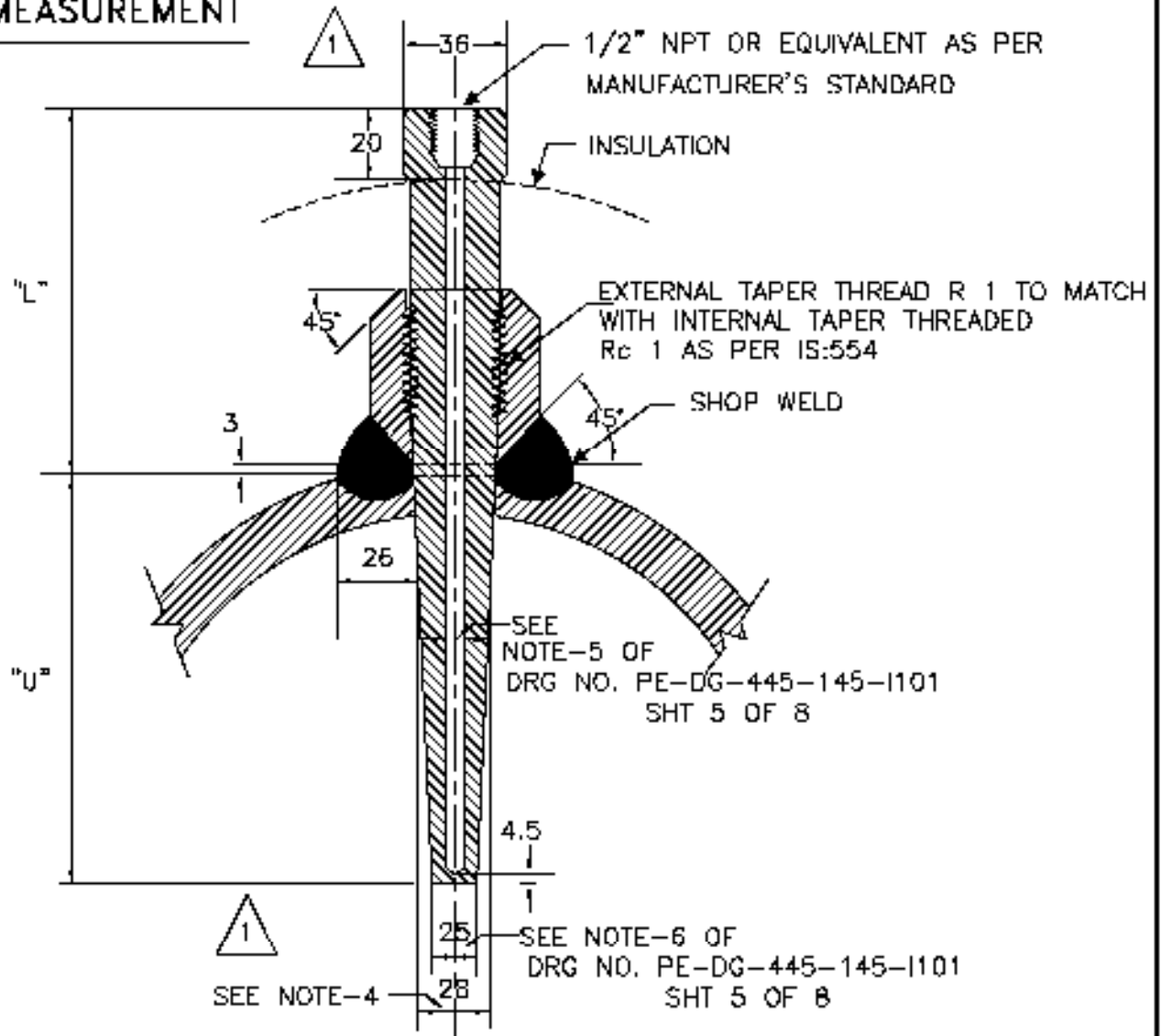
(APPLICABLE FOR PIPE SIZE ABOVE 4")
[(i) DESIGN PRESS = /> 40 Kg/Cm²(g) OR
(ii) DESIGN TEMP = /> 400 DegC]

DRG. NO.
PE-DG-445-145-1101

REV. 01
SH. 5 OF 8 SHS.



TEMP. MEASUREMENT



NOTES :-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE DESIGN PRESS/ TEMP BELOW 40 KG/CM2(g)/400°C.
2. FOR PRESS. TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554, THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. SEE NOTES-2 TO 10 IN SHT. 5 OF 8 OF THIS DRG. 1
4. THERMOWELL SHALL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER Rc 1.
5. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



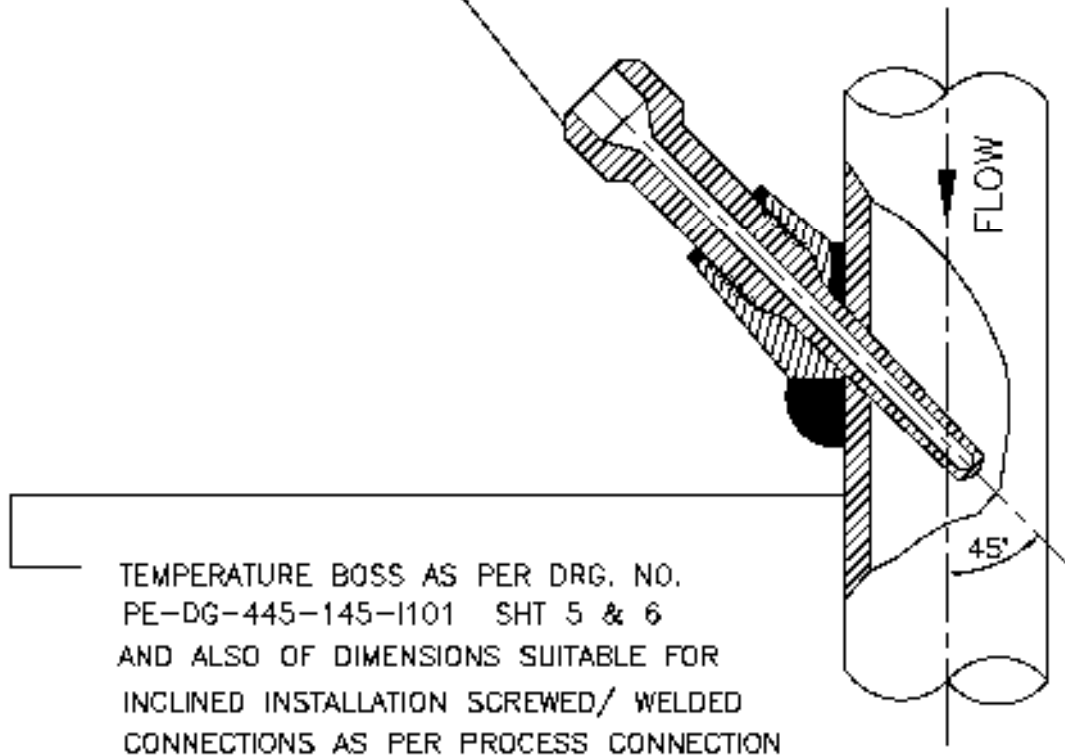
TITLE :
INSTRUMENT STUB DETAILS
FOR TEMPERATURE MEASUREMENT
 (APPLICABLE FOR PIPE SIZE ABOVE 4")

DRG. NO.
PE-DG-445-145-1101
 REV. 01
 SH. 6 OF 8 SHS.

[DESIGN PRESS < 40 Kg/Cm2 (g) & DESIGN TEMP < 400 C]

THERMOWELL SUITABLE FOR THE BOSS
AS PER DRG. NO.

PE-DG-445-145-1101 SHT 5 & 6



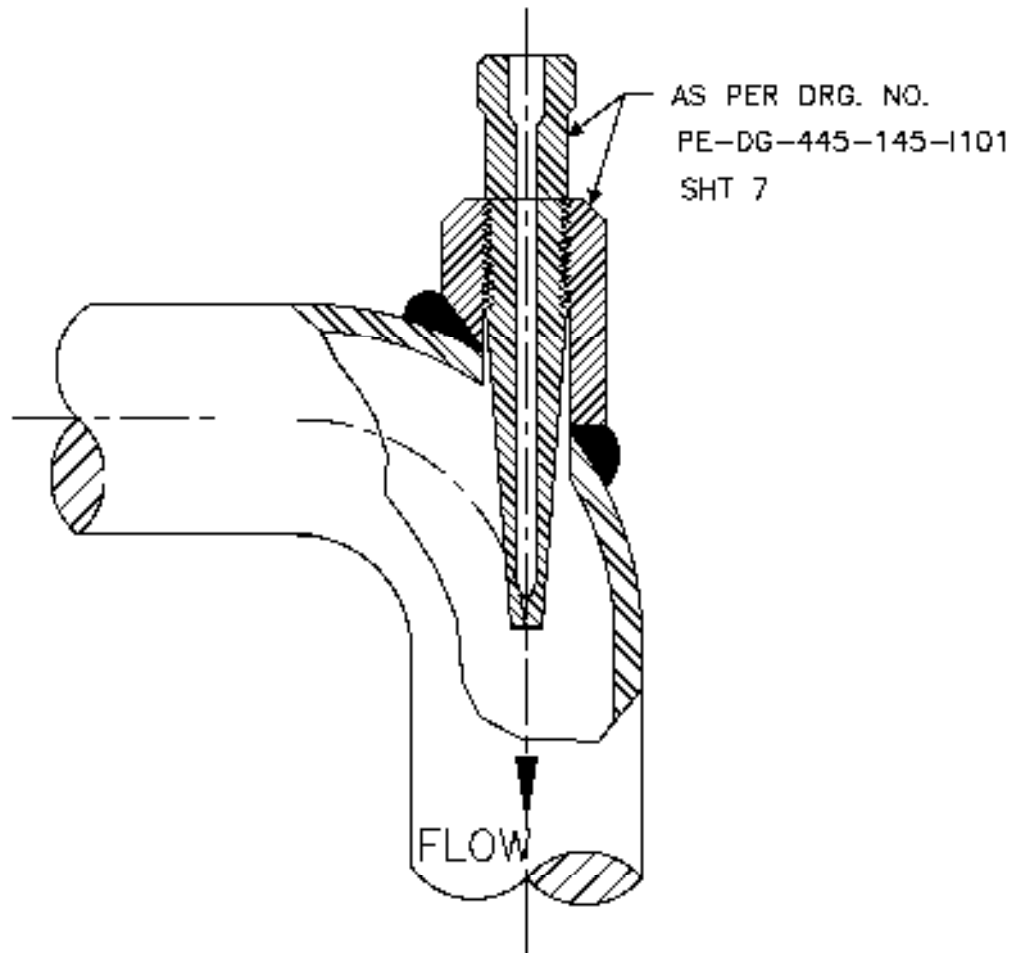
NOTES :-

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION TO BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (AT LEAST 3-4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDES OF THE INSTALLED THERMOWELL).



TITLE :
**INSTRUMENT STUB DETAILS
FOR TEMPERATURE MEASUREMENT
THERMOWELL INSTALLATION**

DRG. NO.
PE-DG-445-145-1101
REV. 01
SH. 7 OF 8 SHS.



NOTES :-

1. THIS INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE. THIS DETAIL IS APPLICABLE FOR THERMOWELL INSTALLATION IN BEND PIPES. △₁
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF MINIMUM 3" SIZE SHALL BE USED.
3. ELBOW EXPANDER SECTION IN HORIZONTAL PLANE TO BE USED FOR LIQUID SERVICE. FOR STEAM SERVICES EXPANDER SECTION TO BE USED IN VERTICAL PLANE.



TITLE :
**INSTRUMENT STUB DETAILS
FOR TEMPERATURE MEASUREMENT
THERMOWELL INSTALLATION**

DRG. NO.
PE-DG-445-145-1101
REV. 01
SH. 8 OF 8 SHS.



**C&I SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

SECTION: C
SUB SECTION: C&I

INSTRUMENT INSTALLATION DRAWING

1

NOTES :

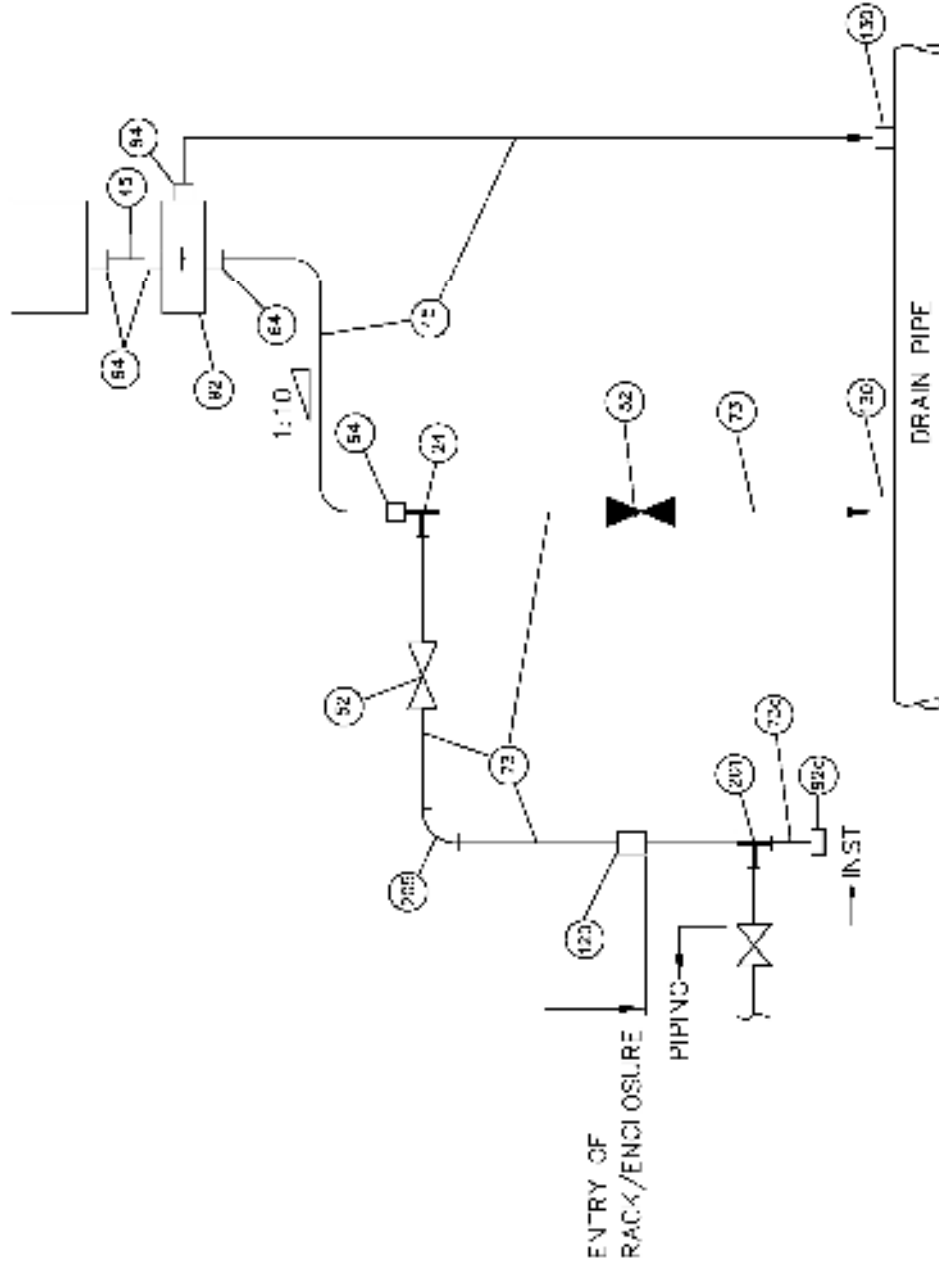
- 1..PROVISION OF SINGLE OR DOUBLE ROOT VALVE AND DRAIN VALVE SHALL BE IN ACCORDANCE WITH THE PRESSURE/TEMPERATURE REQUIREMENT. FOR LINE PRESSURE EQUAL TO OR GREATER THAN 40 KG/SQ.CM 2 NOS ROOT VALVE AND 2 NOS DRAIN VALVE SHALL BE REQUIRED.
- 2..MATERIAL, SIZE AND RATING OF THE PROCESS HOOK UP ITEMS SHOWN IN THE DRAWING ARE INDICATIVE ONLY. ACTUAL REQUIREMENT SHALL BE AS PER PROCESS CONDITION & SPECIFICATION V.IIF/S-VI/CLAUSE NO. 12.02.00..
- 3..DRAIN PIPE IN RACK AND ENCLOSURE SHALL BE 2' NB ASTM A 106 SCH A 106 80 Gr.C. DRAIN HEADER SHALL BE TO THE NEAREST DRAIN PIT AS PER SITE CONDITION.
- 4..ALL FITTINGS SHALL BE WITH DOUBLE COMPRESSION FERRULE & NUTS.
- 5..UNION SHALL BE USED AT EVERY 6M INTERVAL OF IMPULSE LINE OR AS REQUIRED.
- 6..IMPULSE LINE SHALL BE SUPPORTED WITH U-CLAMPING AT EVERY 2.5M SPAN.

FOR TENDER PURPOSE ONLY

 DEVELOPMENT SOLUTIONS PVT. LTD. CONSULTING ENGINEERS		TYPICAL INSTRUMENT INSTALLATION DIAGRAM THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD. KOLKATA, WB SINGUR/SHYAMLI POWER STATION 1. 400 MW (2x200 MW) 2. 400 MW (2x200 MW)		JOB NO. DCL-12405 DWG. NO. 12405 DWG 0022		SCALE : A1 SHEET NO. 34/1	
APPROVED A.T.	REVIEWED S.A.	CHECKED A.K.P. S.K.	DESIGN P.S.S.	DATE 22.03.2017	RELEASE 24.03.2017	NO.	SHEET NO.

PRESSURE TRANSMITTER/PRESSURE SWITCH
MOUNTED ABOVE SOLID POINT

PRESSURE TRANSMITTER/
SWITCH



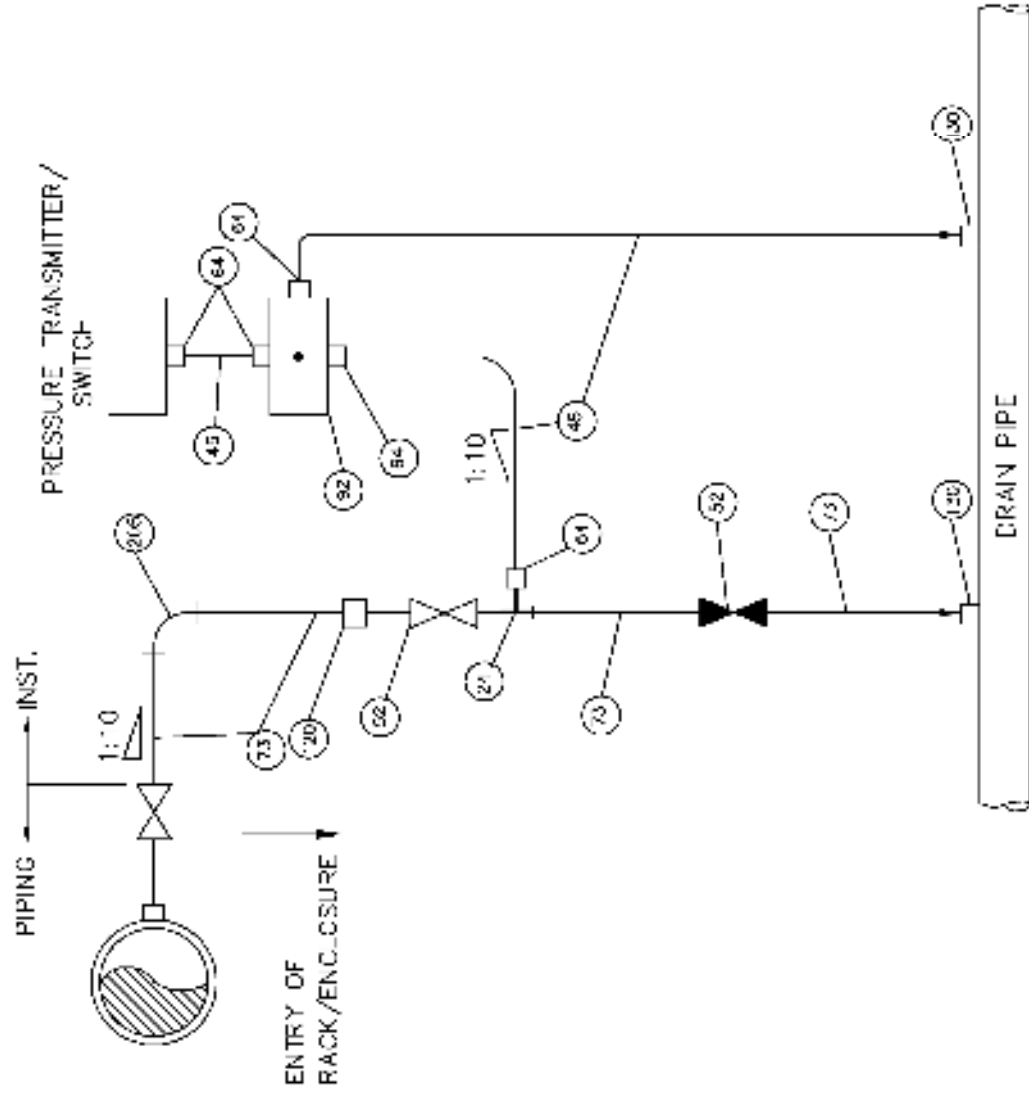
SERVICE : CONDENSER PRESSURE ETC.

BILL OF MATERIAL		
ITEM NO.	QTY./INSI	DESCRIPTION
24	1	UNEQUAL TEE, 1/2" SW X 1/2" NPT (C)
45	3 M	FL-35, 1/2" O
52	2	GLOBE VALVE, 1/2" SW
64	5	MALE CONNECTOR 1/2" NPT(M) X 1/2" OD
73	15	IMPLUSE PIPES, 15 NR
73a	1	NIPPLE, 1/2" SW X 1/2" NPT (C), 150 MM
92	1	2-VALVE MANIFOLD, 1/2" NPT (C)
92a	1	DRAIN PLUG, 1/2" NPT (M)
200	1	BULK HEAD UNION/COUPLING, 1/2" SW
201	2	HALF COUPLING, 1/2" SW
202	1	EQUAL TEE, 1/2" SW
205	2	90° ELBOW, 1/2" SW

FOR TENDER PURPOSE ONLY

		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM		JOB NO. DCL-12405 SCALE: A1	
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.		DWG. NO. 12405-DWG-1-0022	
SUBMITTED TO: WEST BENGAL POWER DEVELOPMENT CORPN. LTD.		DATE: 01.06.2007	
APPROVED:		CHECKED:	
DRAWN:		DESIGNED:	
REVISION:		NO. OF SHEETS:	
SHEET NO.:		TOTAL SHEETS:	

1 2 3 4 5 6
**PRESSURE TRANSMITTER/PRESSURE SWITCH
 MOUNTED BELOW SOURCE POINT**



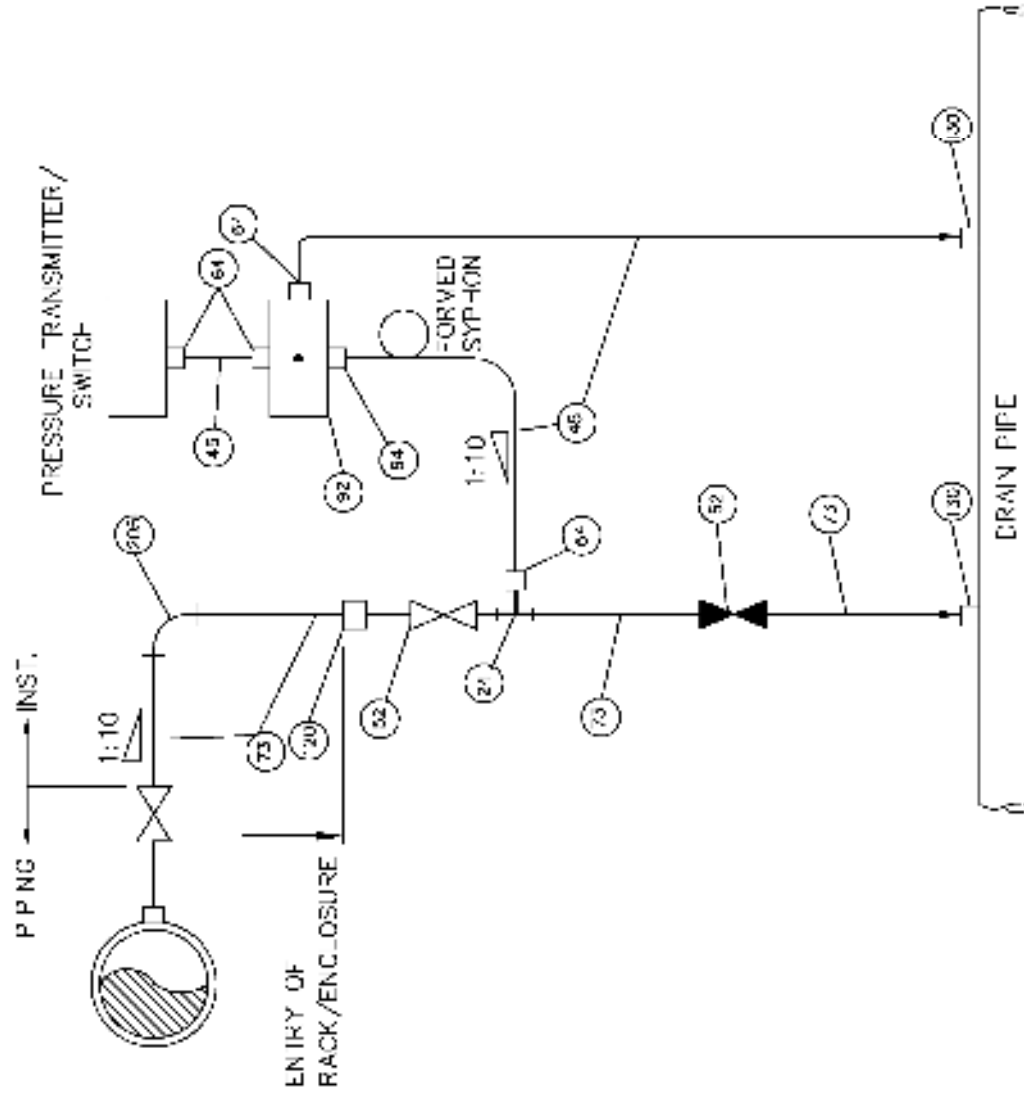
BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
24	UNEQUAL TE. 1/2" SW X 1/2" NPT (C)
46	TUBE, 1/2" OD
52	GLOBE VALVES, 1/2" SW
64	MALE CONNECTOR, 1/2" NPT (M) X 1/2" OD
73	MPL. S. P. P., 15 N.B.
92	2 VALVE MANIFOLD, 1/2" NPT (F)
120	BULK-HEAD UNION, 1/2" SW
130	HAIF COUPLING, 1/2" SW
205	90° ELBOW, 1/2" SW

SERVICE : CONDENSATE, FEED WATER ETC.

FOR TENDER PURPOSES ONLY

		DEVELOPMENT GENERALISTS PVT. LTD. CONSULTING ENGINEERS	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM		JOB NO. DCL-12405 SCALE: ML	
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.		DWG. NO. 12405-DWG-1-0002	
SUBDIVISION: THERMAL POWER STATION		SHEET NO. 1 OF 1	
DATE: 03.06.2017	REV: 0	RELEASE STA-01	4
APPROVED:	S.A.	A.K.P. S.K.	2
REVISION:	DESCRIPTION	3	5
1	4	5	6

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



SERVICE : LOW PRESSURE STEAM

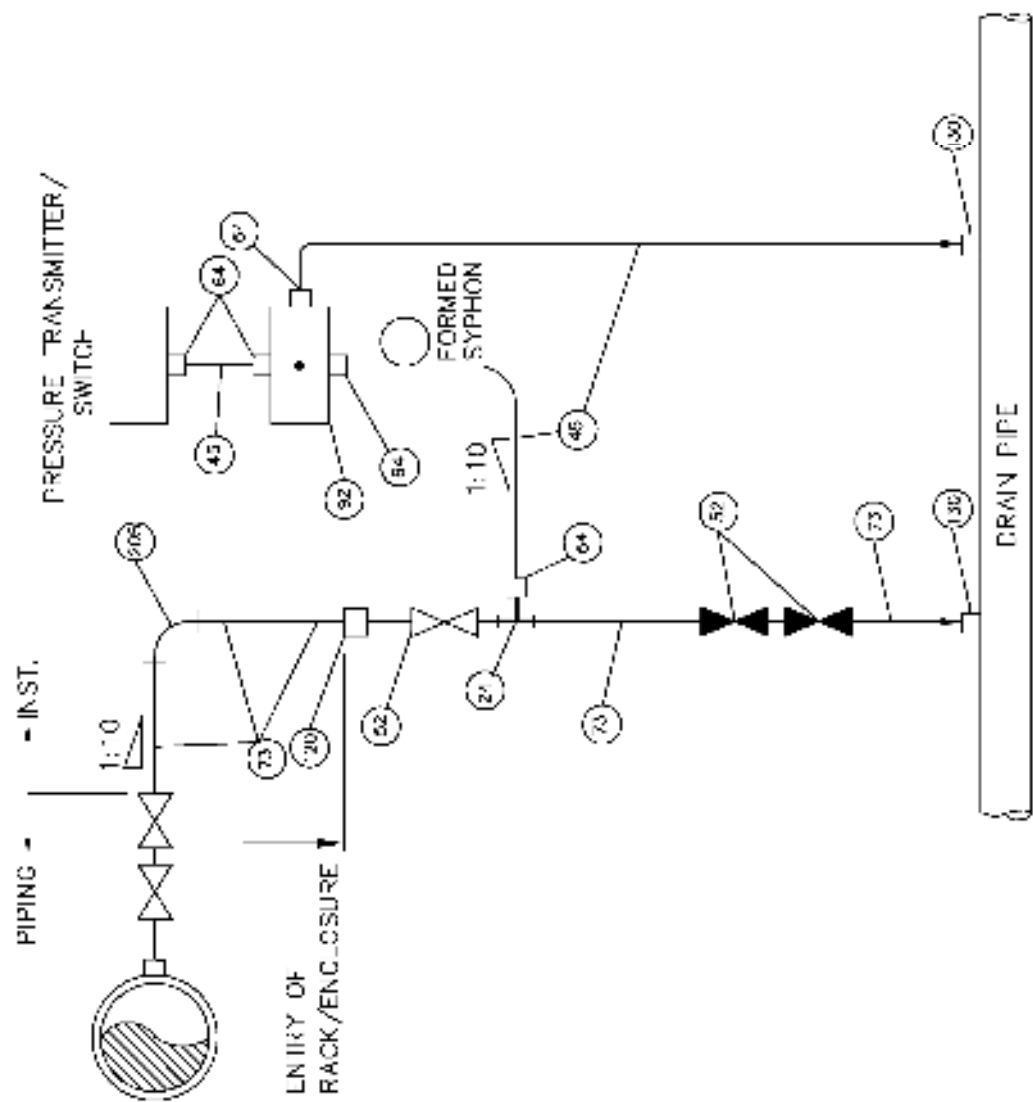
BILL OF MATERIAL		
ITEM NO.	QTY/INST	DESCRIPTION
24	1	UNEQUAL TC, 1/2" SW X 1/2" NPT (C)
46	3 V	TUBE, 1/2" OD
52	2	GLOBE VALVES, 1/2" SW
64	8	MALE CONNECTOR, 1/2" NPT (M) X 1/2" OD
73	15 M	MFL-SE PIPE, 15 NB
92	1	2 VALVE MANIFOLD, 1/2" NPT (F)
120	1	BULK-HEAD FITING, 1/2" SW
130	2	HAIF COUPLING, 1/2" SW
205	4	90° ELBOW, 1/2" SW

FOR TENDER PLOTFOER ONLY

REVISION		RELEASE STATUS		DATE		DESCRIPTION		DRAWING NO.		SCALE		JOB NO.		ENGINEERING	
1				3	2008.03.10		FRESH ISSUE		12405 DWG	1	0002		12405 DWG		12405 DWG
2															

TYPICAL INSTRUMENT INSTALLATION DIAGRAM		DEVELOPMENT CONSULTANTS' INT. LTD.	
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.		CONSULTING ENGINEERS	
SANGRISH THERMAL POWER STATION		JOB NO. DCL-12405	
SANGRISH THERMAL POWER STATION		DRAW. NO. 12405 DWG 1 OF 22	
ENTR. UNITS 1 & 2		SCALE: 1:10	
		RFU: J	

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



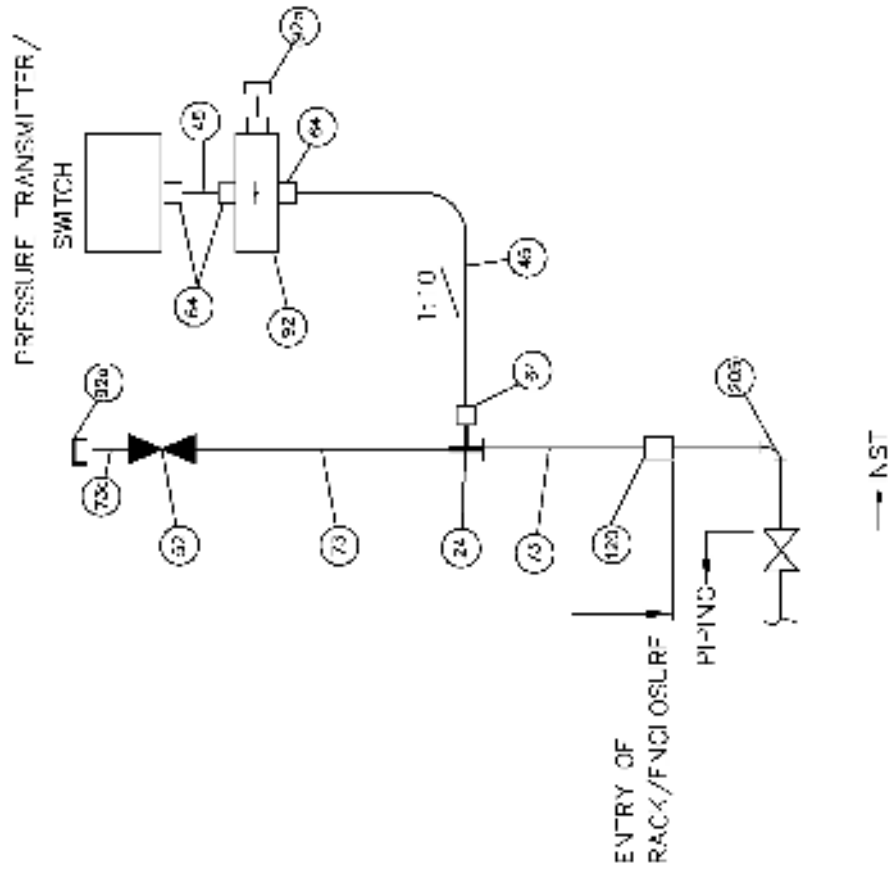
BILL OF MATERIAL		
ITEM NO.	QTY/INST	DESCRIPTION
27	1	UNEQUAL TE, 1/2" SW X 1/2" NPT (C)
45	3 V	TUBE, 1/2" OD
52	3	GLOBE VALVES, 1/2" SW
64	5	MALE CONNECTOR, 1/2" NPT (M) X 1/2" OD
73	15 N	MPL. SE PIPE, 15 NB
92	1	2 VALVE MANIFOLD, 1/2" NPT (F)
120	1	BULK-HEAD UNION, 1/2" SW
130	2	HAIF COUPLING, 1/2" SW
205	1	90° ELBOW, 1/2" SW

SERVICE : SERVICE : MEDIUM & HIGH PRESSURE STEAM

FOR TENDER PURPOSE ONLY

		DEVELOPMENT CORPORATION'S "PT. 110" CONSULTING ENGINEERS	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM		JOB NO. DCL- 2405 SCALE : 1:1L	
THE WEST BENGAL WATER DEVELOPMENT CORPN. LTD.		DWG. NO. 12405 DWS / 0022	
SUBMITTED TO: WEST BENGAL WATER DEVELOPMENT CORPN. LTD.		DATE: 22.03.2017	
APPROVED:	REVIEWED:	CHECKED:	DESIGNED:
A.T.	S.A.	A.K.P. S.K.	P.R.S.S.F.
1	2	3	4
7	8	9	10

PRESSURE TRANSMITTER/PRESSURE SWITCH
MOUNTED ABOVE SOLID POINT



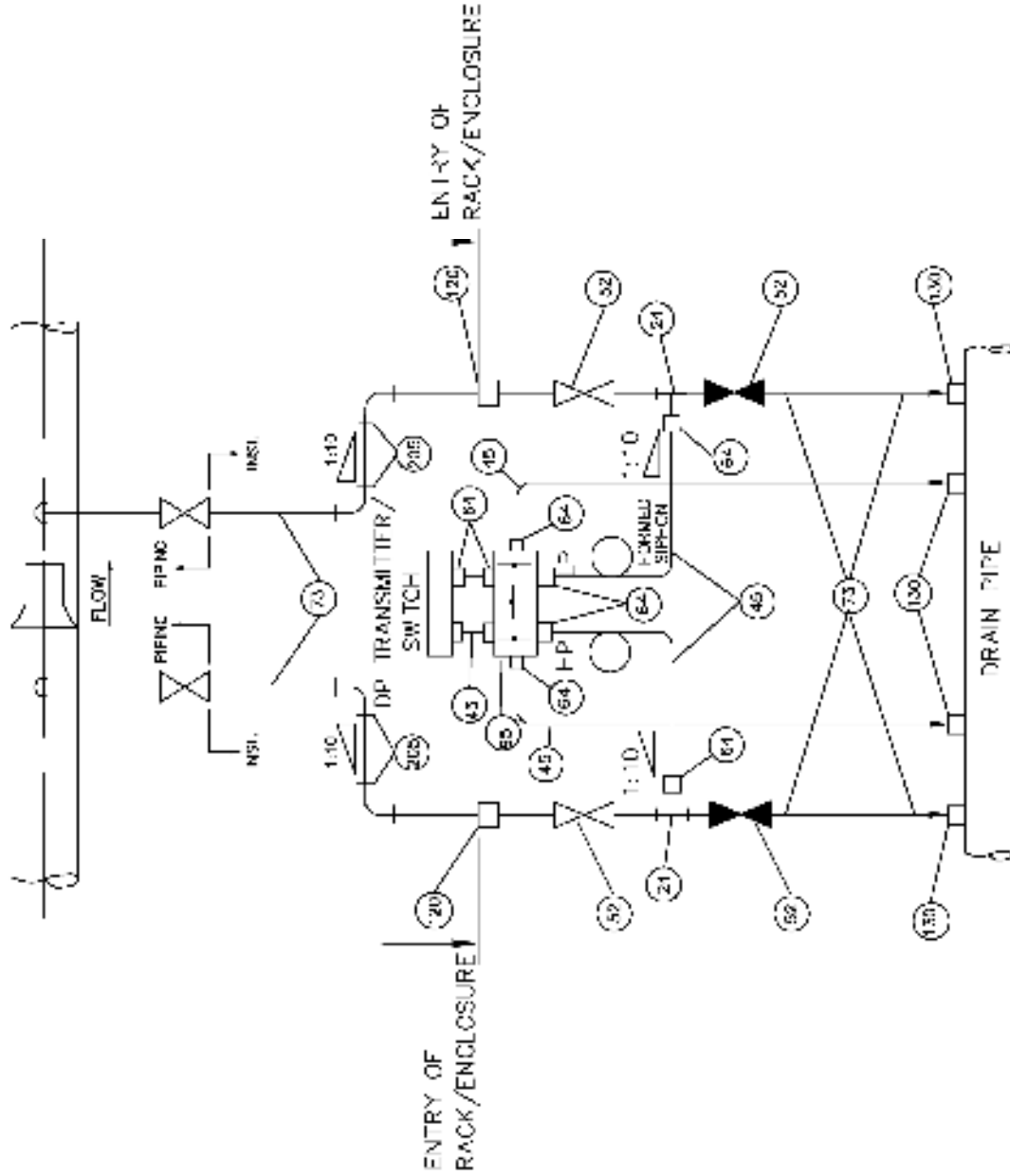
SERVICE : INSTRUMENT AIR

BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
24	UNEQUAL TEE, 1/2" SW X 1/2" NPT (C)
45	FL-25, 1/2" OD
52	GLOBE VALVE, 1/2" SW
64	MALE CONNECTOR, 1/2" NPT(M) X 1/2" OD
73	IMPLUG HIGH, 15 NH
73b	ADP-2, 1/2" SW X 1/2" NPT (C), 150 MM
92	2-VALVE MANIFOLD, 1/2" NPT (C)
92a	VENT PLUG, 1/2" NPT (M)
205	BULK HEAD UNION/COUPLING, 1/2" SW
205	90° HIRBW, 1/2" SW

FOR TENDER PURPOSE ONLY

TYPICAL INSTRUMENT INSTALLATION DIAGRAM		DEVELOPMENT CONSULTANTS INT. LTD. CONSULTING ENGINEERS	
THE WEST BENGAL POWER DEVELOPMENT CORP. LTD.		JOB NO.	DOL-12405
SANGRISHA THERMAL POWER STATION		SCALE	1:10
SANGRISHA THERMAL POWER STATION		DWG. NO.	12405-DWG-1-0002
DATE		REV	DATE
22/04/17		0	22/04/17
RELEASE SHEET		DESCRIPTION	DATE
2		PIPING	22/04/17
3		PIPING	22/04/17
4		PIPING	22/04/17
5		PIPING	22/04/17
6		PIPING	22/04/17
7		PIPING	22/04/17
8		PIPING	22/04/17
9		PIPING	22/04/17
10		PIPING	22/04/17

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



SERVICE : CONDENSATE, FEED WATER ETC.

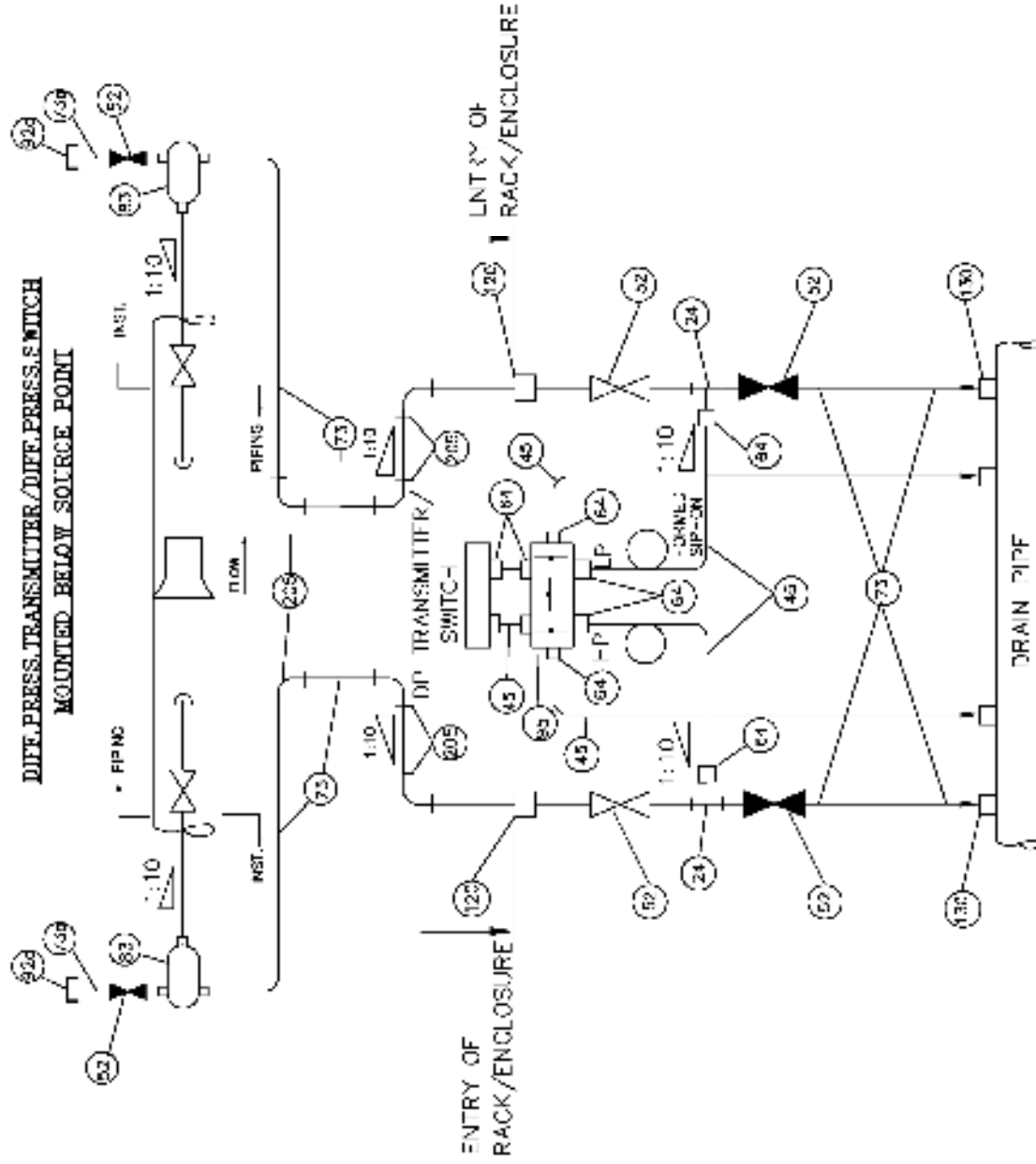
PRIMARY TYPEN : FLOW NOZZLE / OR F.C.

BILL OF MATERIAL		
ITEM NO.	QTY / INSTE	DESCRIPTION
21	2	UNEQUAL. TEE, 1/2" SW X 1/2" NPT (F)
45	6 M	TUBE, 1/2" CD
52	4	GLOBE VALVE, 1/2" SW
64	10	MALE CONNECT. OR, 1/2" NP (M) X 1/2" O.D
73	30 M	IN-JOINT PIPE, 1/2" NH
95	1	5 VALVE MAN'GOLD, 1/2" NPT (F)
120	2	3/4" F-CAD URON, 1/2" SW
130	4	HALF COUPLING, 1/2" SW
205	4	DIFF. P. TRAN, 1/2" SW

FOR TENDER PURPOSE ONLY

REVISION		APPROVED		REVIEWED		DESIGNER		CHECKER		DATE	
		A.T.	S.A.	A.K.P.	S.K.					01	22/03/17
				RELEASE SIGNATURE				DATE			
				TYPICAL INSTRUMENT INSTALLATION DIAGRAM				THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.			
				SARADWATI THERMAL POWER STATION				SARADWATI THERMAL POWER STATION			
				INDIA				INDIA			
				CONSULTING ENGINEERS				CONSULTING ENGINEERS			
				JOB NO. DCL-12405				SCALE : ML			
				DRAW. NO. 12405-DWG-1-0002				S. M. J.			
				DEVELOPMENT GENERAL MANAGER				DEVELOPMENT GENERAL MANAGER			

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



SFRMCT : STEAM

PRIMARY ELEMENT : FLOW NOZZLE/OR FICE

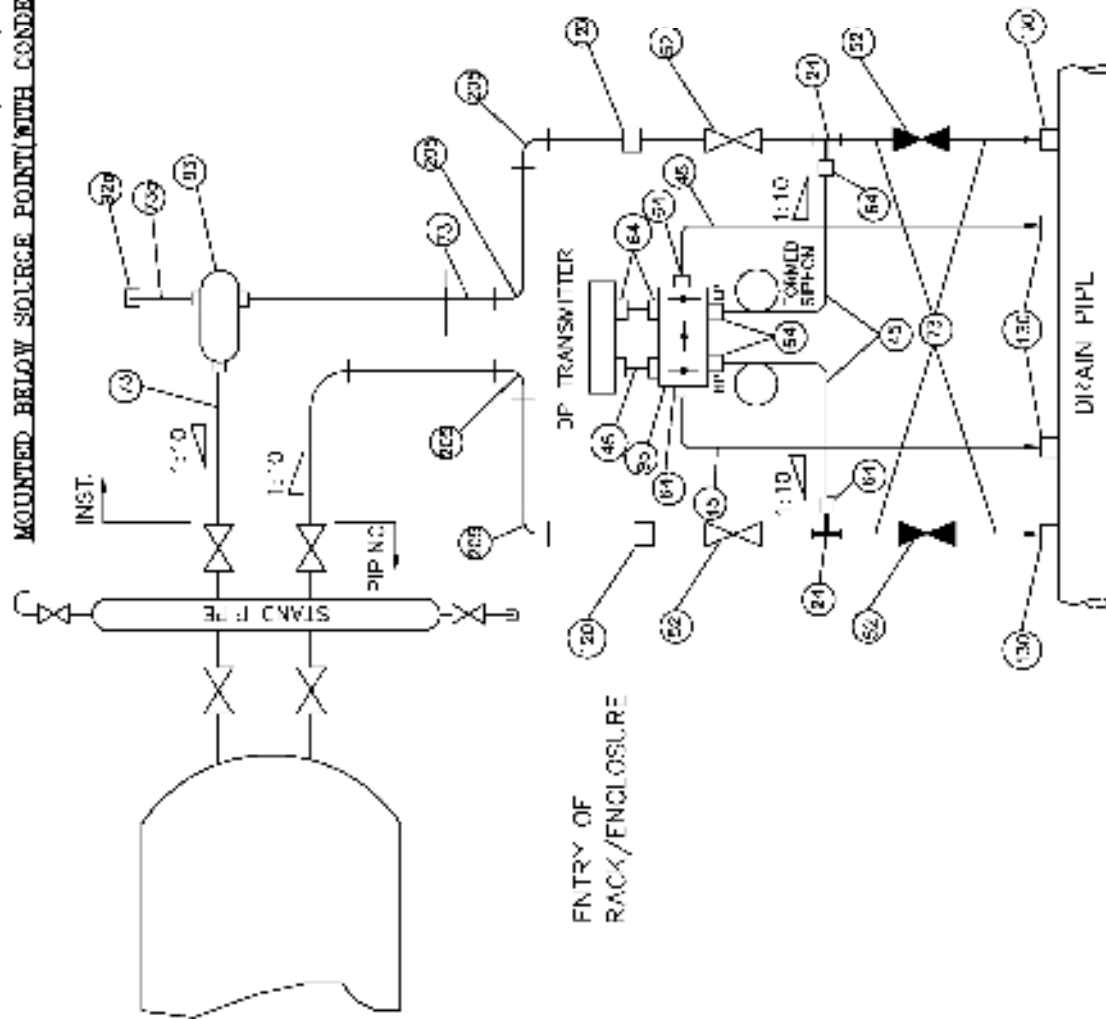
FOR TENDER PURPOSE ONLY

BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
24	JNEQUAL. TIC, 1/2" SW X 1/2" NPT (F)
45	TUBE, 1/2" OD
52	GLOBE VALVE, 1/2" SW
64	MALE CONNECTION, 1/2" NPT (M) X 1/2" OD
73	IM-PULSE PIPT, 15 NR
73a	NIPPLE, 1/2" SW X 1/2" NPT (F), 150 NV
83	CONDENSING POT, 1/2" SW
92a	VENT P-JUG, 1/2" NPT (M)
95	5 VALVE MANIFOLD, 1/2" NPT (F)
170	3ULK-HEAD UP ON, 1/2" SW
130	HAIF COUPLING, 1/2" SW
205	90° ELBOW, 1/2" SW

REV	DATE	DESCRIPTION	BY	CHKD	APP'D	REVIEWED	DATE	DESCRIPTION
1	22/08/2017	FIRST ISSUE						
2								
3								

TYPICAL INSTRUMENT INSTALLATION DIAGRAM		DEVELOPMENT CONSULTANTS INT. LTD	
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.		CONSULTING ENGINEERS	
JOB NO.	DQ-12403	SCALE	AS
DWG. NO.	12403 DWG 1 0022	REV	3

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



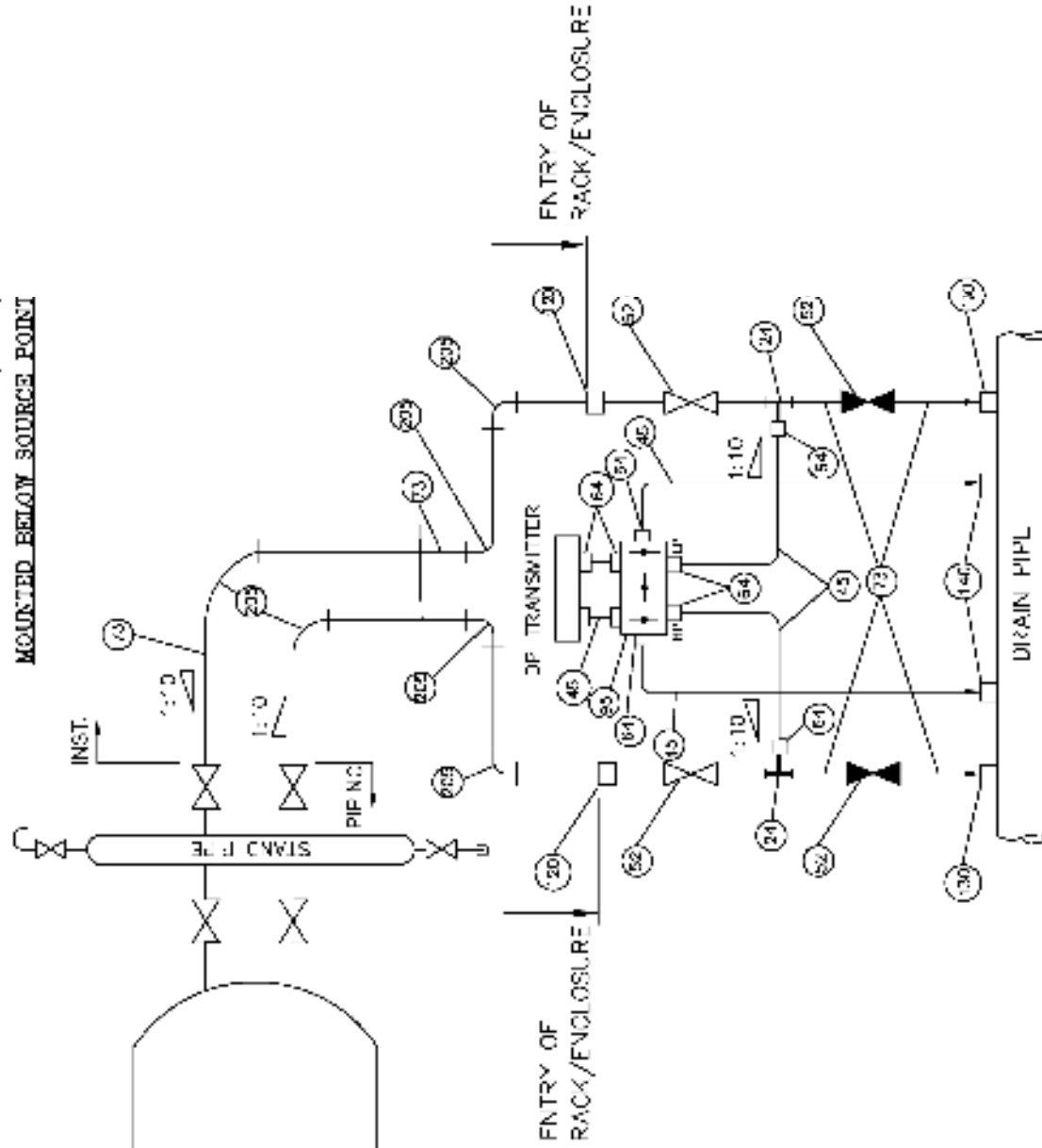
SERVICE : SEPARATOR, DEAERATOR, HEATERS

BILL OF MATERIAL		
ITEM NO.	QTY./INSTR.	DESCRIPTION
24	2	UNEQUAL IEL, 1/2" SW X 1/2" NPT (F)
45	6 M	TUBE, 1/2" OD
59	4	GRDF VALVE, 1/2" SW
64	8	MALE CONNECTOR, 1/2" NPT (M) X 1/2" OD
73	30 M	IMPULSE PPE, 15 NR
73a	1	NIPPLE, 1/2" SW X 1/2" NPT (F)
83	1	CONDENSATE POT, 1/2" SW
92a	1	VALV PLUG, 1/2" NPT (M)
95	1	5 VALVE MANIFOLD, 1/2" NPT (F)
120	2	BULK-HEAD UNION, 1/2" SW
130	4	HAIF COUPLING, 1/2" SW
205	5	90° ELBOW, 1/2" SW

FOR TENDER FLOOR ONLY

REVISION	APPROVED	A.T.	S.A.	A.K.P. S.K.	FIRST ISSUE	22081317	0	REV	22081317	DATE	USA	TYPICAL INSTRUMENT INSTALLATION DIAGRAM		DEVELOPMENT CONSULTANTS '97, LTD	CONSULTING ENGINEERS
												THE WEST BENGAL POWER DEVELOPMENT CORP. LTD.	INDIA		
										SARADWATI THERMAL POWER STATION		JOB NO. DCL-12405		SCALE: ML	
										FOR TENDER FLOOR ONLY		DRAW. NO. 12405-DWG-1-3022		S. V. J.	

DIFF. PRESS. TRANSMITTER (LEVEL MOUNTED BELOW SOURCE POINT)



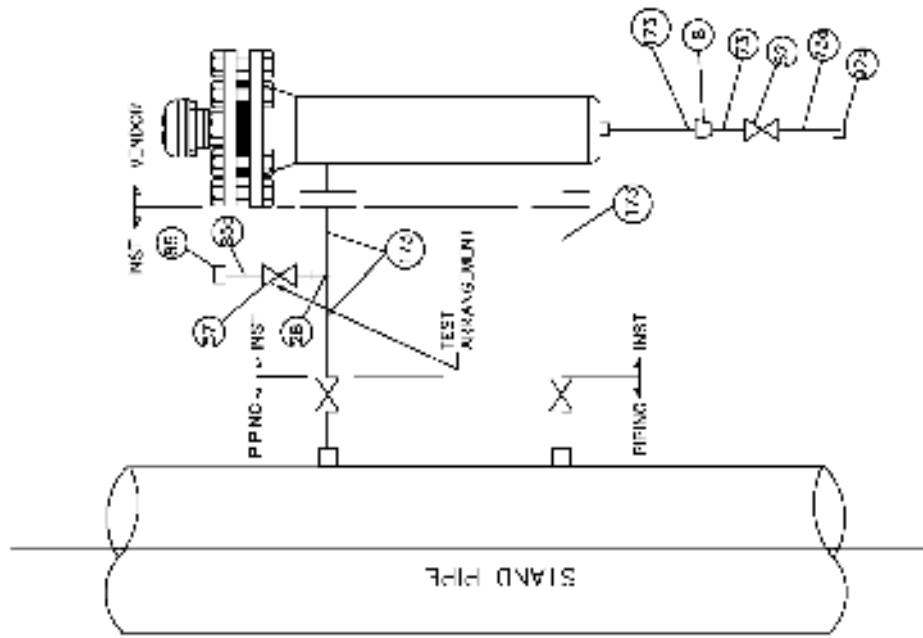
SERVICE : WATER

BILL OF MATERIAL	
ITEM NO.	DESCRIPTION
24	UNEQUAL IEL, 1/2" SW X 1/2" NPT (F)
45	TUBE, 1/2" OD
52	GLOBE VALVE, 1/2" SW
64	MA F CONNECTOR, 1/2" NPT (M) X 1/2" CD
73	IMPULSE PPE, 15 LB
95	5 VALVE MANIFOLD, 1/2" NPT (F)
120	BULK-HEAD UNION, 1/2" SW
130	HAIF COUPLING, 1/2" SW
205	3C' FLOW, 1/2" SW

FOR TENDER FITTINGS ONLY

REVISION									
APPROVED	A.T.	S.A.	A.K.P.	S.K.	FIRST ISSUE	DISSEMINATION	DATE	BY	NO.
							22.08.2017		
TYPICAL INSTRUMENT INSTALLATION DIAGRAM					THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.				
CORPORATE, KOLKATA, INDIA					SUBDIVISION, THERMAL POWER STATION				
SANGHARASHI, BARH, DIST. MUNGER, BIHAR, INDIA					UNIT NO. 1				
ENTR. UNIT 1					12405-DWG-1-3022				
SCALE: ML					JOB NO. DCL-12405				
CONSULTING ENGINEERS					DEVELOPMENT CORPORATION'S, PVT. LTD.				

FLOAT OPERATED LEVEL SWITCH



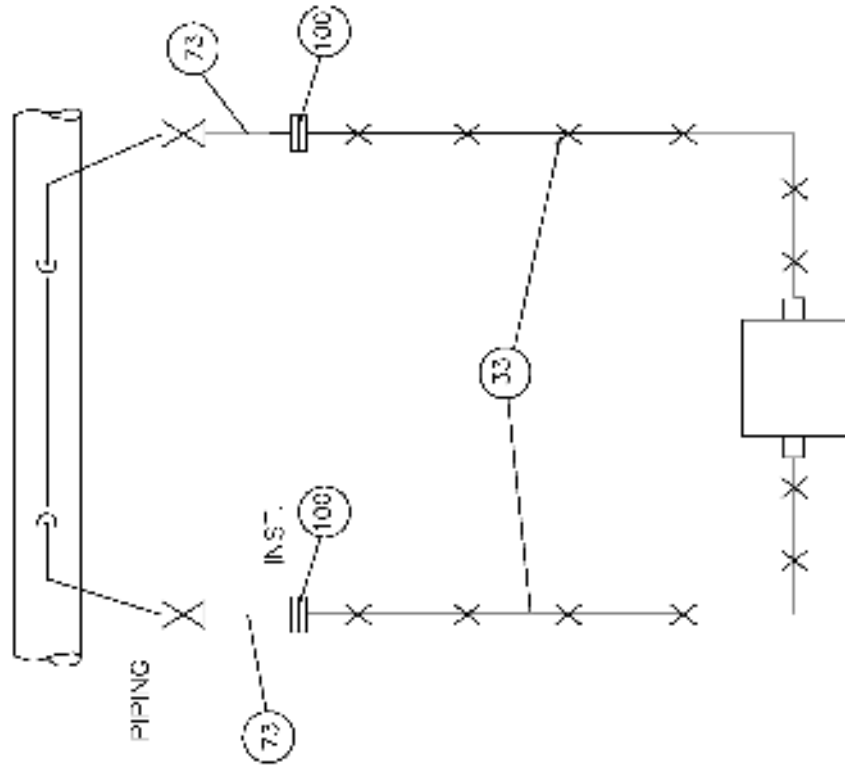
BILL OF MATERIALS	
ITEM NO	QTY/INST DESCRIPTION
8	REDUCER, 1/2" SW X 1/2" SW
28	EQUAL TFF, 1" SW
52	GLOBE VALVE, 1/2" SW
57	GLOBE VALVE, 1" SW
73	IMPULSE PIPE, 1/2" NB
75a	NIPPLE, 1/2" SW X 1/2" NPT (F)
85	PLUG, 1" NP (M)
85a	NIPPLE, 1" SW X 1" NPT (F)
92a	DRAIN PLUG, 1/2" NPT (M)
173	IMPULSE PIPE, 25 NB

SERVICE : CONDENSATE

FOR TENDER PURPOSE ONLY

REVISION	APPROVED	A.T.	S.A.	A.K.P.	S.K.	REV	DATE	DESCRIPTION	RELEASED BY	DATE	TYPICAL INSTRUMENT INSTALLATION DIAGRAM THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD. CALCUTTA, INDIA SUBDIVISION: THERMAL POWER SECTION PROJECT: 12405-DWS-1-0022 UNIT: 1	DEVELOPMENT CONSULTANTS PVT. LTD CONSULTING ENGINEERS JOB NO. DOL-12405 SCALE: ML DWG. NO. 12405-DWS-1-0022
						0	25.06.2017					

DIFFERENTIAL PRESSURE TRANSMITTER/DIFFERENTIAL PRESSURE SWITCH



SERVICE: CORROSIVE / VISCOUS/SOLID BEARING OR SLURRY SERVICE

ITEM NO.		QTY./IN.ST.	DESCRIPTION
53	A/R		SS ARMORED CAPILLARY TUBE
73	2 M		IMPULSE PIPE, 1/2 IN. Ø
100	2		FLANGE ASSEMBLY TO SUIT 1/2 IN. Ø

FILL WITH MATERIAL

DIFFERENTIAL PRESSURE TRANSMITTER/ SWI CH/ GAUG.

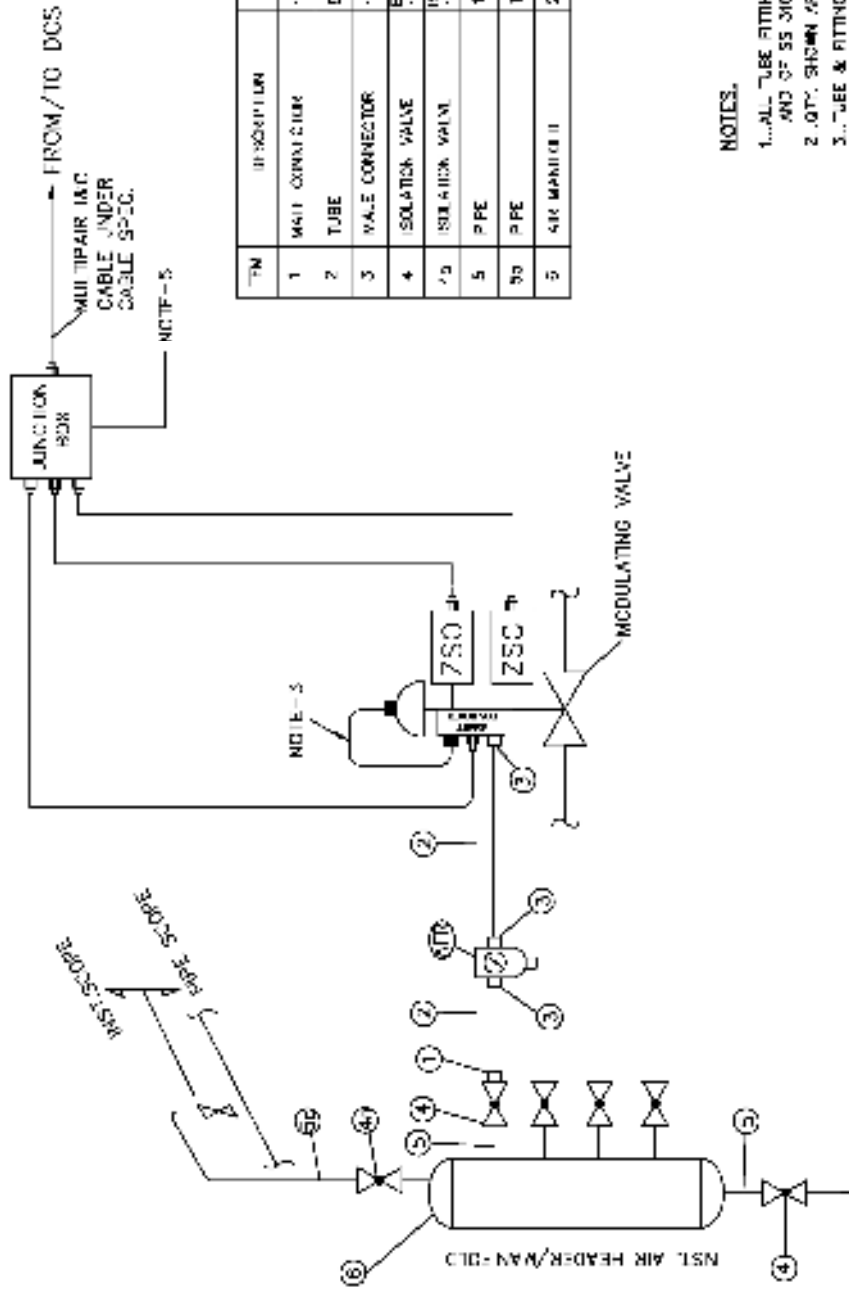
FOR TENDER PURPOSE ONLY

REVISION

NO.	DATE	BY	DESCRIPTION
1	22/08/2017		REVISED

TYPICAL INSTRUMENT INSTALLATION DIAGRAM
 THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.
 KOLKATA, INDIA
 SUBSTATION: THERAPAL POWER STATION
 1. 100 KV BUS
 2. 11 KV BUS
 3. 400 V BUS

DEVELOPMENT CONSULTANTS PVT. LTD.
 CONSULTING ENGINEERS
 JOB NO. DCL-12405 SCALE: M1
 DWG. NO. 2405 DWG / 0022 REV. 0



ITEM	DESCRIPTION	SIZE/CHARACTER	QTY	REMARKS
1	MULTI PAIR IAC CABLE UNDER CABLE TRAY	1/2" (NPT) X 8 mm OD	1	
2	TUBE	8 mm OD X 1 mm THK	16 Pcs.	
3	VALVE CONNECTOR	1/4" (NPT) X 8 mm OD	4	
4	SOLAENOID VALVE	BALL TYPE 1/2" SW X 1/2" (NPT)	2	
5	SOLAENOID VALVE	1/2" SW X 1/2" (NPT)	1	
6	PIPE	1 1/2" NE	A/R	
7	PIPE	1" NB	A/R	
8	AIR MANIFOLD	2" NB	1	

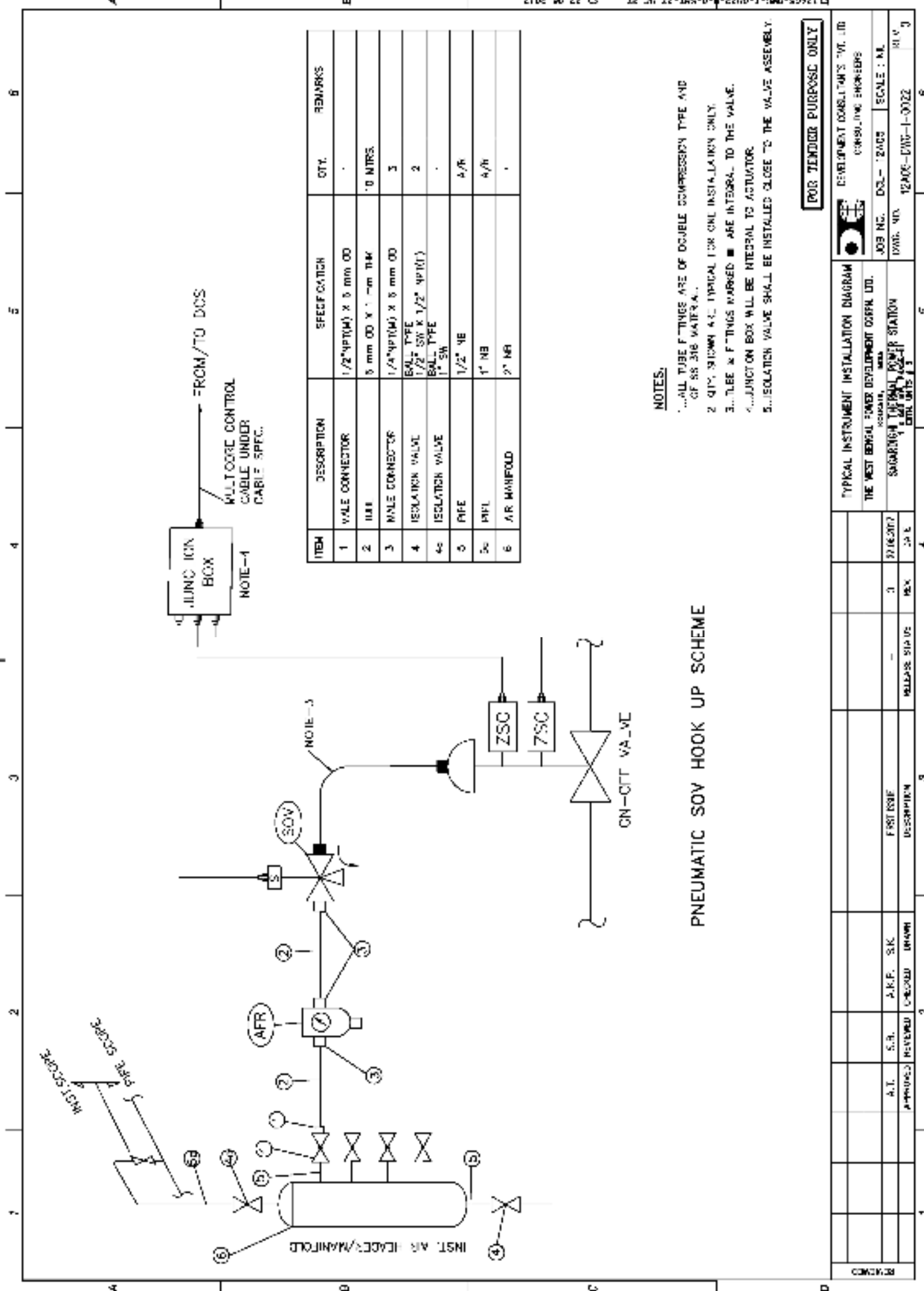
NOTES.

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

PNEUMATIC CONTROL VALVE HOOK UP SCHEME

FOR TENDER PURPOSE ONLY

REVISION		DATE		BY		CHECKED		APPROVED		DESIGNER		DRAWN		SCALE	
<p>TYPICAL INSTRUMENT INSTALLATION DIAGRAM</p> <p>THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.</p> <p>SUBDIVISION: THERMAL POWER STATION</p> <p>PROJECT: WEST BENGAL POWER DEVELOPMENT CORPN. LTD.</p> <p>JOB NO. DCL-12405 SCALE: ML</p> <p>DWG. NO. 12405-DWG-1-0022</p>															
<p>DEVELOPMENT CONSULTANTS PVT. LTD.</p> <p>CONSULTING ENGINEERS</p>															



ITEM	DESCRIPTION	SPECIFICATION	QTY.	REMARKS
1	VALE CONNECTOR	1/2" NPT(M) X 5 mm OD	.	
2	PIPE	5 mm OD X 1' - 00 mm THK	10 METRS.	
3	MALE CONNECTOR	1/4" NPT(M) X 5 mm OD	3	
4	ISOLATION VALVE	BALL TYPE 1/2" SW X 1/2" NPT(M)	2	
4a	ISOLATION VALVE	BALL TYPE 1" SW	.	
5	PIPE	1/2" NB	4/R	
5a	MFL	1" NB	4/R	
6	A/R MAINFOLD	2" NB	.	

NOTES:

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

PNEUMATIC SOV HOOK UP SCHEME

FOR TENDER PURPOSE ONLY

REVISION		DATE		DESCRIPTION		RELEASE STATUS		REV		DATE	
<p>TYPICAL INSTRUMENT INSTALLATION DIAGRAM</p> <p>THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.</p> <p>ASSOCIATE, WEST BENGAL POWER DEVELOPMENT CORPN. LTD.</p> <p>SUBSTATION CONTROL ROOM, POWER STATION</p> <p>1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100</p>											
<p>DEVELOPMENT CONSULTANTS PVT. LTD.</p> <p>CONSULTING ENGINEERS</p>				<p>JOB NO. DCL-12405</p> <p>SCALE: M.L.</p>		<p>DATE: 12/02/22</p> <p>BY: J</p>		<p>12405-DWG-1-0022</p> <p>REV: 0</p>		<p>6</p>	



TITLE:
1 X 660 MW SAGARDIGHI TPS UNIT NO. 5
PHASE III

TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT

SPECIFICATION NO. PE-TS-445-155A-A001

SECTION : III

SUB-SECTION:

REV. NO. 02	DATE : 18.04.2022
-------------	-------------------

SECTION III



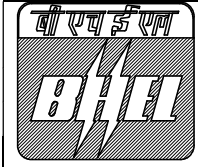
TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
	SECTION : III	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION:	
	REV. NO. 02	DATE : 18.04.2022

SCHEDULE OF PRE-BID CLARIFICATION

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

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

Note: Bidder to furnish all the pre-bid clarifications in the above indicated pre-bid clarification format only. General pre-bid clarifications will not be considered.



TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
	SECTION : III	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION:	
	REV. NO. 02	DATE : 18.04.2022

COMPLIANCE CUM CONFIRMATION SCHEDULE

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

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



TITLE: 1 X 660 MW SAGARDIGHI TPS UNIT NO. 5 PHASE III	SPECIFICATION NO. PE-TS-445-155A-A001	
	SECTION : III	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION:	
	REV. NO. 02	DATE : 18.04.2022

DECLARATIONS

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/ system covered by our format proposal number dated and there is no deviation to the specification.

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

Bidders Company Name

Authorized representative's signature

Name

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

THIS IS A PART OF TENDER TECHNICAL SPECIFICATION NO. PE-TS-445-155-A001

<u>SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL</u>									
 PROJECT:- 2X800 MW UPPUR STPP									
CONDENSATE POLISHING UNIT									
TENDER ENQUIRY REFERENCE:-									
NAME OF VENDOR:-									
SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF withdrawal OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF withdrawal OF DEVIATION IS APPLICABLE	NATURE OF COST OF withdrawal OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME				DESIGNATIONS			SIGN & DATE		
NOTES:									
1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.									
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.									
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.									
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.									
6. Bidder shall furnish price copy of above format along with price bid.									
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.									
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.									
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.									
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.									
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.									
12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.									
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									